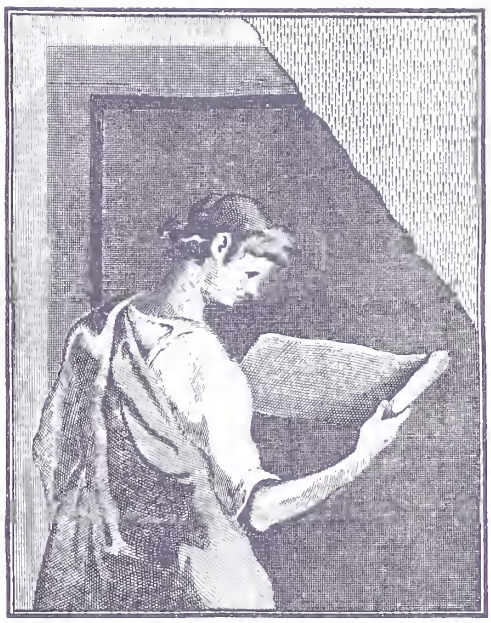

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR

ALL WORKMEN, PROFESSIONAL AND AMATEUR.

EDITED BY

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AUTHOR OF "EVERY MAN HIS OWN MECHANIC."

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# INDEX.

## LIST OF ILLUSTRATIONS.


ADVERTISING MACHINE, 780
Air-pump, 497
Alarum, 424
Aphengescope, 236
Appliances for Work, 136, 180
Arch, Lattice Girder, 276
Arches, 96, 205, 376
Armourers' Hammers, 807
Ash-pan, 566

BACKSTAY, 237
Balloons, Toy, 134
Banjo Case, 139
Bank, 492
Barometer, 477
Bassinette, 274
Bath, A Folding, 645
Battery Plates, 36
Bellows, Fletcher's, 356
Bell-ringer's Table, 380
Belt (Leather) Joints, 779
Bench Stop, 229, 647
Bench and Tool Chest, 223
Bending Brass Treads, 441
Bent Iron, Hall Lamp, 321
Bevels, Instrument for, 299
Billiard-cue Tip, 203
Bird Cage, 59
Blinds, Venetian, 86
Blow-lamp, 269; -pipe, 282, 356, 810
Boiler, 317, 589, 812
Boiler Pump, 684
Bookbinding, 28
Book-box, 2, 37
Book-rest, 648
Bookshelf, 252, 520, 565, 685
Boot for Shortened Leg, 490
Boot Repairing, etc., 12, 112, 201, 280, 345, 405, 516, 534, 796; Heels, 637, Bottle Top, 252 [796; Lasts, 253, 301
Box, Folding, 504
Brackets, 198, 520, 811
Brass-melting Furnace, 429
Bread-cutter, 526
Bristles, 716
Bromide, Apparatus for Making, 558
Bunsen Burner, 636
Butter Cooler, 826

CAGE, FOR SQUIRREL, 365; Rat, 382
Camera Lucida for Micro. Sketching,
Camera Obscura, 396 [326
Candelabrum, etc., 593
Candlestick, 43
Cane, Grooving, 510
Canoe, Canvas, 412
Canopy for Bed Hangings, 241, 242
Canvas, Stretching, 644
Cap, Paper, 43
Carpet Planning, 22
Carpenter's Rule, 381
Carpentry, Stage (*see Stage*)
Carts, Newspaper, 78; Oxford, 525; Tip-cart, 401, 403
Case for Stuffed Birds, 44
Cask Tilter, 266
Casket, 409
Castors, 410; Ball-bearing, 218; Cantilever, 106; Fixing, 507
Castor-pin, 699
Ceiling Panels, 825
Chain-coupling Link, 759
Charcoal Heater, 574
Chess-board, 770
Chicken-rearing Appliances, 737
Child's Carriage, 426
Chimneys, 281; Pot, 266
Chuck, 490, 604
Clock Case, 385, 387, 473, 811
Clocks, American, 236; Gravity, 820; Sand, 333; Water, 699
Closet for the Hall, 145
Clothes Pegs, Novel Use for, 250
Clothes and Tool Chest, 156
Coil, Dr. Spanner's Induction, 282
Coil heated from Register Grate, 221
Colour for Cornice, etc., 210
Colour in our Homes, 689
Compass Work, 231
Concrete Building, 60
Coop for Hen, etc., 788
Copying Machine, 554
Cordage (*see Knotting, etc.*)
Cork Ornaments, etc., 761
Cornice, 210; Frieze and Dado, 667
Cottages, Plan of, 724
Counter Case, 301
Cowl, 266
Cramp Boards, 253
Cramps, 21, 299, 619
Creaser, 270
Crests, 29
Cricket Bat Splices, 75
Curves, Methods of Striking, 475
Cycles, 524; Anti-vibrator, 407, 525; Bearings, 571; Crank and Shaft, 620; House, 573, 585; Parts, 812; Stand for Training, 635 (*see also* Cycloidal Curve, 238 [*Safety Bicycle*)
Cyltine Manifold Copier, 554

DADOES, 715, 753
Damp Course, 556
Decoration of, Fireplace, 651; Study,
Design for Corner, 637 [617, 618
Design for Embossed Work in
Design for Sign, 397 [Leather, 817
Designs for Repoussé Work, 305, 377
Desk and Chair, 29
Diamond Pattern Lumber, Machine
Die for Stamping, 651 [Cut, 170
Distance Register, 460
Doll's House, 221
Doors, Posts of, 629; Sliding, 412
Dove-cot, 289
Dovetailing, 285, 389, 637, 691
Draught-board, 745 [235
Drawers, 310, 792; Irregular Form,
Drawing, Mechanical, 105
Drawings for Patent Office, 215
Dresser for Kitchen, 529, 530
Drinking-flask, 666
Drying-horse for Boots, 313

EAR-RINGS, 20, 101, 164, 165
Easel, Artist's, 350, 478, 614
Egg Saucepan, 422
Eggs, Incubation of, 737
Elbow-pipe, Marking, 477
Electric Bell, 804; Lines, 700, 733
Electric Lamps, 27 [757
Electrical Appliances, 465, 584, 661, 668,
Engines:— Hot-air, 570, 586, 717; Launch, 346; Petroleum, 618; Quarter H.-P., 89, 260, 261, 328, 329, 420, 501, 581, 708

FAIRY BELLS, 572; to Piano, 28
Fastener for Shirt Studs, 90
Fender, Kitchen, 219; Scroll for, 349
Fiddle Case, 423
Fire-guards, Wire, 601
Fireplace, 449, 760
Fitment, Hanging, 565
Flower, Box, 203; Holder, 505; Stand,
Foot-warmer, 806 [107
Force-pump, 717 [732
Forge, Portable, 705; Blacksmith's,
Fountain, Self-acting, 657, 748
Fowls'-house, 62, 673
Frame for Coins, 285
Framework Testing, 326, 426, 533
Framing, Hints on, 68
Fret Machine, 155, 461, 478, 540, 827
Fretwork, 39, 41, 546, 637, 763
Fryer for Fish and Potatoes, 476
Furnace, Section of, 637
Furniture:— Armchair, 661; Bedroom Suite, Combination, 341; Bedstead, 317, 413, 645; Bookcase, 159, 236, 317, 353, 565; Chair and Desk, 29; Chair, Antique Dutch, 790; Corner Bookcase, 652; Hanging Bookcase, 663; Cabinet, 433, 434, 577, 579; Card-table, 745; Coal-box, 75, 440; Commode, 555; Couch, 236; Couch-bedstead, 413; Desk and Chair, 29; Drawers, Chest of, 792; Fender, 219, 349; Hall-stand, 49, 50; Hat or Clothes Stand, 266; Hat-stand of Rails, 213; Jewel Cabinet, 109; Medicine Chest, 233, 520; Mirror, 653, 664; Music Canterbury, 3, 4, and Frontispiece; Ottoman Couch, 204, 824; Secrétaire, 643; Sofa-bedstead, 317; Table, 121, 404, 808; Umbrella-stand, 213; Wardrobe, 105, 177; Wash-hand Stand, 251; Whatnot, 369; Writing Cupboard, 1, 2, 3; Writing Table, etc., 353

GALVANOMETER, 318, 430
Garden, Arches, 740, 741; Decoration, 129; Label, 218; Tool-house, 225
Gas Bag, 172; Globes, Wire, 533
Girder, "Fish-belly," 163
Glass Bevelling, Shapes for, 40
Glass Case, Framing, 493
Glass, Cutting, 476; in Furniture, 117;
Greenhouse, 363 [Lead Pattern, 685
Grindstone, 450
Gun-rack, 60, 494; 110-ton, 382

HAIR CURLING AND CRIMPING, 619
Hall-marks, 521
Hall and Staircase, 709; Lantern, 320
Halving, 691
Harness, Pad, 743; Top Hame, 487
Hat Pegs, 517
Helioscope, 526
Hen-coop, 108
Hive Observatory, 285
Hive for Transportation, 12
Homacoustic, The, 762
Honey Extractor, 298
Hot-water Fitting, 13, 252, 397, 742

INCUBATOR, 75, 561, 605, 609, 731, 796
Inlaying Monogram, 395, and *see M*
Iron Joists, Fixing Wood Floor, 573

JACK, POPE'S CARRIAGE, 138 [563
Joints, Mortise, Tenon, and Halved,

KELTIC ORNAMENT, 721
Kiln, 93
Knotting, Spliceing, and Working Cordage, 65, 137, 200, 245, 309, 361, 469, 552, 553, 613, 677, 725

LABOUR-SAVING APPLIANCES, 441
Lace Frame, 430
Lamp, 253; for Lantern, 597; Wicks,
Landing Nets, 775 [Trimming, 26
Lantern, Cabinet, 316; Carrier, 685; Curtain, 205; Lamp for, 597; Microscope, 749; Objective, 219
Lathe, 453, 569, 714; Attachment, 666; Chuck, 490, 604; Headstock for, 813; Mandrel, 430; Overhead, 716;
Lead Joint Runner, 425 [Treadle, 621
Lenses, 461
Limelight Apparatus, 220
Lithography, 149, 231, 232, 297, 450, 451
Locomotive Steam Chest, 316

MACRAMÉ BOARD, 681
Machines and Appliances:— Advertising, 780; Appliances, 136; Bundling Firewood, 590; Dovetailing, 692; Drilling, 10; Mitring, 9, 170; Planing, 346; Squaring, 9; Wire Crimping, 120
Magnesium Lamp, 62
Mandoline, 777
Mantelboards, 265
Masons' Work, 96, 98, 185, 265, 324, 376
Mast, Scarfing, 523
Mat Making, 750
Meat Safe, 216
Medicine Cupboard, 233, 520
Metronome, 628
Microscope, 749, 796; with Polariscope
Microscope Lamp, 51 [fitted, 631
Mirror, Hanging, 653, 664 [539
Mitre, etc., 136; Board, 478; Cramp,
Models, Horizontal Engine, 781; House and Figures, 301; Yacht,
Money-box, 492 [77, 91
Monogram Designs:— E.E., 379; N.H.H., 395; T.W.C., 461; E.M.N., 604; C.L.H., 667; J.D.B., 700; E.M.C., 733; E.H.S., 733; N.R., 766; S.B., 779
Mortising, 121, 285, 524
Motors—*Electro*, 785; Griscom, 331; Siemens' Bridge Type, 72; *Water*
Muzzles, 533 [—Demon, 122

NAIL, DOUBLE-POINTED, 570
Nests of Pigeon-holes, 104, 249
Nut-cracker, 218
Nut, Double Grip, 618

ORGAN, PARTS OF, 669; Pipes, 446

PAINT MILL, 588
Painting Brush, Tying, 234
Panel, 648, 665, 745
Panelling, 822
Pattern Making, 277
Pen, Combination, 293
Pencil Sharpener, 380
Perspective (*see Stage*)
Photographic, 427; Cabinet, 557; Camera, 45, 234, 395, 477; Camera Case, 660; Dark Room, 279; Dark Slide, 426, 459, 476; Draining Rack, 132; Enlg. Camera, 395; Frame, 763; Instant. Shutter, 348, 408; Lenses, 461, 827; Studio, 620; Tent, 152, 172, 217; Transparencies, 696; View Finder, 699
Photographs, Novel Use for, 520; for Household Decoration, 745
Piano, 589, 733, 745; Fairy Bells to, 28;
Picture-cord Grip, 442 [Stool, 141
Picture Frames, Oxford, 25
Picture Hanging, 184
Picture Suspender, 554
Pigeon-holes, Nest of, 104, 249
Pigeon-house, 285
Pipe Mounts, 92
Plan of Heavens, 638
Planchette, 317
Plans, Cottages, 724; Schools, 489
Plant Case, 12
Plumber's Joint, 333
Polishing Metal, 103
Polishing, Movement of Rubber, 54
Porch for Cottage, 161
Poultry Houses and Runs, 673, 728
Pulleys, 173
Puzzle Money-box, 73

RAIN-PIPE, 253, 381, 765
Raising Heavy Weights, 53
Razor, How to Strop a, 7
Razor Strop, 390
Reading Stand, 648, 684
Repoussé Work, Designs for, 377
Resin Box, 539
Resonance Box, 823
Retort Stand, 538
Revolver and Sword, 775
Rifle Rack, 60, 494
Room, Plan of Removable, 205
Rope Mat Making, 750
Ruling, 231
Rustic, Bracket, 811; Chandeliers, etc., 593; Clock Case, 811; Dove-cot, 289; Porch, 161; Tool-house, 225; Verandah, 193, 257

SADDLE, 566
Saddler's Clamp, 470
Safety Bicycle, Its Practical Construction, etc., 33, 92, 100, 168, 223, 283, 308, 356, 436, 521, 596
Sails, Canoe, 13
Sashes, 487, 680
Sash Fastener, 154
Saw, Crack in, 294; Frame, Circular, 107; Guard, 525; Hammering, 235, 525; Repairs, 205
Saws, 347, 637; Bow, 518; Hand, 421
Scaffold Chain, 378
Scarf Ornaments, 773, 805
School, Design for, 489
Scraper, Sharpening, 474
Screen, Cheval, 748; Hinges, 349
Screws, Cutting, 808; for Leg Joints, 252; in Metal Work, 69; Top and Reamers, 344, 744; Thread of, 133; for Wood Carvers, 375
Sheet Metal Work, 360, 472, 537
Sign-writing Design, 397
Smiths' Work, 312; Forge, 732
Speculum Grinding, 13, 365
Spirit-lamp and Blow-pipe, 282
Splicing (*see Knotting, etc.*)
Spoon and Salt Box, 605
Springs for Gluing Purposes, 439
Spurs with Concealed Rowels, 458
Squat Ball Shapes, 445 [793
Stage Carpentry, 561, 563, 633, 711, 713,
Stage Perspective, 417, 456, 500
Stand for Lantern, 299
Steamer for Bamboo, 252
Stencilled Decorations, 17
Stencils and Brushes, 189
Steps, 376
Still Parts, 702
Stone Carving, Examples of, 357
Stove Slips, 173
Stretching Canvas, 644
Stuffed Bird Case, 44
Sundial, 445, 542, 685
Sussex "Trugs," 697

TABLE, FOLDING, 808; Parts, 780;
Tea-tray, Oak, 824 [Shelf, 683
Telegraph Instruments, 300
Telephone, 588; Line, 733
Telescope, 444; Astro., 701; Parts of, 599; Speculum Grinding, 13, 365
Testing Framework, etc., 326, 426, 533,
Thermometer, Making, 181 [795
Tin, Apparatus for bending, 302
Tool, Chest, 156, 801; Sharpening, 172
Tools:—Anvils, 699; Appliances, 136; Bevelling, 299; Boot Making, 12, 541; Broach, 243; Chisel, 253; Cramp Drill, 826; Cycle Making, 228; Diamond and Pearl Setting, 284; Drill Stock, 325; Jigger-iron, 541; Masonry, 185; Metal Turning, 103; Panel Gauge, 766; Plane, 776; Poker Work, 538; Rimer or Broach, 243; Rule, 381; Saw Hammers, 699; Saw Set, 421; Scribing

Blocks, 457; Smithing, 372; Spanner, 267, 378; Vice Saw, 810; Vice Bench, 169, 421, 461; Vice, Parallel, 714; Violin, 85; Wood Carving, 455; Wrench Hammer, 378
Trammels, 616
Traps, Mole, 606; Pigeon, 28; Rat, Trestles, 337 [485
Tyre, "Ring" Cushion, 154

Valve, 238; Box, 329
Ventilator for Windows, 603
Verandah, 193, 257
Violin, 4, 5, 85, 148, 212, 827; Bow, 617
Violoncello Sound-hole, 318
Vulcanite, Joining, 430

Wall Decorations, 625, 753
Wash-tub, 468
Water-closets, 296
Water-pot, etc., 360
Weather-glass Tube, 484
Weights, Moulding, 782; Raising, Wheatstone Metre Bridge, 373
Wheel, 358; Cutting, 61; Rubber Felloe, 505; Toothed, 411
Whip Crock, 711
Window Box, 394
Window Decoration, 617, 789; Plant Case, 12 [tary Rail, 93
Window Making, 481, 518, 776; Sani-
Wire Fencing Design, 670
Wire, Straightening, 153; Gauge, 55
Wirework, 8, 120, 153, 196, 197, 244, 293, 340, 393, 437, 485, 533, 601, 692, 693, 740, 741, 788
Wood-carver's Screw, 375
Wood Carving:—Butter Dish, 81; Clock Case, 385, 387, 473; Fireplace, 760; Panels, etc., 549
Woodcock's Feather, 221
Wood Floor, Fixing to Iron Joists, 573
Wood Turners, Galvanometer for, 57
Woods, Sycamore, Section, 4
Wool Winder, 765, 782, 798
Workbox, Lady's, 365, 781
"Work" Certificate Frame, 603
Workshop Plan, 205
Work-table, 821
Writing-desk, 683, 765

Zither, 392
Zither, Stringing, 530, 551

# INDEX TO SHOP.

Accordion, 830; Reeds, 251
Accumulator, 126, 172, 204, 460, 475, 571, 685; Pocket, 285, 443, 539
Acid, Hydrofluoric, 45, 668
Adhering Composition, 765 [780
Advertising, 476, 493; Machine for, Advice to Young Workmen, 157
Agreement, 332
Air Cushion, 222, 302, 398; Proofing, 142; Pump, 222, 635, 651, 798
Alabaster, Polishing, 59; Working, 637
Alarum, 29, 44, 396, 398, 540, 589, 651, 734, 766, 812
Algebraical Question, 155
Alloy, 429
Amateurs, Hints for, 779
American Leather Cloth, 156
Ancient Lights, 108
Aphengescope, 236, 364
Aquafortis, 731
Aquarium, 188, 363, 365, 380, 507, 571; Cement for, 187; Painting, 13
Arches, 190, 205, 668
Architecture, 748
Artificial, Eyes, 635; Foot, 413, 701; Asbestos, 702, 814 [Hand, 702, 814
Ash-pan, Making, 491
Astronomy, 653
Aviary, 188
Axes, 573, 731
Axle, 668

Backstay, 237
Bagpipe, 764
Balloons, 222, 251, 302
Balls, 302
Balusters, Turned, 158, 254, 286
Bamboo, 107, 302, 446, 542, 733, 830; Binding, 252, 780; Canes, 205, 797
Banjo, 27, 76, 139, 140, 331, 411, 412, 443, 462, 590; Fittings, 221; Piccolo, 318; Tailpiece, 253; Vellum, 270
Bar Hole, 366
Barometer, 366, 413, 573, 796; Repairing, 477; Tube, 77
Barrels, Measurement of, 526, 606, 622
Basket Making, 143; Sussex "Trug," Bass, 142; Bar, 61, 111 [619
Bassinette, 124
Bath, 171; Heating, 414, 510, 558, 571
Bath-room Air, 763
Batteries, 14, 270, 317, 398; Austin-Leclanché, 13, 157; Box, 139; Bunsen, 395; Chromic Acid, 731; for Coil, 604, 621, 795; Dry, 110, 174, 203, 364, 508, 540, 574; for Electric Bell, 364; for Electric Light, 428, 508, 540, 603, 604, 621, 667, 684, 700; for Electro-Motor, 236, 828; for firing Fuse, 621; Galvanic, 411, 573, 813; Gassner, 395; Leclanché, 78, 142, 158, 283, 302, 380; Medical, 208, 283, 427; for Night Light, 621, 763; Pocket, 93; Potash, 92; Voltaic, 701
Battery Matters:—Carbons, 30, 92, 316, 427; Casting Lead Caps to Carbons, 44; Charge for, 44, 189, 795; Chromic Acid Cells, 62; Coupling Cells, 139; Current from, 93; Electro-motive Force of, 126; Plates, 188; Repairs, 364; Troughs, 206; Zincs, 139
Beaded Mahogany, 494
Beams, 171
Bear on Pole, 443
Bearings, Squeaking, 539
Beer, 588
Bellows, 605; Carved, 14, 108, 110 [330
Bells, Tuning, 798; Bell-ringer's Table, Belting, Cotton, 158, 254, 270, 347; Belts Slipping, 221 [Joints, 779
Bench, 302, 427
Bench and Tool Chest, 142, 222, 667
Bending, Metals, 558; Tube, 123, 285, 413, 667, 702; Brass Treads, 441
Bent Iron, 77, 189, 653, 812
Besoms, 750, 766, 779, 782; Plates, 635
Bevels for Dovetailing, 285
Bevels, Instrument for, 299
Billiard-ball Dye, 107; Cue Tips, 203
Bird Cages, 43, 59, 235, 237, 702; Bird Stuffing, 188
Blackboards, 155, 620, 731
Black, Dead, 268, 300
Black (Berlin) for Lamp Stand, 156
Blacklead, 142, 635
Blast Gas Furnace, 190
Bleaching Wood, 669 [Roller, 651
Blinds, Venetian, 43, 189, 750; Spring
Blocking, Cards, 76, 251; Gold, 331, 700
Blower, Foot, 716; Root's, 398
Blower, or Blast Fan, 286
Blow-lamp, 187, 188, 269; Blow-pipe, 190
Boats:—Canoes (*see C*); Pair-oared, 350; Punt, 446, 478; Propeller, 557; Sailing, 606, 718
Boiler Matters:—Corrosion in, 750; Feed, 446; Field's, 459; for Greenhouse, 476; Incrustation, 475; Injector, 61; Lid, 124; Marine, 174, 317, 686; for Model, 812; Pocket, 414; Pump, 684; Water Tube, 76
Bois-Duré, 620, 637
Boncs, 398; Calcined, 332
Bone Handles for Knives, 157
Bookbinding, 27, 45, 108, 188, 508, 510, 652; Bookcases, 171; Gold Blocking (*see B*); Leather, 188; Printing in Gold, 652; Repairing Bible, 220;
Bookshelves, 685 [Sewing, 91
Books, Soiled, 108; Stains out of, 361;
Books:—"Applied Mechanics," 445; Arches, 190; Bird Stuffing, 188; Blacksmithing, 45; Boat Building, 13; Book-keeping, 493; Brasswork, 108; Brazing, 571; Cabinetmakg., 748; Canoes, 13, 812; Casting, 413; Chemistry, 109, 139, 683, 731; Coach Building, 158; Colour Mixing, 190; Crests and Monograms, 156; Drain Work, 126; Drawing, 365; Dynamo, 77, 141, 621; Electric Bells, 75, 171, 254, 399, 605, 654, 717; Electric Lighting, 605; Electrical Engineering, 77, 604; Electricity, 798; Electroplating, 460, 476; Electrotyping, 189; Engines, 302, 475; Engineer's, 190, 301, 717, 827; Estimating, 653; Exoties, 590; Flues, 315; Geometry, 507; Glass Working, 139; Glass Writing, 43, 347; Goldsmiths', 828; Hot-water Engineering, 315; Hydraulics, 781; Iron Foundiug, 413; Iron Work, 701; Joinery, 60; Lathes, 475; Lithography, 268; Locks, 593, 686; Machine Design, 77, 411; Mathematics, 221; Measurements, 491, 573, 718; Metal Plate, 446; Metal Turning, 28; Metal Work (sheet), 574; Microscope, 93; Milling Machines, 669; Motors (Elcctro), 636; Moulding, 413; Paint Mixing, 190; Painting Prices, 509; Pattern Making, 140, 589, 812; Perfumery, 606; Photographic, 315, 414, 811; Piano Tuning, 667; Plumbing, 716; "Popular Educator" (Cassell's), 573, 701; Pottery and Porcelain, 606, 766; Ready Reckoner, 572, 574, 718; Saddlery, 780; Sanitary Engineering, 126, 574; Saw Benches, 475; Scales and Weights, 171, 190; Screw Cutting, 798; Sewing Machines, 206; Sign Writers, 156, 667; Silversmiths, 443; Slide Rule, 574; Staining, etc., 220, 255, 718; Tailoring, 654, 733, 734, 750, 814; Technical, 780; Varnishing, 718; "Violin as it Was and Is," 46; Water-colour Painting, 811; Water Power, 781; Weights of Metals, 301; Wood Carving, 110, 573, 651; Wood Turners' Patterns, 238
Boot and Shoe Making, 187, 733, 812; Finishing, 541; Hand Sewn, 493, 589; Iron Feet, 412; Lasts, 46, 252, 268, 301; Repairs, 571, 637, 651, 748, 779, 796, 812; Soling, 12, 45; Tennis Shoes, 109; Wax, 301; Welting, 12; Wurtemburg Heels, 637
Boot Blacking, 75, 110; Shoe Gloss, Boot for Shortened Leg, 587 [302
Boot Studs, 589
Boots, to soften, 812
Boring and Cutting, 27, 812
Bottles, 317, 396, 462; Paraffin, 252
Bow-hairing, 221
Boxes, Millboard, 782; Tin, 126
Brace Making, 206
Bracket, 811; for Clock, 331
Brackets, Plush on, 620
Brass, 76, 108, 222, 285; Angle, 108; Bearings, 366; Castings, 76, 765; Cleaning, 718; Colouring, 683; Ferrules, 460; Instruments, 477; Lacquer, 14, 254, 285, 364, 476, 750; Melting, 270, 429; Moulders, 683; Plates, 444; Savings Bank, 382; Scraps, 478; Wind Instruments,
Brasses, Connecting, 574 [45
Brazing, 333, 605, 620, 764, 812; Gas Generator for, 477
Bread Cutter, 366; Machine, 286, 398,
Bricks, 171 [526
Bridge, Building, 715
Bristles, Fastening on, 716
Bromine, 558
Bronze, Darkening, 156; Paper, 589
Brooklet, 235
Brooms, 348
Brush Making, 142, 443
Brushes, Paint, 797
Bugs in Room, 715
Building, Cost of, 267; Accommoda-
Bullion, 606 [tion, etc., 156
Bunsen Gas Burner, 626
Buttons, Linen, 510
Burnishing, 75, 76

Cabinet Ironmongery: — Brass
Cabinet Maker, 509 [Angle, 108
Cages for Birds, 45, 59, 235, 237, 702, 830; Mice, 14; Rats, 382; Squirrels,
Cameo Cutting, 765 [365
Camera Obscura, 396, 460
Camphor, Black, 795
Candle Making and Tallow Refining,
Candlestick, 43 [461, 782
Cane, for Chair, 478; Grooving, 310; Split, 350
Canoe Building, 158, 476, 621, 701;
Canvas, Oil, 332 [Sails, 13, 412
Cap, Paper, 43
Carboline, or Carbolinum, 765
Carbon Plates, 45, 427, 494 [477
Cardboard, Use of, 572; Designs in,
Carpenter, Naval, 156
Carpenter's Bench, 302, 331, 460, 494;
Carpenters' Society, 251 [Shop, 598
Carpentry, 171, 362, 395, 557, 715
Carpet, 92; Cleaning, 300
Carriage, Crests, 172; Fittings, Silvering, 398; Painting Mottoes, 221; Varnishing, 123, 235, 254
Cartridges, 205
Carts:—Battlesden, 11; Dog, 121; Newspaper, 78; Oxford, 535
Carvers' and Gilders' Society, 637
Case Hardening, 252
Case, Turned Wood, 14
Case for Stuffed Bird, 41
Casks, 653
Castings, 14, 46, 76, 108, 142, 188, 189, 221, 574, 576, 590, 765; Dynamo, 366; for Engine, 477
Castors, Fixing, 507; Pin, 699
Casts, of the Foot, 19; Plaster, 476
Catches for Jewel Case, 173
Catgut, 174
Cattle Marking, 112
Celluloid, 267
Cement, 364, 462, 525, 542, 590, 651, 765, 828, 829; Glass, 798; Hydraulic, 571
Cementing Lenses, 718
Central Foundation Schools Carpentry Classes, 763
Chains, Gold and Silver, 60
Chair Making, 46
Chair, Canes for, 478, 829; Repairing, 171; Renovating Leather Seats, 302, 366, 462, 590; Seats, 270, 414
Chairs, Hammock, 76; Invalid, 493
Chapel and Class-room, 589
Charcoal Furnace, 589
Chasing, 109
Checkering, 142, 270
Chemicals, 333, 411; Apparatus, 427,
Chemist, 300 [541
Chess-board, 124, 174, 636; Chessmen,
Chimney, Smoking, 126 [109
China, Drilling, 44, 411, 828
Chloride of Mercury, 156
Chronometer, 78
Chucks, 366, 430, 590, 716, 733; Four Jaw, 652; Mounting Cushman, 123; Oval, 604; Self-centring, 108
Circle, Dividing the, 29
Clarionet, 156; Reeds, 683
Classes, Carpentry, 491, 763; Drawing, 605; Instruction, 203; Wood Turning, 653
Clay for Building, 110; Colouring, 108, 334; Mixture, 260
Clocks, 75, 124, 141; Alarum (*see A*); American, 139, 140; Cases, 93, 220, 236, 350, 493, 811; Chime, 78; Cleaning, 13, 108, 140, 539; Conversion, 187; Dutch, 605; French, 155, 190; German, 188; Gongs, 796; Grandfather, 187 512; Hydrostatic, 492, 699; Magnetising, 443; Match Lighting, 605; Parlour, 187; Pendulum, 46; Repairs, 13, 108; Sand, 333; Tools, 78; Wheels, 444; Workman s, 283
Closets, Dry Earth, 108
Clothes and Tool Chests, 156
Coach-work, Transfers, 221
Coal-dust, 526, 750
Cocks, Leaking, 508
Cocoa-nut Fibre, 155, 603
Coffin Plates, 814
Coils, 685; Induction, 125, 174, 428, 701; Insulation for, 189; Materials for, 508, 685; Medical, 28, 92, 204, 283, 331, 397, 603, 829; Shocking, 28, 125, 171, 398, 492, 654; Spark from, 125, 331; for Vacuum Tubes, 189
Coins, Fixing, 285, 397
Colours, 333; for Cornice, 253; for Diagrams, 765; Matching, 622; Mixing, 190
Colouring, Bright Steel Surfaces, 542, 622, 638; Kitchen, 237; Plaster
Compasses, 270 [Figures, 668
Concertina, Keys, 652; Reeds, 350
Concrete, 60
Conservatory, 348
Contract, 492
Cooking Utensils, 125
Coopering, 46, 635
Coop for Hen, 108
Copal Resin, 316
Coppering Solution, 46, 394
Copper, Repairing, 299 [Weight, 668
Copper, Sheets, 267, 444; Turning, 315;
Copying Apparatus, 620, 750
Copying Printed Matter, 108
Coral Cleaning, 94
Core-box, 589
Cork, To use with Glass-paper, 476
Cornet Valves, 652
Cornice, Colours for, 253
Corrosive Sublimate, 156, 251
Cot, Child's, 797
Cotton Band Machine, 439
Cotton Belting, 158, 251, 270, 317
Couch Scroll, 78
Counter Case, 301
Cradle Swings, 299
Cramps, 253, 299, 539, 619
Crank-pin, 301
Crewel-work, Transfer, 477, 557
Cricket Bat, 75, 507
Crystoleum Painting, 238, 350
Cuffs and Collars, Glazing, 12
Curling Hair, Liquid for, 493
Cutlery Case, 828
Cutting, Fine, 523
Cutting Cone Patterns, 685; Elephant's Teeth, 155
Cuttings, Arrangement of, 493
Cycle Matters:—76, 78, 251, 319, 459, 524, 556, 558, 601, 652, 813; Anti-vibrator, 510, 525, 763; Bearings, 539, 571; Brazing, 189; Castings, 189, 349, 812; Cement, 590; Chain, 446; Crank, Safety, 620; Cyclometer, 349, 444, 748; Enamel, 94, 108, 189, 364; House for, 78; "Hub Dish," 348; Mechanics, 396; Parts, 267, 269, 318, 366; Patents, 637, 717; Plating, 235, 508; Repairs, 189; "Safety" Gear, 334; Spoke, 637; Tandem Safety, 476; Tires, 349, 521, 652, 748, 829; Varnish, 443; Wheels, 235, 237, 302, 637. *Bicycles*, 13, 92; Safety, 44, 283, 365, 446, 476, 494, 573, 589, 670, 748. *Tricycles*, 302

Cycloidal Curves, 363
Cylinders, Toy, 251; Wax, 188

DAMP WALLS, 269, 462, 590
Darning Weavers, 621, 734
Decanter Stains, 333
Decoration, 541; in Applied Arts, 203; Smooth Surface for, 428
Delta Metal. 702
Dentistry, 797, 812
Designs for Wall Papers, etc., 732
Desk and Chair Combined, 29
Desk, Leather, 652
Diamond and Pearl Setting, 284
Diamond Chips, 541, 619
Diamonds (Paste), 733, 798
Diapason, 190
Die, 651; Cutting and Stamping, 587; Embossing, 574; Sinking, 349, 395
Distance Register, 28, 460
Distemper, 396, 509, 587; Lines, 428
Distillation, 828
Dividing Rules, etc., 220
Dog Kennel, 652
Doll's House, 46, 221
Door, 491; Automatic, 316; Papier-maché, 14; Sliding, 412
Double Bass, 253
Dovetailing, 285, 637
Draught-board, 124, 174, 636; Table,
Draught Excluder, 603 [206
Draughtsmanship, 363, 443, 462, 493,
Drawers, 492; Supporter, 317 [571
Drawing, 605; Enlarging, 14, 141, 142, 174; Crayon, 268; Fixing Chalk, 174; Fixing Pencil, 411; Reproduction, 222; Transfer, 731;
Dresser, 733 [Working, 782
Driers, 699
Druggists, 109
Drum Heads, 812
Dulcimer, 29, 62, 107, 155, 188, 380, 397, 444, 492, 494, 557, 667 [430
Dye for Billiard Ball, 107; Crimson,
Dynamos, 27, 29, 76, 77, 125, 251, 283, 317, 366, 427, 540, 571, 588, 589, 605, 621, 684, 700, 813; Castings, 701; Engine for, 732; Gramme, 189; Heating of, 461; Manchester, 141, 685; Model Allianee, 141; Motive Power for, 427, 684, 732; Power of, 316; Shunt-wound, 28; Simplex, 396, 491; Voltage of, 461; Winding, 396, 685

EARLY RISER'S FRIEND, 686, 766
Earth—Analysis, 141
Easel, Artist's, 158, 350, 478, 795
Ebonising Pinewood, 811
Ebonite, 44
Ebony for Walking Sticks, 494
Eidograph, 620
Elastic Mould, 326
Electric, Appliances, 414; Belt, 174, 203, 204, 251, 315, 349, 396, 413, 427, 588, 795; Coils (*see Coils*); Detector, 621; Engine, 508; Leyden Jar, 508; Machine, 28, 475, 668, 715, 830; Magnets, 475; Scarf Pin, 731; Signalling, 254; Strength of Current, 221, 382
Electric Bells, 77, 93, 94, 125, 171, 174, 364, 476, 573, 658, 733, 829; Connections, 605; Cost of, 189; Jumpers, 443; Lines, 700; Magnets, 508
Electric Lamp and Lighting, 14, 44, 45, 75, 126, 139, 140, 172, 221, 238, 254, 363, 364, 394, 411, 491, 540, 571, 684, 686, 700, 715, 732; Arc Lamps, 460; Carrying Capacity of Wires, 540; Cost of, 139; Coupling Transformers, 795; Gas Lighter, 206, 316, 334, 589; Incandescent, Repairing, 188, 413; Maguay, 733, 765; Manager, 588; Materials, 332, 414; for Neck-tie, 349; Night Light, 77, 621, 683; Safety Fuse, 491, 797; Voltage, 427
Electrical, 573; Engineering, 604; Experiments, 27; Galvanic Water, 732; Instruments, 315; Meaning of Voltage and E.M.F., 332; Measurements, 221; Schools, 157, 427; Shoek, 684; Swindlers, 763
Electro-deposition, 411, 812
Electro-magnetic Apparatus, 428, 605
Electrotyping, 45, 158, 507; Copy of Hound's Head, 364
Elliptic Curves, 300
Emigration, 125, 173, 190, 795
Employment, 125, 668
"Enamelloid," 300
Enamels and Enamelling, 251, 444, 509, 555, 748, 798; Black, 365; Cloth, 125; Fretwork, 750; Metal, 44; Slates, 46, 142; Stoving, 524; White, 350
Engines, 45, 75, 332, 461, 574, 748, 795, 813; Beam, 221, 716; Compound, 286, 414; Compressed Air, 795; Cover, 348; Cylinder, 462, 670; Drawings of, 110; Eleetric, 508; Gas, 75, 142, 206, 257, 302, 347, 604, 733, 764, 798; Horizontal, 171, 509, 781; Hot-air, 79, 204, 445, 539, 715, 716, 717, 732, 748, 781; Naphtha, 475; Oil, 462; Oil for, 461; Painting, 590; Petroleum, 109, 142, 222, 235, 254, 764, 779; Power of, 45, 796; ½-H.P., 235, 620, 716, 811; Valves, 364; Water. 427
Engine and Boiler Management, 652
Engineering, 331, 334
Engraver's Wages, 156 [494, 733, 830
Engraving, 110, 221; on Metals, 156,
Envelopes, Expanding, 477, 494;
Estimating, 653 [Patent, 541
Etching, 430, 781, 827
Examinations, 812; Engineering, 798;
Exhibitions, 76, 510 [Papers, 301
Exotics, 590

FAIRY BELLS, 28, 61, 268, 269, 571, 572,
Fan, Blast, 286, 398 [718; Pegs, 747
Fan Blowers, 222, 750
Fan, Covering, 78; Mounting, 126
Fender, 219, 349, 798
Fern Case, 749
Ferrotype Process, 364
Fiddle, 635; Japanese, 637
Field Glass, 541
Filling, 668
Fire Boxes, 683; Extincteur, 606, 734; Grate, 556; Lighter, 142; Smoking, 126
Firewood, Bundling, 478, 590
Firing Paintings on Glass, 108
Fish and Potato Fryers, 476
Fishing Rods, 94, 557, 733; Ferrules,
Fittings, Brass, 555 [190, 460
Fixing Carbon, 428
Flageolet, 702, 814
Flask, 795
Floorcloth, Copal Varnish for, 428
Floor for Warehouse, 573
Flower-box for Bay Window, 203
Flower-pot Cases, 621, 782
Flower-stand, 107, 508, 733
Flute, 620; Cases, 221
Force Pump, 717
Forge, Blacksmith's, 732
Fork Crown, 731
Formulæ:—Capacity, of Barrels, 526, 606; of Saucepan, 157; of Tank, 13, 670; Curves, 475; Electric Current, Strength of, 221, 382; Girders, 588; Hydraulic Lift, 716; H.P., 27, 30, 45, 203, 796; Propeller Screws, 588; Speed of Drums, Pulleys, etc., 475; Speed of Waggon, 315; Velocity of Gases, etc., 699; Water Delivery, 29, 60
Fortune-telling Cards, 636
Fountain, 156, 188, 380, 397, 507, 748; "Desideratum," 190; Driven by Engine, 510, 638; Feet for, 126; Self-acting, 635, 651, 748, 829
Fowls'-house, 62
Framing Engravings, 587
Frame for Looking-glass, 268
Frames for Wardian Case, 462
Freezer, Ice-cream, 619
Freezing Mixtures, 737
French and German Accents, 764
Fretwork:—12, 75, 269, 412, 494, 556, 654, 766, 827; Bending, 157; Bracket, 108; Clock Design, 350; Corner Design, 637; Cornice, 139; Enamelling, 750; Enlarged, 619; Frames, 414 620, 763; Fretworker's Address, 190; Machine, 94, 110, 141, 155, 157, 173, 235, 301, 334, 443, 461, 475, 478, 540, 557, 590, 686, 766, 797, 830; Market, 733, 830; Patterns, 188, 379, 380; Piano Frets, 268; Saws, 59, 444, 748, 766; Shield, 700; Thin Lines, 222, 380, 414; Wood,
Frosting, 14, 427, 779 [270
Frosty Windows, 764
Fungus, 364
Furnaces, 637; Hydrogen, 684; Portable, 414; Smelting, 60; Vertical, 765
Furniture:—Armchair, 395; Bedroom Suite, 491; Bookcase, 125, 157, 172, 188, 236, 283, 397, 443, 524, 556, 652, 798; Bookcase, Corner, 494, 652; Bookcase, Rotating, 316; Bookshelf, 125, 252; Cabinet, 139, 254, 732; Chiffonier, 443, 572; Coal-box, 75, 254, 364, 732; Commode, 555; Couch - bedstead, 413; Couches, 188, 204, 236; Crib, 733; Drawers, Chest of, 555; Dressing-table, 157; Escritoire, 108; Fender, 219, 349, 798; Hall Lamp, 108; Jewel Cabinet, 109; Moorish Stools, 782; Ottoman Couch, 704; Overmantel, 364, 443, 653, 670; Sideboard, 94, 285; Sofa - bedstead, 317; Table, 558, 683, 733, 780; Wardrobe, 334, 541; Washstand, 251; Work - table, 252; Writing-desk and Bookcase, 236; Writing-table, 108
Furniture Matters:—Antique Designs, 782; Colouring, 59, 315; Education in, 571; Fancy, 315; Firms, 555; Folding, 620; Home-made, 91; Restoring, 620; Reviving, 779

GALVANISED IRON, 750
Galvanising, 173, 251, 254, 318
Galvanometer, 206, 300, 318, 427, 430
Garden, Barrow, 173; Hammoek, 108; Workshop, 571
Gas Matters, 283, 749; Burners, 427; Incandescent Light, 475, 621; Luminous Flame Stove, 461; Meter, 364; Water in Pipes, 91
Gases, Velocity of, 699
Gauges, 539
Gesso Work, 541, 668
Gilders' Society, 637
Gilding, 350, 398, 668; Frames, 398, 412, 443, 604; Metal for, 626; on Varnish, 428; with Alloyed Gold,
Gilt Frames, Cleaning, 429, 606 [779
Girder, 588; Holes in Web, 257
Glacial Decorations, 286, 366
Glass:—Blowing, 542, 638, 686; Case, 493; Cement, 365, 542, 798; Cutting, 476; Decanter Stains, 333; Drills, 411; Embossing, 76, 443, 667; Etching on, 157; Fastening, 365; for Fountain, 748; Gilding, 107, 125, 267, 379, 382; Ground, Imitation, 654; Lamps, 493; Leadwork, 685; Measuring, 126; Mending, 750; Mildewed, 364; for Overmantel, 316; Painting, 108, 573; Removing Letters from, 398; Shades, 443; Signs, 395; Silvered, 668; Silvering, 44, 45, 59, 107, 364; Views on, 300; Working, 139; Writing on, 43, 110, 222,
Glazier's Diamond, 668 [347
Globe, 620
Glue, 76, 443, 558, 606, 734; Cox's, 268; Fish, 316; Preserving, 477; Waterproof, 428, 542, 574, 590, 638
Gold, Alloys, 828; Colouring, 828; from Buttons, 13, 668; Frosted, 173; Gold Lace, 667, 779; Leaf, 75; Paint, 574; to Soften, 60; Transfers, 76; Unworkable, 412
Gold Blocking, 334, 700
Gold Bronze, 221
Gold Size, 555
Golf Balls, 413
Gongs, 796
Graining, 140, 509, 541, 588, 651, 702, 795, 797; Cheap Furniture, 187; Oak, 509; Tools, 652
Granite, Imitation of, 365
Graph, 38, 220, 283, 635
Greenhouses, 157, 221, 349, 363; Boiler, 476; Heating, 526; Wash, 268
Grinding Scissors, 221
Grinding Stones, 699
Grindstone, 206; Drilling, 510, 622
Gum, 350, 556, 622, 733
Gun, 110-ton, 383
Gun, Barrels, Browning, 94; Colouring, 158; Walking Stick, 125; Rack, 60, 334, 494

HAIR CURLER AND CRIMPER, 619
Hair Cloth, 46
Hair Oil, 366
Hair, Removal of, 396; Teasing, 142,
Hall-marking, 379, 524 [206
Hammock, 108, 508, 635
Hand Screws, 731
Hardware, 171 [Reeds, 45
Harmonium, 141, 588, 748, 781, 795;
Harp, 140, 478, 667; Æolian, 29, 108, 651
Harvest Festival Decorations, 460
Hatching, Heat for, 411
Hat Making, 398
Hearthrugs, 637
Heating, 13, 252, 605; Coil, 221, 397; Perkin's System, 171; Room, 462,
Heliograph, 398, 526 [574, 590
Hinges, 61, 92, 283
Hints, 779
Hives, 12, 107, 828; Observatory, 107,
Hole-boring, 300 [285
Home Industry, 765
Home-made Novelties, 812
Honeycombed Holes, 827
Honey Extractor, 461
Hook, Steel Spike, 764
Hoop Rollers, 303
Horns, Polishing, etc., 396, 444, 445
Horse Collar Hames, 733
Horse-power, 203 (*and see Formulæ*)
Horse, Wooden, 718
Hot-water Fittings, 13, 252, 605
Hour Globes, 700
House, Colouring, 333; Repairs, 363
Hydraulic, Lift, 302, 716; Propulsion, 558

ICE-CREAM FREEZER, 91, 619
Ice, Preserving, 78, 142
Illuminating, 381, 606
Illustrations, Newspaper, 716
Impressions, 46
Improving One's Position, 94
Incubators, 27, 75, 78, 91, 94, 141, 157, 158, 188, 189, 235, 251, 283, 411, 459, 477, 558, 571, 573, 605, 668, 731, 781, 796, 811, 829; Damper, 461
Index Rerum, 158
Indiarubber, 604, 798; Arrow Shooter, 398; Balls and Balloons, 302; Covering Steel, 798; Cutting Rings, 750; Felloes, 125; Hand, 814; Mat, 414, 558; Moulding Compo, 635; Softening, 332, 798; Stamps, 365, 430, 443, 633, 701; Substitute, 221; Types, 619
Influence Machine, 475
Ink, 75, 604; Autographic, 206; Poster, 430; Printers', 158, 701; Removing Stains, 302, 493; Ticket Writers', 158, 254, 493, 604; Transfer, 558, 622, 734
Inking Roller Composition. 302
Inlaying, 139, 171, 173, 188, 414, 446, 606, 718, 780; with Fret Machine, 797; Mother of Pearl for, 13
Insects in Woods, 556
Inspeetorship, 27, 525
Insulating Compound, 364
Insulation for Coil, 189
Invention, 381, 494, 589, 827
Invisible Printing, 622
Iron, Angle, 60; Galvanised, 750; Lasts, 110, 412
Ironwork, 108, 253, 635; Venetian, 796
Ironmonger's Spare Time, 764
Ivorine, 556
Ivory, Balls, 142; Carving, 14; Colouring, 350; Imitation, 302; Tablets, 574, 686, 718

JAPANESE LEATHER PAPERS, 428
Japanning, 91, 318, 717
Jewel Case, Making, 477
Joints, Wiping, 124
Junction for Water Pipe, 253

KALEIDOSCOPE, 445
Kettle, to Clean "Fur," 219
Kiln, 93
Kinetic Theory of Matter, 829
Kites, 462
Knife and Spoon, 445
Knife, Treadle, 206
Knitting, 78 [Cordage, 173, 715
Knotting, Splicing, and Working

LABELS, TIN, 42, 442
Lace Frame, 158, 430
Lacquering, 43, 93, 637, 708; Brass, 14, 254, 285, 364, 476, 750; Electro-plate, 795; Steel, 158
Lamp, 253, 507; Explosions, 507, 603; Filling, 93; Magnesium, 62; Moderator, 156, 219, 268; Paraffin, 156, 253
Lantern, 28, 172, 187, 219, 235, 349, 365, 683; Cabinet, 316; Carrier, 685; Curtain Rolling, 205; Lamp for, 491; Lens, 604; Microscope, 749; Oil, 606; Slides, 204, 269, 557, 829; Stand for, 299
Lapidary Work, 542, 622, 718
Lasts, 46, 252, 268, 307, 412
Lathes, 11, 123, 286, 332, 428, 443, 475, 539, 542, 621, 670, 684, 750, 779, 781, 798; Angle for Centres, 413; Chuck, 716; Elizabethan Twist in, 443; Fan Power for, 733; Fret Saw, 444, 812; Headstock, 813; Mandrel for, 142, 206, 430, 446, 539; Overhead, 716; Rounding Wood in, 331; Speed, 651; Wheel, 300,
Launch, 782; Screw, 606 [795
Lead, Burning, 315, 716; Glass Work, 685
Leather:—In Binding, 188, Buff, 238; Patent, 268; Restoring, 462; Scrap, 46, 206; Skiver, 366
Lenses, 653, 797, 798, 813, 827, 828; Mounting, 157
Lettering, 397; Bottles, 188; Cart and Waggons, 187; Embossed, 286; on Opal, 171
Letters, 828; Affixing, 620; Opal Glass, 365, 398, 605; Removing from
Leyden Jar, 508 [Glass, 398
Life Buoy, 364
Lifts, Hydraulic, 302, 716
Lime, 429
Limelight Apparatus, 220
Lime Washing, 350, 509
Lithography, 108, 157, 268, 286, 524; Reverse Transferring, 509; Transfer Paper, 509; Zinc Plates for,
Locket, Repairing, 316 [509
Locks, 77, 428, 429, 478, 590, 638, 763;
Locomotive, 652, 812 [Picks, 78
Looking-glass, 428
Lubricant, 141
Luminous Paint, 556, 637, 750, 798

MACHINES, 94; for Advertising, 780; Bread, 286; Burnishing, 603; Cutting, 156; Lead Burning, 716; Milling, 124; Mitring, 62, 635; Pea Planting, 475; Power to Drive, 510; Rollers, 125; Sand Blast, 349; Tagging, 763; Wire Crimping, 539; Wimshurst's, 445; Wood Slicing, 174; Wood-wool Making, 620; Wool Working,
Machinery Oil, 331 [734
Macramé Board, 811
Magic Lantern, 604, 715
Magnetic, Belt, 174, 349; Needle Poles, 44; Saturation, 73
Magnetism, 765, 828
Magnets, 76, 251
Magpie, 652

Mail Cart, 521, 653, 670; Handles, 414,
Mandoline, 606 [510; Springs, 203
Manganese, 319
Mangle Rollers, 651, 734, 795, 814
Maps, Colouring, 175
Marble, 557; Cleaning, 961; Imitation, 398; Removing Stains, 317
Marbling, 267, 415, 699, 795, 797; Colours, 45; Learning, 11
Marine Glass 813
Marionette, 510
Marquetry, or Buhl Work, 16, 798
Mast, Splicing, 523, 603
Mastic Cement, 651
Match Making, 733
Mathematical Instruments, 731
Mats, 286, 411, 558, 590 [300
Mattress, Spring, 206; Cleaning Tick,
Meaning of Voltage and E.M.F., 332
Measuring Instrument, 128
Measuring Up, 782
Mechanical Office Work, 620
Medal, Copying, 381
Medical Electricity, 475
Medicine Chests, 316
Melting Brass, 429
Metals, 13; Hammered, 29; Softening, 798; Strength of, 390
Metal Work, 363
Mice Cage, 14
Microphone, 414, 780
Microscope, 93, 459, 749, 796; Mounting, 252, 573; Objects, 798; Polari-
Milk Pan, Rusty, 78 [scope, 587
Mill, 590
Mining, 414; Engineering, 331, 146
Mirror, 459, 619; Hanging, 653; Silvering, 45; Wardrobe, 716
Mitre Cutting, 478
Mitre Shoot, 78 [798
Modelling, Clay, 718; Wax, 206, 622,
Models:—Boat, 556; Boiler, 811; Boiler for, 812, 827; Cardboard, 14, 574, 702; Engines, 350, 493, 572, 781; House, 301; Locomotive, 670, 812; Ships, 14, 126, 635, 701, 733, 761, 830; Steam Launch, 494, 590, 622, 638; Wheels, 107; Working, 493; Yacht, 77, 91, 493, 572, 781, 830
Mole Traps (*see Traps*)
Monograms, 510, 558, 606, 798, 811; E.E., 379; N.H.H., 395; T.W.C., 461; N.R., 590, 766; C.L.H., 667; J.D.B., 700; E.M.N., 604; E.M.C., 733; E.H.S., 733; S.B., 779
Mosaic Work, 459; Flooring, 124
Motion, 539
Motors:—For Dynamo, 427; *Electro*, 27, 93, 236, 365, 508, 636, 681, 732, 813; Atkinson, 316; Griscom, 331, 443; Manchester, 201; "Paddle-wheel," 301; *Water*, 269, 332, 411, 606, 766, 796; Demon, 512; Haag's, 782; *Wind*, 414, 761, and *see Engines* [Carbon Plates, 286
Mould for Lead Casting, 41; for
Moulding, Compo, 331, 635; Lead Weights, 782; Plumbago, 188, 331
Mounting, Engraving, 685; Etchings, 524; Maps, etc., on Linen, 300, 573
Mounts, 155, 173, 590, 828
Musical Box, 29, 60, 652, 669
Musical Instrument, 656

NAILS, 302
Naval Architecture, 733, 830
Nets, 430
Netting, 191, 573
Nickel Bath, 45
Nose Instrument, 811
Nut, Grip Lock, 781

OHM, THE STANDARD, 283
Oil, Boiled or Unboiled, 459, 542, 638; Delicate Machinery, 331; Light, 798; Lubricating, 446; Marks, Removing, 331 [686
Oil Colours, Quick-drying Medium,
Oiled Paper, 300, 508
Oil Paintings, 411; Cleaning, 349; Framing, 349; on Silk, 427
Oilstone, 92, 718, 814
Opal Glass Letters, 365, 398
Optical Illusion in Advertising, 476
Organ, 108, 382, 462, 493, 669, 779, 811; American, 91; Blowing, 446; Diapason, 190; Pipes, 219, 416
Organette, Chords for, 76
Oxide of Cobalt, 718

PACK SHEETING, 525
Paint, 125, 140, 411, 428, 444, 509, 667, 797; for Art Metal Work, 555; Brushes, 797; for Cart, 189; for Cloth, 669; Enamel, 221; Filling, 668; Gold, 574; Luminous, 556, 637, 750, 798; Testing, 140; for Tickets,
Painter, 140 [30
Painting, 125, 250, 350, 509, 686, 702, 715, 766, 811; Banner, etc., 798; Bird Cage, 237; Brushes, 652; Blinds, Venetian, 189; Coach, 91, 539; Engine, 590; House, 108, 395; Lantern Slides, 61, 829; Poster, 107; Pottery, 332; Scene, 605; on Silk, 235, 427; Tile, 144; Van, 539
Panels, 619; Alabaster, 651; Background for, 61; in Cabinet, 732
Pantograph, 13, 187, 667, 795
Paper, 604; Damp Proof, 350; Hanging, 398; Lanterns, 493; Letters, 257; Making, 45, 702; Machine, 14; Staining, 237; Wheels, 460; Wood
Papering, 715 [Pulp, 460
Papier-maché, 299, 332
Paraffin, Mixing, 587; Stove, 590
Parchment, Transparent and Waterproof, 44
Paste, 733; Preserving, 477
Patents, Taking out, Cost, etc., 45, 77, 155, 156, 203, 222, 366, 381, 444, 491, 492, 508, 587, 620, 635, 683, 717, 763, 813; Agents, 573, 619; Bicycles, 639, 717; Colonial and Foreign, 491; Lock, 429; Patenting an Improvement on an Existing Patent, 412; Provisional Protection, 380, 492, 542, 671; Receipt of Deposit, 749; Selling, 508; Specifications, 251, 301, 492, 557; Tables, Various, 491; Use of the Word, 171
Patterns, 189; Tinware, 300
Pearl Setting, 281
Pelican Writing Pencils, 107
Pen, 142; Fountain, 142
Pencil-holder, 15
Pencil-sharpener, 380
Penholder, 333
Periscopic Glasses, 764
Perpetual Motion, 492, 764
Phonograph, 43, 78, 91, 173, 188, 220, 331, 350, 366, 700, 750, 780; Cylin-
Phosphor-bronze, 686 [ders, 429
Photographs, Colouring, 142, 653; Mounting, 718; Sizes of, 462; Tinting, 443
Photographer's Cabinet, 557
Photographic Appliances, etc:—Bromide Enlargements, 427; Camera, 13, 45, 91, 92, 190, 238, 270, 281, 331, 331, 366, 380, 397, 443, 444, 459, 461, 476, 477, 541, 556, 573, 605, 636, 654, 670, 686, 811, 813, 814; Cam. Bellows, 158, 204, 300; Camera (Enlg.), 395, 637; Chemicals, 111; Collodion Wet Process, 748; Dark Slides, 459, 461, 476; Detective Camera, 107, 300, 331; Developer, 347, 461; Developing, 76; Duplicating on Plate, 124; Dry-point Work, 444; Enamelling, 715; Enlarging, 91; 302, 427, 509; Expedients, 779; Frames, 204, 620, 763, 812; Lenses, 77; Negatives, 302, 381, 557, 652; Plates Backed, 797; Positives on Dry Plate, 510; Prints (Blue), 619, 651; Re-touching Medium, 334; School, 715; Sensitised Paper, 381; Shed, 716; Shutter, 318; Studio, 395, 620; Tents, 172; Transferring, 459; Varnish, 381, 715; View Finder, 699
Photography, 14, 204, 206, 270, 332, 348, 683, 686, 718, 766; Chemistry of, 315; Ferrotype, 361, 443; Kallitype, 828; on Metal, 763; Pinhole, 428; on Wood, 281; on Zinc, 781
Photo-lithography, 142, 219, 350
Piano Matters, 61, 268, 269, 573, 589, 717, 731, 797, 829; Damp, 717; Fairy Bells to, 28, 268; Frets, 268; Front, 717; Keys, 267; Panel, 139; Sticker Action, 267; Stool, 111, 300; Tuning Hammer, 268; Wrest Pins, 29
Picture, 269; Cords, 237
Picture Framing, 185, 283, 349, 587, 590, 603, 620, 652, 653; Circular, 557; Clay, 381; Cleaning Gilt, 129, 606; Cork, 823; Fretwork, 414; Gilding, 398, 412, 443, 604; Mouldings, 222, 635; for Photos, 204, 620, 763
Pigeon-house, 285
Pins, 622, 766
Pipe, Mounting, 11, 92; Mouthpieces, 188, 622, 798; Vulcanite Stem, 476
Pipe over Plinth, 381, 573
Pitch, White, 427
Planchette, 317
Planing, 283, 588
Plan of the Heavens, 510, 638
Plant Case, 12, 189, 719
Plaster-of-Paris Cement, 364
Plate, 795; Cleaning, 334
Platelayers, 175
Plate Racks, 30, 46
Plating, 60, 77, 124, 267, 779, 781; Cycles, 267, 508; Outfits, 174, 653; Stripping, 413; Nickel Plating, 45, 123, 396, 491; Silver and Electro-plating, 285, 316, 395, 397, 460, 475, 508, 510, 571
Platinum, 59; Contacts, 413
Ploughs, 508
Plumbago, 509, 635; Moulding, 331
Plumbers' Joints, 124, 171, 333
Plush in Brackets, 620
Plush Frames, 509
Pneumatic Tires, 748
Pointing, 512, 574
Poisons, Sale of, 315
Poker Work, 493
Polishing, 41, 60, 75, 77, 94, 109, 124, 157, 171, 173, 203, 220, 254, 315, 381, 411, 445, 462, 476, 194, 556, 653, 669, 702, 780, 829; Alabaster, 59; Bookcase, 318, 429; Cleanser, 462; Cracked and Dull, 315; Fillers, 251; Fretwork, 653; Glaze, 716; Horns, 441, 445; Marble, 139, 651, 668, 683; Pebbles, 638; Removing, 188; Reviver, 238, 315, 397, 462; Table, 109; Tin, 716; Tool Handles, 315; Vulcanite, 718; Walking Stick, 397
Pompeian Blue, 190
Porcelain Studies, 427
Posters, Theatrical, 187
Potash Solution, 702
Praxinoscope, 251
Prescription, 429
Pressure Rivet, 318
Printing, 92; Ink, 158, 701; Invisible, 622; Letterpress, 222; Press, 283, 317; Rollers, 303, 428; on Tin, 415
Propeller Screws, 588
Protection Stamp, 443
Protractor, 349
Puffs of a Locomotive, 652
Pulleys, 475; Chain, 173; Loose, 395; Pumps, 13, 331, 398, 558 [Rope, 158
Punch Trade, 443
Punt, 446, 478
Purses, Puzzle, 701
Putty, 556; Hardened, 14
Puzzle, 219, 572, 701
Pyrotechny, 158

QUARTZ, 206
Quasi-square Turning, 811

RAILS, CIRCULAR, 221
Rain-water Pipe, 761
Rat Cage, 382
Razors, 254; Case, 622; Paste for Sharpening, 175; Setting, 221; Strop, 317, 653
Reading Stand, Invalid's, 681
Rearer, 459
Reeds, Accordion, 251; Concertina, 350; Harmonium, 126, 795
Reflector, 316
Refrigerator, 398, 571
Registration of Designs, 510
Resin, 556; Resin Box, 539
Riddle, 270
Rifle Rack, 60, 331, 494
Ring, 651; Repairing, 477
Roasting Jack, 686
Rocking, Cradle, 558; Horse, 493, 781
Roller Model, 91
Rollers, Hoop, 94
Roofs, 189; Iron, 361; Pitch of, 462
Room, Removable, 205
Rope Mats, 750
Royal Engineers, Subjects for, 667
Rule, A Two-foot Slide, 413
Rushes, 525
Rust, Removing, 220
Rustic Woodwork, 414, 811

SABLE PENCILS, 205, 443, 601
Saddlery, 780; Collar Hames, 733
Safes and Safe Locks, 462
Sanitary Rail, 93
Sauce, 445
Saucepan, Capacity of, 159
Saucer, Combination, 476
Savings Bank, Brass, 492
Saw Bench, 622, 766; Guard, 535
Sawing, 748
Saws, 107, 111, 332, 317, 398, 478, 571, 637, 782; Band, 46, 190, 286, 653, 700, 813; Blade, 508; Buckling, 139, 203, 205; Circular, 11, 30, 46, 91, 94, 107, 188, 203, 395, 492; Cracked, 253; Grinding, 188; Hammering, 188, 235, 332, 525, 606, 699, 731; Hand, 205, 523, 603, 763, 795; Rate, 187, 235, 251, 299, 379, 491, 635; Set, 652; Scales, 171 [Sharpening, 556
Scene Painting, 43, 108, 141, 605, 716
Scenic Artist, 267
Scholarship, 493
Scissors, Grinding, 221
Scrapers, 459
Scraps, 121
Screens, 30, 26, 349, 556, 636; Cheval, 718; Draught, 28, 556, 781; Scraps on, 129; Varnish for, 220
Screwing Tackle, 606
Screw Propeller, 588
Screws, 108, 654
"Scriptograph," 220
Sealing Wax, 206, 366, 686
Set-pan, Repairing, 299
Sewer Gas, 363
Sewing Machines, 206
Shaftiug, 459
Shafts, Bent, 397
Sharpening Clipping Machine, 110
Shed, Price for, 157
Sheet Metal Work, 523, 571, 603, 604
Ship and Naval Craft, 556; Stoker, 349
Shocking Coils (*see Coils*)
Shooting Board, 108
"Shop" Insertion, 573; Letters, 603
Sieve, 46, 156
Sign Writing, 125, 365, 397; Charges for, 156, 317 (*and see Lettering*)
Silk Weaving, 331
Silver, Bleaching, 173; Chloride Cell, 781; Cleaning, 93; Foil, 60
Silvering, Buttons, 124; Mirror, 45; by Nitrate, 44 (*and see Plating*)
Size, 267, 637; from Parchment
Skates, 653, 637, 766 [Scraps, 135
Sketches, 717, 827
Skins, 91; Cleaning, 253; Curing, 30; Dyeing, 798; Preserving, 397; Softening and Mounting, 507, 795
Slab, 700
Slate Pencils, 14
Sledge, 606
Sleepers, 524
Slide Rest, 77, 219, 413
Slide Rule, 333
Slide Valve, 347, 653
Soap, 77, 331, 332, 350
Soda, 587
Solder and Soldering, 30, 92, 174, 667; Jewellery, 332; Lamps, 156; Pewter, 206; Rings, 477; Unsoldering, 605; Whitening Joints, 126; Zinc
Soldiers, Metal, 635 [to Brass, 191
Solenoid, 316
Spanner, 267
Speaking Machine, and Tube, 43
Speculum, Grinding, 13, 365
Speed of Waggon, 315
Spindles, 380, 539
Spiral Cutters, 732
Spirit Stand, 590
Sponge, Slimy, 524
Spoon Boxes, 301, 605
Spray Diffuser, 526
Springs, 189, 590; Steel, 61, 686, 734, 798
Squat Ball Making, 415
Squirrel's Cage, 365
Stains and Staining, 125, 203, 220, 285, 315, 476, 525, 653; for Blackboard, 629; Black and Ebony, 110, 172, 332, 380, 445; Fishing Rods, 557; Floor, 220, 411; Green, 251, 269, 668, 780; Ivory, 319; Mahogany, 44, 60, 142, 716; Oak, 428; Red, 349, 411, 716; Walking Stick, 187; Walnut, 254; Wicker, 462, 558, 574; Xylonite, 701
Stains, Monuments and Tombstones,
Stair Blockwood, 636 [798
Staircasing, etc., 108, 301, 193
Stamping, 45; Relief, 43, 76
Stationery, 299; Holder, 573
Stay Bolts, 750
Steamboat, 332
Steam, Carriages, 62; Chest, 316; Consumption of, 795
Steamers, Propeller for, 493
Steamship *Sarah Sands*, 302
Steel, Fastening to Cloth, 11; Hardening, 588; Sheet, 171; Tubing, 716
Stencils, 156, 189, 269, 411; Paper for,
Steps, 829 [459, 590
Stereoscope, 828
Stereotyping, 110; Metal, 779; Plates,
Stick Handles, 446 [635
Still, 542, 620, 702
Stones, Cleaning, 761, 798; Combe Down, 332; Preserving, 526, 633, 731
Stove, 59; Cooking, 268; Enamel, 46, 142, 521; Finishing, 700; Repairing, 173; Trivets, etc., 683
Straining and Mounting Tracings, 493
Strength in Metal Work, 363
Stuffing Fish, 110, 206; Bird, 188
Sundial, 413, 415, 542, 685
Surveying, 413
Sussex "Trugs," 619
Switchback Railway, 761
Sword Scabbard, Spots on, 318
Syphon, 62

TABLE ALTERATION, 558
Table for Bell-ringers, 380
Table Shelf, 683
Table-top Stand, 733
Tailoring, 782
Tank, Capacity of, 13, 670
Taps, 622
Tar Stains, 589
Tarpaulin, 222, 396
Telegraph, Instrument, 300, 814, 828; Wires, 91
Telegraphing, 251
Telephones, 91, 125, 508, 588, 686, 780; Bell, 587, 748; Lines, 733
Telescopes, 379, 381, 414, 460, 621, 635, 636; Astronomical, 701; Cleaning, 190; Galilean, 541; Lenses, 571; Retracting, Achromatic Eyepiece, Magnifying Powers, 651, 701; Speculum Grinding, 13, 365
Tempering, etc., 188, 493; Axes, 573, 731 [251
Terra-cotta, Mending and Stopping,
Terra-cotta Plaques, 398
Testing the Accuracy of Framework, 427, 507, 523, 603, 683, 811
Texts for Church Walls, 825
Thermograph, 189
Thermometer, 61, 220, 573, 653, 781
Ticket Writing, 269; Ink, 158, 251, 493, 601
Tile Painting, Medium for, 444

Timber, 286; Purchasing, 462
Tin:—Boxes, 126, 203; Can Ear, 604; Printing on, 302, 334, 445; Running, 413; Scrap, 334; Spangled, Tinfoil, 779 [268
Tinners' Mixture, 267 [Spots, 429
Tinning, Copper Pans, 315; Rusty Tips, 525, 651
Tire Clincher, 604; Pneumatic, 476
Tobacco, 45 [667
Tool Chest, 142, 156, 222, 286, 299, 556,
Tool, Cleaning, 140; Fitting, 188; Handles, 414; Tempering, 493
Tools, 94, 812:—Anvil, 699; Bevelling, 299; Bits, 14, 158; Boot Making, 283; Carpentry, 381, 718, 814; Carvers', 446, 494; Draw-knife, 46; Drill Chuck, 239; Drills, 251, 411, 492, 572, 750; Engravers' Metal, 156; Gauge, 251, 333, 606; Glaziers', 763, 764; Grainers', 268; Hammers, 699; Ivory Carving, 14, 556; Panel Gauge, 606, 766; Plane Iron, 190; Plane, Chamfer, 347; Ploughs, 700; Purfling Gauge, 251; Rebating Cutter, 443; Rose Cutter, 469; Spanner, 556; Spiral Cutters, 732; Tinman's, 716; Vice-bench, 461; Watch and Clock Making, 78, 141, 443; Wood Carving, 172; Wood Screwing, 573, 654
Tortoiseshell, Imitation, 667
Toy Manufacturer, 605
Toy Wheels, 619
Trade, Choice of, 124
Trade Marks, 348
Tram Line Curves, 397
Transfer Drawings, etc., 590, 734
Transfers, Gold, 267
Transferring, 459; Printed Matter, 78
Transparleum, 14, 30
Traps, Mole, 590, 606, 653, 763, 764,
Trellis Work, 478 [782; Pigeons, 28
Triple Expansions, 574
Tubing, Gasfitters' Compo., 829
Tub, Pig-scalding, 30
Tuck Pointing, 462, 542, 574
Turkeys, 302
Turned Surfaces, Finishing, 459
Turning Designs, 557
Turning, Patterns for, 445; Square, 14
Type, 331, 523; Cases, 587; India-Type-writing, 828 [rubber, 619

Umbrellas, Silk, 302, 443; Fittings, 302; Materials, 361; Repairing Silver Handle, 443; Sticks, 443, 542 [590, 702, 733, 734, 781
Upholstery, 124, 286, 379, 398, 430, 462,

Vacuum Pans, 606
Valve, 238, 572; Cornish, 540
Vapour Bath, 331
Varnish and Varnishing, 44, 75, 139, 220, 237, 379, 398, 411, 556, 557, 702, 765, 811; Black, 446, 510, 558; Blackthorn, 555; Bookbinders', 414; Carriage, 123, 235, 254; Colourless, 397; Copal, 268, 379, 428, 509; Cycles, 443; for Floorcloth, 428; for Leather, 733; Oil, 555; Photographic, 381, 715; Shellac, 699; Stain for, 315; Transparent, 477; Violin, 253, 443, 715, 827; Walking Sticks, 429; for Zither, 636
Vellum, 765, 812
Velocity of Gases, etc., 699
Veneering, 76, 171, 587
Ventilation, 93, 603, 701
Ventriloquism, 606; Dolls for, 493
Views, Coloured, 45
Villas and Cottage Plans, 27
Violin, 30, 45, 46, 94, 141, 286, 302, 651, 683, 827; Bass Bar, 333; Bridges, 188, 301; Case, 635; Split in, 189; Varnish, 253, 443, 715, 827
Violoncello, 141, 221, 348, 636
Voting, Mechanical, 619
Vulcanite, Joining, 430; Pipe-stem, 476; Polishing, 718; Tubing, 701

Wages, 475, 764
Walking Sticks, 238, 476
Wall Papers, Washable, 542
Walls, Decoration of, 428; Dry, 556; Tarred, 542, 797
Wardian Case, 493
Waste Products, 779
Watches, 78, 93, 300, 652; American Lever, 123; Ancient and Curious, 747; Case, 412; Case Engraving, 427; Cylinder, 382; De-magnetising, 695; Geneva, 141; Jobbing, 718; Movement, 493; Oil, 315; Parts, 540; Plates, 475; Springs, 363; Tools for Cleaning, 141; Verge, 187; Waltham, 635
Watch Key, 477, 492
Watchmakers, Papers for, 526
Water, Aspirator, 670; Delivery, 29, 60; Power, 92; Spray, 189; Wheel, 718, 765
Water Colours, 574, 686
Waterproof, 140, 558; Cloth, 348, 556, 620; Cotton, 396; Covers, 509; Glue, 428, 542, 574, 590, 638; Leather, 413, 493
Wax, 286; for Carvers, 157; for Modelling, 206, 622, 798
Weather-glass, 670, 796
Wheel of Life, 493
Weights of Copper, 668; of Cordage, 139; of Galvanised Iron Sheets, Wheelbarrow, 811 [etc., 443
Wheels, 77, 107, 269, 398, 619, 669; for Back Gear, 28; Cart, 670, 764; Cast Steel, 349; Clock, 444; Cog, 588, 653; Cutting, 61, 219; Emery, 700, 716; Fly, 539; Paper, 334, 460; Setting out Teeth, etc., 142; Speed of, 237; Spokes, 59; Toothed, 411; Toy, 619
Whip Handles, 622, 702, 750
Whip Stand, 590
Whistle, Brass, 142
White Metal, 622, 718
Whitewashing, 363, 395, 556, 636
Wicker Stains, 462
Windmill, 414; Sails, 222
Window Cleaning, 27, 46; Frames, 301, 795; Sash, 397; Steaming, 46
Window Flower Box, 141
Wiping Joints, 124, 333
Wirework, 394, 619, 702, 811; Basket, 43; Blind Writing, 187; Crimping, 542; Covered Wire, 460; Wall, 670
Wood Balls, 142; Bleaching, 669; Imitation, 797; Insects in, 556; Merchants, 108; Purchasing, 782
Wood Block Surface, 605
Wood Carving, 75, 77, 157, 172, 444, 782, 795; Bedstead, 300; Compo, 779; Markets for, 622; Patterns, 187; Prizes, 107; Writing Cabinet, Wooden Horse, 590 [108
Wood Engraving, 332
Wood Pulp, 350, 446
Woods, 109, 141, 287, 349; Briar, 142; Pitch Pine, 125; Red, 573; White, Wood-Turning, 110, 158, 228, 557 [653
Woodworking, Short Lessons in, 795
Wool Winder, 621, 765, 782, 798
Wool-working Machinery, 734
Work-box, 365, 781
Workshop, 205, 395, 571
Worm and Wheel, 269
Writing-desk, 523, 556, 683, 732, 765

Xylonite, 109, 238, 251, 286, 318, 366, 381, 556, 574, 652, 748; Staining, 701
Xylophone, 109

Zincography, 732
Zither, 302, 541, 557, 668, 701, 747, 828; Tuning, 588; Wood for, 652

# INDEX TO GENERAL ARTICLES.

Advertising, Machine, 314; Phonograph, 538
Air-pumps and their Construction, Alarum, 423 [498
Amateurs, Woodworking for (*see W*)
Ambulance, Simple, 151
Analysis, Chemical, 37
Appliances, 135, 179, 758
Aquarium Cement, 410
Arches, 375; for Garden, 739
Armourers' Hammers, 807
Artistic Lithography (*see Litho-*
Art Work in Leather, 818 [*graphy*)
Ash-pan Making, 565

Balloons, Toy, 134
Barometers, 483
Bassinette, 274
Bath, A Fold-up, 645
Batteries for Electro-gilding, 35
Beading, 742, 762
Beaumontage, 727
Bedsteads and Fold-up Bath, 645
Beneh, 758; Stop, 647; Vice, 169
Bent Iron, Hall Lantern, 321
Blinds, Venetian, 86
Blowpipe, 810; and Spirit Lamp, 282
Boiler, Explosions, 388; Scaling, 378
Boiler Management (*see Engine and Boiler Management*)
Bookbinders, Wrinkle for, 602
Book-rest, 648; Bookshelf, 565
Books, New Coverings for Old, 418
Books:—"The Amateur," 58, 122, 314, 602, 698; "Art Decorator," 314; Astronomy, 522; Blacksmithing, 234; Building Construction, 586; Cabinet Making, 746; Church Decoration, 490; Colours for Marbling, 202; Cyclist, etc., 522; Decoration, 490; "Discovery," 570; Electrical, 376, 714; "Electrician" Primers, 362; "Electro-Plater's Handbook," 58; Furniture Designs, 506; Geometric Turning, 202; Graining, 90, 634; "Guide to Dublin," 522; "Light," 650; "Machinery Market," 170, 314, 602; Magnetism, 714; Manual Instruction in Wood, 794; "Measures, Weights, and Moneys," 186; Mechanics', 650; "Mechanics' Almanack," Calvert's, 778; "Optics of Photography and Photo. Lenses," 826; Photographic Development, 58; "Photography in a Nutshell," 90, 602; "Screws and Screw Making," 186; Slöjd, 330; Smith's Tables, 202; "Success, and the Way Into It," 26; Tables for Ascertaining Area of Superficies, 698; Telephone Handbook, 826; Ventilation, 58; Watch and Clock Making, 346; "Wood Carver," 474, 826; Woodwork, 298, 794; *Catalogues, Price Lists, etc.*:—Cox & Co., 122; Garrett and Son, 122; Hobday's, 474; Melhuish's, 826; Photographic Annual, 122
Boot and Shoe Repairing:—Soling and Heeling Tools, 113; Patching, 201; Invisible Patching, Blindstab, 279; Underlaying, Toe-piecing, Loop-stitch, Seat-stitch, How to Stitch-draw, 345; Half Heeling, Keep Heels Level, 491; To Re-welt and Re-sole Hand-sewn Work, 515
Boots, Mechanical Blacking, 426; for Shortened Leg, 490; Cycling, 378; Drying-horse for, 313
Boring Square Hole with Centre-bit,
Box for "Work," 36 [26
Box, Folding, 503; Glass-topped, 282
Bracket, 198
Brazing, 356, 375
Briquettes, Smokeless, 373
Bronze, To Imitate, 602
Bruises in Wood, How to Raise, 183
Brush for Bottles, 314
Brush, How to Tie a Painter's, 234
Butchers' Trays, 697
Butter, Cooler, 826; Dish, 82
Button, Bachelor's, 394

Canopy for Bed Hangings, 241
Carpentry for Stage (*see Stage*)
Carriage Jack, 138
Cart, "Tip," 402; Painting, 403
Case Hardening, 770
Cask Tilter, 266
Castings, Sheet Iron in, 412
Castography, 314 [106; "Ideal," 410
Castor, Ball-bearing, 218; Cantilever,
Ceilings, Panelling, 825
Cement, Aquarium, 410; Hard-and-Fast, 602; for Lamps, 26
Chain-coupling Link, 759
Chamfers, 742 [tities, 199
Charcoal, To Prepare in Small Quan-
Chess-table, 770
Chicken-rearing Appliances, etc., 738
Child's Carriage, "Victor," 427
Chimney-pot or Cowl, 266; Smoky, and How to Cure them, 281
Chimneys, Clearing of Jackdaws' Nests, 375 [514
Clarionette Repairs by an Amateur,
Classes:—City Polytechnic, 522; Goldsmiths' and Jewellers', 522; Finsbury School, 522; Wood Carving, 506
Clock Case, Carved, 384, 473
Clock, Mysterious or Gravity, 818; A Perpetual Electric, 347, 362
Clothes Peg, Novel Use for, 250
Collar and Saddle Lining, 730
Colour Applied to Form, 209
Colour in our Homes, 689
Colours, Lithography, 457; Marbling,
Conjuring Tricks, 330 [202
Constructive Strength in Metal Work, 52, 162, 275, 630
Coops for Hens, etc., 787
Copier, The Cyltine Manifold, 554
Copper Welding, 426
Copyright in Design, How to Secure, 562, 674, 722; in Sculpture, 790
Cordage (*see Knotting, etc.*)
Cork Work, 761
Cottages, Specification and Design,
Cranes and Hoists, 181 [723
Cycles, Anti-vibrator for, 407; House, 514, 585; "Ring" Cushion Tire, 154; Safety Stand and Home Trainer, 634; Tires, 378; Winter Care of, 615; and *see also Safety*
Cycle Boots, 378 [*Bicycle*
Cyltine Manifold Copier, 554

Dados, Wall, 754
Decoration, 662; Drawing-room Stencilled, 17; Fireplace, 657
Designs for Chess-table, 770; for Cottages, 723; for Fretwork, etc., 458; for Furniture, 506; for Repoussé Work, 376; for School, 488
Dish in Repoussé Work, 306
Dog Muzzles, 532
Door, 628, 632; Plate-glass, 439
Dove-cot, Rustic, 289
Dovetail, 389, 691
Draught Excluder, 506, 698
Drawers, to Make, 258, 310; Bearers,
Drawing, Mechanical, 105 [374
Dresser for Kitchen, 529
Drilling Glass or Porcelain, 538

Early Riser's Friend, 423
Ear-rings and other Ornaments, 20,
Easel, An Artist's, 613 [101, 164
Egg Saucepan, Patent Signal, 442
Electric Bell, Converting Hand-bell to, 803 [730
Electric Clock, 347, 362; Night Light,
Electrical Machine, and Accessory Apparatus, 465, 582, 658, 755
Electrical Novelties, Jewellery, etc., 503; Plant Growing, 347
Electrolysis, Commercial, 538 [282
Electro-Medical Apparatus, Schall's,
Enamels, Silico and Club Black, 362
Enamel Letters, 506
Engine and Boiler Management, 229, 290, 354, 403
Engine, How to Make a Quarter H.P. Steam, 22, 87, 258, 327, 419, 509, 579, 646, 706, 778
Engines, 403; Ammonia Gas, 426; Hot-air, 314, 570, 585; Petroleum (Capitaine's), 618; Small Launch,
Envelopes, 378 [346
Etching on Glass, 330
Exhibition, Art Work, 766
Expanding Casket, 409

Fiddle-case, 423
Fire Escape, 186; Fire-guards, 690
Fire Extinction on Board Ship, 362
Fireplace, Decoration of, 657 [565
Fitment to Hang above Harmonium,
Flask, Workman's, 666
Flower Holder, 505
Flute, Clarionettes, etc., Repairs, 514
Fly-wheel to Shaft, Fitting, 358
Folding Boxes, 503
Foot-warmer, 806
Forge, Portable, for Amateurs, 705
Frames, Plush-covered, 594
Framing Woodwork, 67
"Frederick Crane" Chemical Company's Specialities, 26
Fret Saw Machine, 59
Fretwork, Designs, 151, 448; Glove Box, 39; Music Canterbury, 3; Panels, 546; Automatic Savings Box, 810; in Xylonite, 130
Furniture and its Glass, 39
Furniture:—Armchair, 664; Bedroom Suite, Combination, 341; Bookease, 353, 438, 663; Bookease and Writing Cupboard, 1; Cabinet, 433, 578; Chair, 790; Coal Box and Music Stand, 439; Drawers, Chest of, 791; Hall Stand, 50, 213; Hat or Clothes Stand, 266; Medicine Cupboard, 233, 518; Music Canterbury, 3; Music Stand, 439; Ottoman Couch, 824; Secrétaire, 642; Table, 121; Table, Box Top, 404; Table, Folding, 808; Wall Mirror, 664; Wardrobe, 150, 178; Whatnot, 369; Writing Cupboard and Bookcase, 1; Writing Table and Bookcase, 353

Galvanometer, 170
Games, etc., 362
Garden, Arches, 739; Label, 218; Tool House, 225; Tubs and Boxes, 129
Gas Globes, Wire, 532
Gas Meter, 426
Gilding Picture Frame, 262
Girders, 630
Glass, Cleaning, 184; Door-plate, 489; Drilling, 538; Etching on, 330; in Furniture, 39, 116
Gluing, 561, 822; Springs for, 439
Gold Paint, 119, 186
Graining, Transfer Sheets, 250
Graph, 601
Greenhouse Sashes, 482
Grindstone, A Workshop, 450
Gutta-percha Substitute, 410

Hall, Corner Closet for the, 145
Hall Lantern in Bent Iron, 321
Hall Stand, Substitute for, 213
Hardening, 546
Hard Stopping or Beaumontage, 727
Harness, Improvements in, 487; Linings, 730; Pads, 743
Harp, Æolian, 347
Hat-pegs, Handy Row of, 518
Heating Apparatus, 742
Holdfasts for Wood Carvers, etc., 455
Homacoustic, The, 762
Honey Extractors, 298

House, Making the Best of a Bad, 449, 548, 617, 649, 760, 789
Houses, Sanitary Fittings, 44, 295
Hydraulic Propulsion, 442

Incubator, etc., 610, 738 [74
Indiarubber "Grip" Handle Cover, Ink Blots, Removing, 538
Inks, Proctor's "Defiance" Writing, Insulating Material, 330 [74
Inventors, Hints to, 314, 330, 346, 362, 378, 394, 410, 426, 442, 506, 538
Iron, Cast, Columns, 246
Iron or Steel, to Discover Flaws, 330

Jack, Carriage, 138

Kallitype, Improvements in, 678; Photo Printing Process, 306
Keltic Ornaments, Examples of, 722
Kitchen Dresser, 529
Knife and Spoon, 330
Knotting, Splicing, and Working Cordage:—Introduction, Calculating Strain of Rope, 6; Simple Knots, Joining Ropes, 65; Eye Knots, 137; Hitches and Bends, 199; Ring Knots, 244; Shortenings, 309; Ties and Lashings, 361; Fancy Knots, 468, 551; Splicing, 613; Working Cordage, 676; Pointing a Rope, Mainstay, Shear Legs, Hammock Clews, Stern Ladder, Mat-making, Conclusion, 725
"Kristaline," 202

Labour-saving Appliances, 441
Lacquers, 26, 202
Lamps:—For Magic Lantern, 597; Microscope, 51; Spirit and Blowpipe, 282; Wicks, Trimming, 26
Landing Nets, 775
Lantern, Lamp for, 597
Lathe, 10, 453, 567, 694; Attachment for, 666; Chuck, 490; Prize Holly, Lead Joint Runner, 425 [714
Lengthening a Revolver Sight for Long-distance Shooting, 775
Letters, Enamel, 596
Lighting Arrangements in Temporary Decoration, 593
Lithography, Artistic:—Printing Surfaces, Stone, Zinc, Transfer Paper, 19; Materials, Technical Work, Stipples, 149; Technical Work, Stippling, 231; Chalk Work, 296, 386; Practical Work, Colour, 451; Practical Work, Conclusion, 530; Colours, 457
Locks, Tubular Reversible, 314
Locomotive, Something about the "Puffs" of a, 406

Machines:—Cutting Diamond Pattern, 170; Dovetailing, 602; Drilling, 10; Mitring and Squaring, 9; Mitre, Eclipse, 170; Perforating, 458; Planing, 346
Macramé Board, 681
Making the Best of a Bad House:—The Study, 449, 548, 617, 649; Entrance Hall, Staircase, Front Door, Study Door, Walls, 709; The Dining-room, 760, 789
Mandoline Matters, 777
Mantelboards, 265
Masons' Work:—Introductory, Various Styles, Various Stones, Weight and Crushing Stress of Stones, 98; Tools, Scaffolding, Hoists and Cranes, Centres, Mortar, Cement, and Concrete, Foundations, Setting-out, 184; Damp Course, Footings, Walling, Pointing, Dressing Stones, 263; Workshop, Drawing, Moulds, Ordering Stones, Setting, Dowels, etc., Window Sills, Yorkshire Paving and Kerb, 323; Staircases, Arches, Niches, Chimney-pieces, Measuring, 375
Means, Modes, and Methods, 26, 119, 151, 183, 234, 250, 375, 439, 601, 647
Meat Safe, 216
Mechanical Drawing for Teachers,
Medicine Cupboard, 233, 518 [105
Metal Work, Constructive Strength in, 52, 162, 275, 630
Metal Work, Screws in, 69
Metal Work (*see Sheet*)
Microscope, Sub-stage and Polariscope for, 631
Microscopic Sketching, Camera Lucida, 325
Mirrors, 518
Mitres, 67, 809
Money-box, 73
Motors, Model Electric, 71, 785; Water,
Mouldings, 67, 742, 762 [122
Mounting Canvas for Painting, 644
Mounts, 518
Mousetraps, Paper, 394

Nail, Double-pointed, 570
Nests in Chimneys, Clearing, 375
Netting, Hints on, 535
Nut Cracker, 218
Nut, Double Grip, 618

Oil Painting, Mounting Canvas for, 644
Orrery, Patent Revolving, 730
Our Guide to Good Things, 10, 26, 58, 74, 90, 106, 122, 138, 154, 170, 186, 202, 218, 234, 250, 266, 282, 298, 314, 330, 346, 362, 378, 394, 410, 426, 442, 458, 474, 490, 506, 522, 538, 554, 570, 586, 602, 618, 634, 650, 666, 682, 698, 714, 730, 746, 762, 778, 794, 810, 826

Pads to Open and Release a Fallen Horse, 743 [657
Painting, 689; Cart, 403; Fireplace,
Paints, Heat-resisting Mastic, 682
Panels, 67, 713, 822
Paper, 378
"Passe-Partouts," and other Decorative Matters, 662
Patentees, Words to Would-be, 182,
Pattern Making, 277 [213
Pencil, 378
Penholder, Novel Combination, 298
Perspective, Stage, 417, 455, 499
Photographic:—Camera, Airedale, 234; Camera, Hand, 474; Camera Case, 660; Dark Room Light, 279; Dark Slide, 426; Fixing Tank, 386; Instantaneous Shutter Roller Blind, 408; Kallitype, 306, 678; Lens Shutter Adapters, 821; Photographine, 234; Plate-draining Rack, 134; Tents, 151, 216; Transparencies, 695
Photographic Advertising, 538
Photographic Expedients, 581
Photography as a Means of House Decoration, 695, 744
Photography, Novel Use for, 518
Piano, Decoration of, 745; Hammers, 314
Picture Frames:—Fastening Corners, 119; Gilding, 262; Gold Paint for, 119; Oxford Frames, 24
Picture Cord Grip, 442; Hanging, 184; Suspender, 551
Pigeon-holes, Nest of, 103, 249
Plane, 551, 567, 579
Plants, Electrical Growing, 347
Plating, Silver, 118; Gold, 35, 82
Platinum, Substitute for, 506
Pointing, 264
Poker Work, 538
Polishing, French, 9; Bodying in, 194, 226; Chat with a French Polisher, 278; "Dry Shining," 406; Fillers, 166; Glazing, 333; Rubber, 53; Spiriting off, 223
Polishing, Metal, 102
Porch for Cottage or Small Villa, 161
Poultry Farm, 673, 728
Printing of Stereos, Rapid, 442
"Puffs" of a Locomotive, 406
Puzzle Money-box, 73
Pyrography, 538

Raising Heavy Weight, 53
Razor, How to Strop a, 7
Razor Strops, 390
Reading Stand, 648
Reamers, Hints on, 343
Repoussé Work, 306, 657, 665; Finger Plates or Panels in, 376
Resonance Box, 823
Retort Stand, 538
Revolver, Lengthening Sight, 775
Rope Strain, 6
Rustic Woodwork, 129, 161, 193, 225, 257, 289, 505

Saddles, 566; Linings, 730
Saddler's Clamp, 470
Safety Bicycle, Its Practical Construction, etc.:—Introduction, Gear-up, Tools, etc., 33; Positions of Rider, Saddle, Handles, and Pedal Shaft, Steering Line, Handle-bars, Pneumatic and Cushion Tires, 99; Drawing and Steering Barrel, Handle-bar, Tubes and Mud-guards, L-Pin, Materials, 167; Wheels, 227; Turning and Fitting Parts, 307; Brazing, Socket Joints, 356; Brake, Mud-guards, Driving Axle and Chain Wheel, Cranks and Pedals, Saddle and Spring, 435; Enamelling, Nickel-plated Parts, Rubber Tires and Fixing, Fitting Together, Accessories, 521; Final Re-fitting up, Accessories, Hints to Cyclists, Care of Machine, 595
Sanitary Fittings of Houses, 295
Sashes (*see Window Making*)
Sash Fasteners, 154 [Hand, 421
Saws, Bow, 518; Circular, 26, 294;
Saw, Repairing Circular, 294; Setting, 370, 422; Sharpening, 421
Saw, Use of, 598, 612
Scaffold Chain, 378
Scaffold and Hoist, 138, 184
Scaling (Boiler) Preparations, 378
Scarf, Ornaments, 771; Rings, 804
School, Design for, 488
Sciscophone, 330
Sconces, 518
Scraper, How to Sharpen, 474
Screws, 69, 132, 743, 808
Scribing-blocks, 457
Sheet Iron in Castings, 442
Sheet Metal Work:—*Oval and Cylindrical Vessels*—358, 471. *Square and Oblong Vessels*, 536
Shelves, 518, 822
Shirt Studs, etc., Patent Fastener, 90
Shop, 11, 27, 43, 59, 75, 91, 107, 123, 139, 155, 171, 187, 203, 219, 235, 251, 267, 283, 299, 315, 331, 347, 363, 379, 394, 411, 427, 443, 459, 475, 491, 507, 523, 539, 555, 571, 587, 603, 619, 635, 651, 667, 683, 699, 715, 731, 747, 763, 779, 795
Shopping Casket, Expanding, 409
Shutters, Revolving, 248
Slippers, Leather, How to Make, 534
Smiths, Practical Papers for, 310, Punching and Drifting, 371; Working of Steel, Iron and Steel, Heating, 486; Hardening and Tempering, 546; Tempering Mixtures, 710; Case Hardening, Model Work, Die Forging, 770; Arrangement of Shops, Machines, and Tools, 802
Smokeless Briquettes, 378
Soldering Iron, Gas-heated, 330
Specification for Pair of Cottages, 725
Splicing (*see Knotting, etc.*)
Spontaneous Combustion on board Vessels, 362
Springs for Gluing Purposes, 439
Spurs with Concealed Rowels, 458
Stage Carpentry:—Profile, Covering Boards with Canvas, Gluing, Set Pieces, Wings, 561; Doors and Windows, Springs, Dogs, etc., Vampires, 632; Borders, Ground Rows, etc., 712; Rollers, 792
Stage Perspective, 417, 455, 499
Staining, Mahogany, 119; Black, 601; Brown, 439 [ing, 74
Steam Pipes, Non-conducting Cover-
Stone Carving, Scraps of, 357
Stone-work, etc. (*see Masons' Work*)
Stucco-work, Artificial, 362
Suggestions for Workers and Hints to Inventors (*see Inventors*)
Sussex "Trugs," 697

Tables, Folding, 808; Fixing Tops of, 8; Round, 121
Tambourine, 146
Tangent Galvanometer for Wood Turners, 56
Tanks, their Shape, Capacity, and Weight of Contents, 630
Taps and Reamers, Hints on, 343, 743
Tea-tray, Oak, 824
Telescope, A Four-draw, 598
Tempering, 546, 710
Tenons, 67
Thermometer, How to Make a, 181
Tiles, Design for, 657
Tins, What to do with Empty, 647
Tool Chest, 801
Tools:—Bench Block, 229; Broach, 243; Cramp, 21; Drill Stock, 325; Drilling, 825; Gauges, 458; Hammers, 807; Rimer, 243; Smiths', 802; Vice, 169, 714, 810; Wire-working, 119
Trade Notes and Memoranda, 94
Trammels, their Uses and How to Make Them, 615
Traps, Mouse, 394; Rat, 484
Trestles, About, 338
Tricycles (*see Cycles*)
Tuning Metronome and Monochord for Amateur Tuners, etc., A, 627
Type-writers, 347

Varnishes, 212
Venetian Blinds, 86
Verandah, Rustic, 193, 257
Violin, How to Make It, 4, 83, 146, 241; Bow, 647; Case, 423
Voting, Mechanical, 538

Wall Coverings, 625
Wall Papers, To Clean, 179
Warming-pan, 775
Wash-tub, How to Make, 468
Waterproof Cloth, 410
Weather Glass, 483
Wedges, 67
Welding Copper, 426
Wheatstone Metre Bridge, 373
Wheel, Fitting to Shaft, 358; Rubber Felloe, 505
Whip Crock, Girth-tightening, 711
Willesden Paper, 674
Window and Door Grip Fastener, 154
Window Making, 632; Greenhouse Sashes or Dead Lights, 482; Roof Lights, 547; Sashes, 679, 775
Window Box, 394
Wirework in all its Branches:—Introductory, Crimping, 7; Wire Gauze, 55; Crimping Machines, Benches, Tools, 119; Straightening, Soldering, Galvanising, Tinning, Lacquering, The "Swift," 153; Crimping, Putting Together, Meshes, Guiding Boards, Slides, 195; Twisting, Twisting Machine, 244; Lacing, Shuttle, Splicing, Cutting-up, 291; Scroll Irons, "Gothics," 339; Worm Block, Tying, Frames, Knuckles, 393; Peg Latticing, Hexagonal Mesh, 437; Rat Traps, 484; Dog Muzzles and Gas Globes, 532; Fireguards, Bodging, Stay-bars, Eyewires, Hooks, 600; Toasting-forks, Grid-irons, etc., 691; Garden Arches, 739; Hen Coops, Pea-guards, 787 [375
Wood-carvers' Holdfast, 455; Screw,
Wood Carving, 82, 170; Case for Clock, 381, 473; Classes for, 506
Woodwork, Framing, 67
Woodworking for Amateurs:—Introduction, List of Tools, 535; The Plane, 551, 567, 579; The Saw, 598, 612; Setting-out, Squares and Gauges, 632, 647, 666; Setting-out, Halving and Dovetail Halving, 691; Boring Holes, Panels and Frames, 713; Mouldings, Chamfers, Beads, etc., 742, 762; Hard Wood, 778; Curved Lines, 794; Mitres and Scribes, 809; Fixing Shelves, Putting Work together, 822
Wood Turning, 56
Work-table, 821
"Work," Book-box for, 36; Rules for Contributors and Correspondents, 42
Workshop Applianees, 135, 179, 758

Xylonite for Fret-sawyers, 130

Zither, 390; Stringing, 550

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# WORK

## An Illustrated Magazine of Practice and Theory

### FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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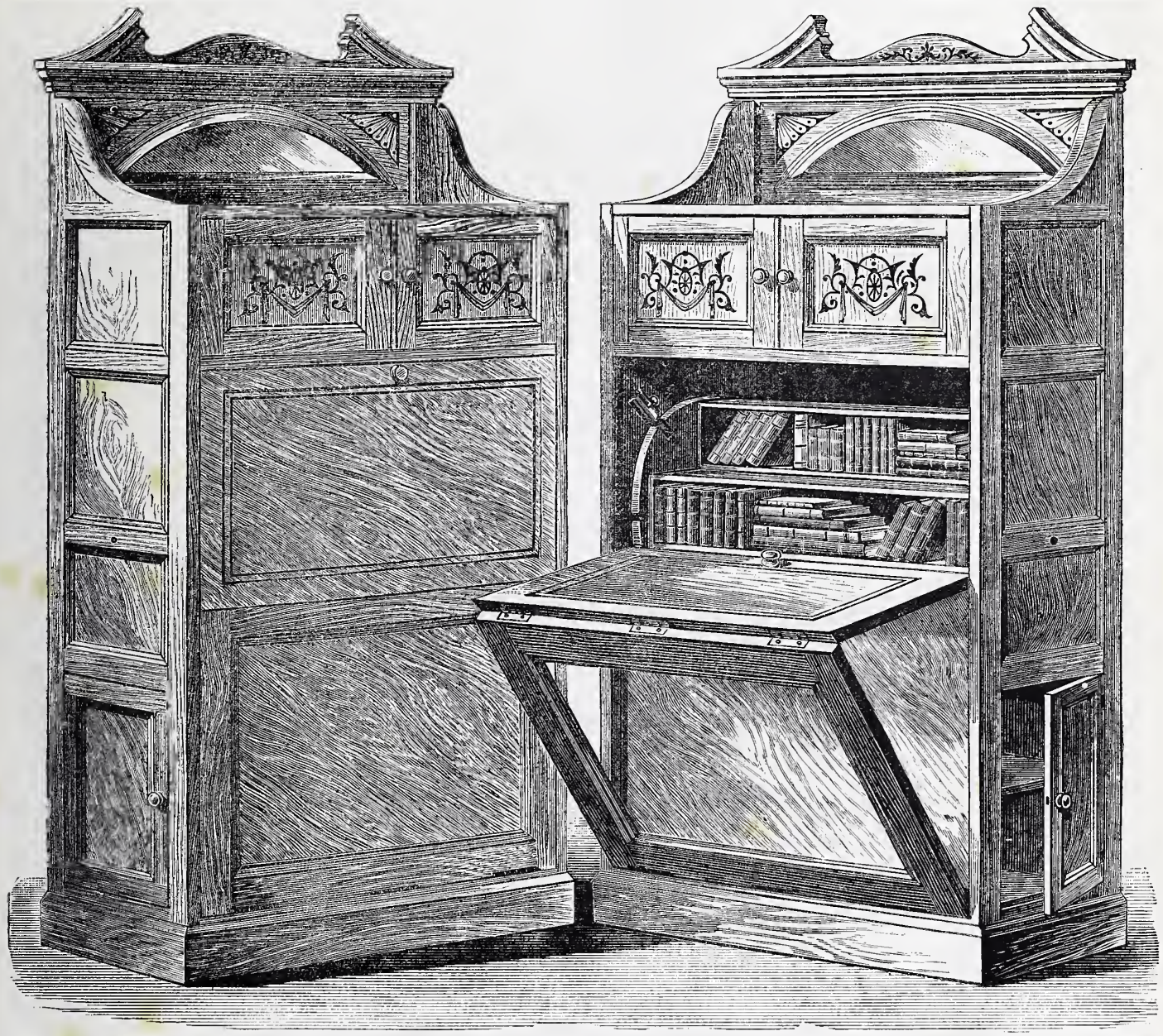


Fig. 1.—Cupboard closed.] [Fig. 2.—Cupboard open.

A WRITING CUPBOARD, WITH ADJUSTABLE WRITING FLAP AND BOOKSHELVES REVOLVING HORIZONTALLY.

## A WRITING CUPBOARD, WITH ADJUSTABLE FLAP AND BOOKCASE REVOLVING HORIZONTALLY.

BY JAMES SCOTT.

Utility of Cupboard—Construction—Bookcase and Book Boxes—Small Cupboard at Top—Plinth—Dimensions and Mode of Making—Backboard—Doors—Pediment—Revolving Bookshelves—Writing Flap—Finishing.

Many a man may find such an article as I have designed for this week a welcome addition to his home. I say "home," because I have specially intended it to be of more service there than in business departments, although in the latter it would certainly be found very useful. In most offices, however, the adjustable writing flap would not have much advantage over the ordinary writing-desk tables, as very few men indeed would like to clear the papers from it every night in order to shut up the cupboard.

But, as before said, in the home it may find a welcome. There are several persons who find it a matter of necessity, or perhaps pleasure, when they are within their homes, to write or study occasionally; and this combined bookcase and writing table, possessing, as it does, a few advantages over

ordinary articles of the kind, will enable them to do so as comfortably and conveniently as possible.

As may be seen by a glance at Figs. 1 and 2, very little trouble will be occasioned to put the article into position for use as a writing table or bookcase. The cupboard has, in front, a flap and a rather wide framing hinged together. In opening the cupboard, the catch at the top of the flap is released, and an arrangement (of which more will be said later on) prevents the top edge of it coming from between the cupboard sides, with the natural result that (the bottom of the lower framing being hinged as in Figs. 1 and 2) the flap is adjusted on the slope, and is adequately supported by the lower framing, etc.

The framing is much to be preferred to a solid board, as there will then be sufficient accommodation for the knees of the person who may be writing at the article.

The other feature of the cupboard, and one that will, I think, be considered a novel and useful one, is that of the bookcase being so made and fixed as *to revolve horizontally*. The advantage of this feature will, perhaps, be readily conceived. A series of boxes, of which one is shown in Fig. 16, all of one size, or of different dimensions (provided, in the latter case, space is properly allotted for their movements), are pivoted between two circular boards, which, in their turn, are pivoted to the sides of the cupboard. A person may be occupied writing at the desk, and find it necessary now and again to make reference to some particular volume or paper in his possession. With the ordinary secretary bookcase, supposing the volume required was on the top shelf, this would necessitate his rising from his seat; and in the present case, with so large a writing flap, this would be found doubly inconvenient; but as the shelves revolve horizontally, the volume can be obtained by turning the boxes until that one in which it is contained comes round to the front.

If all the book boxes are the same size, and are generally proportionately stocked, whenever the hands were taken from the case after revolving it, it would remain steady; but as differently sized boxes may be used, or, if all one sized are made use of, some shelves might be well filled, while others were half empty, I have shown how the case can be kept steady by means of a bolt fitted within the cupboard, which will enter into notches or holes in the edges of the two circular boards at the ends of the case. It will be best to countersink the heads of *all* pivots, so that none of them may interfere with the free revolutions of the boxes.

In Figs. 3, 4, and 5, I have given elevations of three bookcases; in one diagram showing equally sized boxes, and in the other two, boxes of different dimensions. Other sizes may be made, but they will have to be worked out very carefully, for in revolving, unless proper space is allowed for the movements of each box, some will knock one against another. My diagrams are drawn to 1¼ in. scale, and those who understand scales will have no difficulty in finding what size each is intended to be. Here are a few hints, however, for those who do not understand scales, and who, by their ignorance are unable to arrive at any conclusions concerning what, at some time or another, may have been, or shall be, said. If ¾ in. scale is alluded to, all that need be done is to have a narrow piece of card or paper, and from an ordinary rule or measure indicate upon it a sufficient number of spaces, each ¾ in. long, and divide the first space into twelve equal parts. For any other scale, this same method should be followed, of course making each scale the length of the figure given, and always dividing the first space into twelve equal parts, which will represent inches. When a drawing or diagram is said to be drawn to a certain scale, the rule with that scale marked upon it should be used to measure the diagram or drawing, every large space representing a foot, and every small space an inch. These remarks may seem to some unnecessary, but I have personally met with men who have thanked me for the simple information. I shall give the dimensions of the equally sized boxes in due course, but shall leave the others to the reader.

I have represented in my design a small cupboard at the top, which may be found convenient for a good many purposes, but, of course, I need not say that it is not indispensable.

The suggestion of the bookshelves revolving, as shown in the design, may be turned to use separately and apart from the writing table, such as adapting it upon a table within a case, with either one or two doors on one side or on each side.

Sketches of one way of making the plinth are shown in Figs. 10 and 11. The latter represents a top view of it, and the former an under view, showing corner blocks inserted to add to its strength, and also to which castors (if they are required) may be screwed.

Fig. 16.—One of the Hanging Book Boxes.

The length of it will be 46½ in., the width 20 in., the depth 5 in., and thickness of boards, say, ¾ in. To this is screwed the top carcass.

I have intended the sides of the cupboard to be "mock"-panelled—*i.e.*, a whole board with beading mitred and glued on to it; but, of course, with this article, properly panelled sides may be used, as the only boards joining them crossways will be the top and bottom boards and the board forming the bottom of the top cupboard. The shelf at the bottom of the job need only fit loosely on to a ridge screwed inside the cupboard to support it.

The length of the cupboard sides in front will be 62½ in., and at the back 75 in.; the width 18 in.; and the thickness, I think (as the job is really so open), no less than 1½ in. The small doors at the bottom might each be 22 in. long and 15 in. wide.

The top and bottom boards of the article, and the bottom board of the small top cupboard, will each be 42 in. long and 18 in. wide (all my measurements in this paper allow sufficient for joining), and about ⅞ in. thick. The sides are joined together in front at the bottom half of the article by a board 42 in. long, 26 in. wide, and ¾ in. thick. This board will be necessary to form a background for the knee-framing, unless, in place of the latter, a whole board is used, which I certainly do not advise, on account of the inconvenience it will create. The board should be joined at a distance from the edges of the side boards equal to the thickness of the front framing.

I always prefer the back board of an article of this kind to be made as one whole thick board instead of thin matchboard. The height of it should be 62½ in., the top edge of it thus coming flush with the top surface of the top boards.

The doors of the top cupboard will each be 19¾ in. long, 10½ in. wide, and ⅝ in. thick. Panels of, say, ⅜ in. stuff, nicely inlaid, carved, incised, or stencilled, will rob the article of some of its plainness. I have not intended this small cupboard to have a division down its middle; a piece of moulding will be glued on to one of the door edges, as shown by A in Fig. 18.

The pediment and the top back board containing the looking-glass are shown in Figs. 8 and 9. The top edge of the larger back board must be cut to receive the bottom of this part, which should be screwed to the larger back board and to the back edge of each side board. The height from the bottom edge to the top of the straight moulding will be about 15 in.

The revolving bookshelves or boxes now claim attention. Two circular boards, each 18 in. in diameter, and about 1¼ in., or even 1½ in., thick, are pivoted with good, strong pegs to the inside of the job. On the outside these pivots need not show, my sole purpose for showing them in my drawings being merely to indicate their position.

Taking the boxes represented in Fig. 3, the length of them will be 36½ in. or 37 in., according to the thickness of the circular boards, the depth 7 in., the width 6 in., and the thickness of the boards composing them ½ in.; the pivots connecting them with the circular boards being driven through precisely the spots I show, each one being at 2 in. from the edge of the circular boards. When fitted in its proper place, the bookcase will, if equally weighted, as I said before, remain in the position it may be left after turning it round; but a bolt, or something similar, is to be preferred, and whatever is used must work only in the *edge* of the circular boards, and *not on the surface*, as in the latter case it would interfere with the free movements of the boxes, and they would thus become utterly useless. A bolt need only be fitted on one side, unless very heavy books are within the case. It will be fitted as in Fig 12, and the edge of the circular board may be either as in that diagram, *i.e.*, with holes drilled into it, or, as in Fig. 13, with notches. To further support the case, I should advise the screwing to the sides of the article, directly underneath the circular boards, of stout pieces of board, as in Fig. 6.

I should not recommend the fixing of a board underneath the bookcase, other than that shown in Fig. 2, as if one is used, should a book or paper accidentally fall from the boxes, great difficulty would be experienced in getting it up again; whereas, should one fall, if the article is made as I intend it to be, it would lodge upon the lower shelf, and thus be very easy to get at.

I do not say that the present article, so far as the bookshelves are concerned, would be found desirable where it is not necessary to write at the same time as referring to the books; although, after all, little extra trouble would be required to obtain a book by drawing down the flap than would be caused by opening an ordinary bookcase, the extra trouble being that, unless the book wanted was in view, the shelves would have to be turned; but, as before said, this is a decided advantage when sitting at the desk.

Attention must now be given to the writing flap. A very convenient size for it will be 39 in. by 18 in. It will be hinged

to the under framing as shown; which latter might be 26 in. wide, with a moulding round its inner edge. The flap I have represented as having a couple of lines incised round it. Of course, a moulding would be entirely out of the question.

If the flap were lined with ornamented leather, or leather cloth, it would not be found an objectionable feature of the article when closed, and would certainly be better for writing purposes than the bare wooden surface. The thickness of the flap and framing should be about ¾ in.; and here let me add that both will work better if the edges which meet are canted and hinged as in Fig. 15. A neat, strong catch will be required to keep the flap up as in Fig. 1.

A groove must be cut from just underneath the top cupboard to the top edge of the front board, in each side board, as in Fig. 7. Behind the writing flap, at each side near the top edge, will be a peg, as shown in Fig. 17. The protruding end of this peg will be inserted in the groove A A, and it is this that will keep that part of the flap always between the cupboard sides.

I have not provided any place for stationery; but, if considered inconvenient to keep it in one of the revolving boxes, a compartment could be fitted in front between the cupboard sides and under the top cupboard, where it would not interfere with the freedom of the book-boxes.

## A HANGING MUSIC CANTERBURY IN FRETWORK.

BY J. W. GLEESON-WHITE.

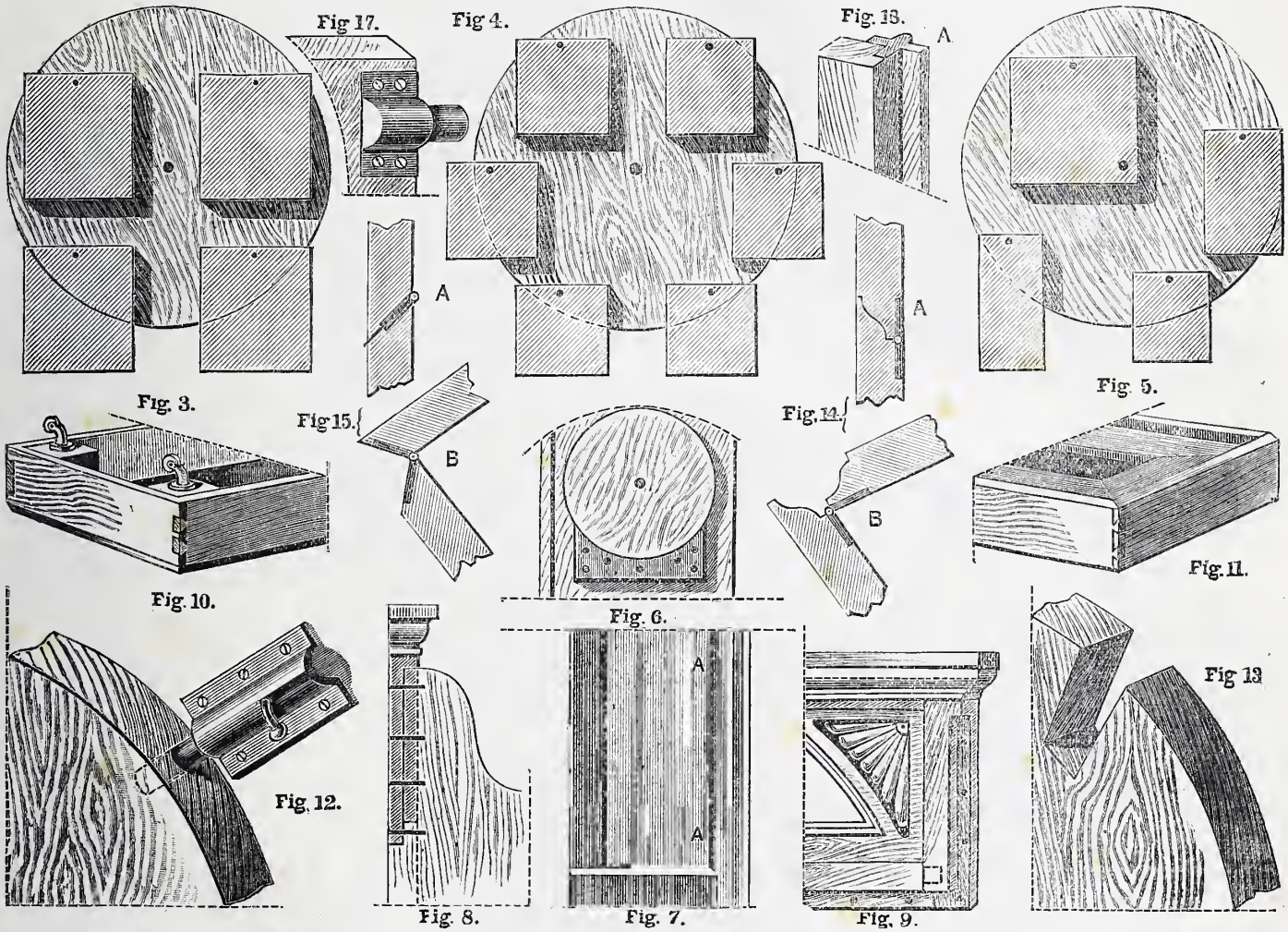
[*For Illustration of Canterbury complete, and Full-size Working Drawings of Parts in Fretwork, see Supplementary Sheet presented with this Number.*]

Why a whatnot with receptacles for music is called a Canterbury it boots not to inquire. Enough that it be so, and that, whilst explaining the meaning of the article to be constructed after the annexed design, it was easier to use the accepted word. Anything less suited for its actual purpose ought to be difficult to parallel, yet, even as Herbert Spencer points out in his first chapter of a "Study of Sociology," it is an unfortunate truth that we all make shift with ineffective but conventional articles, when a little common-sense, or ingenuity of a very mild degree, would fit them for their purpose to a far greater extent.

The orthodox Canterbury does hold a series of bound volumes of folio music in a fairly satisfactory way—that is, if music books must needs repose upon their edges, in a different fashion to ordinary volumes. But our music in daily use (or, at all events, the newest pieces) is seldom, if ever, bound into stiff volumes; and to contain a quantity of sheet music, there is no word to offer in its defence. It is ill adapted for sorting, as the divisions are too capacious; it damages the music, lets in dust, and, above all, the pieces slide under each other in a maddening way too painfully familiar to need description. There are, it is true, Canterburies that take the form of cupboards for music, with duly panelled shelves. These are admirable when the quantity at hand is sufficient to fill them; yet they offer too much space for the average amateur, and too little for the professional or really rabid music lover, who, like his cousin, the bibliomaniac, knows no bounds to the appetite once it is acquired.

The structure herein to be set forth is for the lowest mean average—the possessor of, say, a hundred pieces of sheet music, more or less—and the problem to be solved: required, a conveniently placed receptacle, fitted to keep the music sorted into its several varieties—songs, dance music, pianoforte solos, duets, and so forth—readily accessible, and sightly enough in itself to add to the adornments of the apartment.

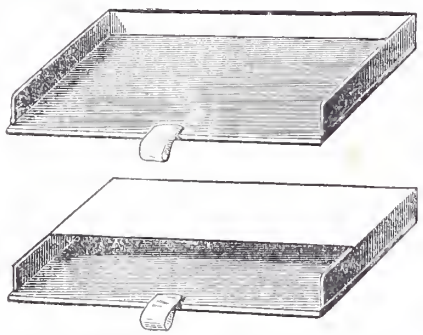
Of all mechanical methods of decorating wood, fretwork is, perhaps, the most general and the least exacting in its demands. No art knowledge is required; patient accuracy in each of its simple stages—in the tracing of the design, the sawing itself, and final polish—will produce work that is, so far as it goes, satisfactory and decorative.




**Figs. 3, 4, 5.—Different sized Book Boxes drawn to 1½ in. scale. Fig. 6.—Wooden Block under End of Circular Board. Fig. 7.—Groove in Side Board. Figs. 8, 9.—Side and Front Elevation respectively of Glass Frame. Figs. 10, 11.—Under and Top Part respectively of Plinth. Fig. 12.—Bolt in connection with Circular Board. Fig. 13.—Notch in Circular Board in place of Hole. Figs. 14, 15.—Two Ways of connecting Writing Flap with Lower Frame—A, Erect; B, in Position to write upon. Fig. 17.—Small Peg behind Flap. Fig. 18.—Moulding on Edge of Door.**

Like humanity, it has its faults—it harbours needless matter in the wrong place; but do not we, physically and mentally? It is spiky, and apt to be intrusive, catching in lace and dusters—easily paralleled in life. It is not so strong as it looks, and has dozens of those failings which an American humorist says he loves, because they make him feel a brother to every man he meets. If you go against its grain, it is short-tempered; if you go with it, it is obtuse; and so an excellent homily of mediæval style, full of laboriously trifling affinities, might be evolved, with some cudgelling of brains, from the much used, yet much abused, minor art dubbed fretwork.

For many reasons, in place of the usual Canterbury, a set of shelves to hang at a convenient height near the piano was thought to be more useful. If a violinist is a member of the family, they would, placed on the wall at a suitable height, support his music desk. In this way, the whole thing becomes a bracket with many shelves, and has space for bric-à-brac on the top one. When artificial light is used, such a place is likely to be more handy than the usual groping in one's own shadow at the ordinary Canterbury.



Trays or Drawers for Music.

Certainly, the old-fashioned article has an enlarged knife-box aspect, as though it were meant to be carried about. But, not to speak of its peripatetic use in crowded thoroughfares—which is absurd—did any one ever meet another so laden? My own notion is that it would break off at the first attempt to lift it from its native floor, while the absurd little quadruped, with its four dumpy legs in the air, would be a funny sight, even if it survived the unusual transit.

But why attempt a crusade against the unprotected and helpless piece of furniture? It is better to leave it to its friends, and introduce its would-be successor.

The weight of sheet music is not trifling. That so ephemeral a thing as the average modern song should be so heavy in bulk is astonishing. Yet, to make good its pretence to be worth two silver shillings, it must needs be on stout paper. Consequently, strength must be the aim, and the fretwork sides which support the whole weight should be cut out of wood—preferably three-ply wood—not less than a $\frac{1}{4}$ inch thick, and of fairly hard quality.

It will be seen that the design is planned so as to take shelves at a very short distance apart. If the size of the whole side piece is too large for the machine, the bracket portions may be cut separately, and fixed below the bottom shelf.

The top railing at the sides and back may also be cut in detached portions and fixed, as the brackets. In this case, the uppermost and lowest shelves should project slightly, and be finished with a moulding round sides and front.

It would greatly facilitate reference to its contents if false drawers or trays, of thin wood or cardboard, covered with cloth, as shown, were fitted to each recess. If preferred, these sham drawers might be developed into actual drawers, bearing each on its front the emblazoned legend of its contents.

But these additions will easily suggest and recommend themselves to workers according to their several needs. For instance, if the suggestion of its serving to support a music desk should be carried out, not only might a fretwork desk adorn its top, but brass candle sconces might be added at its sides.

For choice of wood, bearing in mind that some number of feet are needed, the most economical and effective plan would be to ebonise the whole, and thus allow common deal to be used for the shelves and uncut portions, or at best cheap mahogany.

Aspinall's enamel on fretwork is possible, if great care be taken in rubbing down the surface of the wood, using repeated applications of scalding water; and after each has thoroughly dried, taking off the grain which thereby swells up with fine glass paper, a good surface might be secured, on which the enamel could be used with a really good effect. How far a naturalistic painting of the leaves and fruit forms would be pleasant, I cannot say personally. In one out of a thousand persons who has an instinct for colour, it might be a delightful novelty; but I fear me that the nine hundred and ninety-nine would achieve an egregious failure.

Whatever its shortcomings, it is possible that the completed article will be found as admirable to those who may construct it as it has been to its creator.

## THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

INTRODUCTION—WOOD FOR VARIOUS PARTS—BELLY, BACK, RIBS, NECK AND SCROLL, BASS-BAR, SOUND-POST—BLOCKS—LININGS AND PURFLING—OUTSIDE AND INSIDE MODELS: HOW TO MAKE THEM.

**Introduction.**—A great writer on the subject has divided mankind into two classes—those who play the violin and those who do not. It is almost unnecessary to say that the violinists are in a minority; but if those who do not perform on this instrument continue to encourage those who do, there will be little cause for dissatisfaction.

It is not my purpose in these lessons to attempt to trace the origin of the violin—writers without number have used their pens for this purpose—but the fact remains that the instruments brought to a state of perfection never exceeded, if even equalled, came from the workshops of the Cremonese masters, and have earned for them almost immortal fame. The effectiveness of the violin, when handled by a competent performer, is so obvious that a person must indeed be devoid of all musical feeling who is not influenced thereby.

No matter what the theme—a rollicking jig or a sublime adagio—no instrument better fitted to give expression to the feelings has yet been invented. Its melodious strains may for a time be drowned by the blare of the cornet or the blasts of the trombone. Now and again the liquid notes of the flute or the oboe's plaintive wail may divert the ear of the listener, whilst the full and sweet melody of the clarionet is not to be ignored. The ear, however, soon becomes tired of these, although they add pleasing variety, and it is the violin alone which never becomes monotonous. In the orchestra it reigns supreme. To dwell further on the merits of this most fascinating instrument would only be too easy and congenial, but in a publication like WORK something more practical is

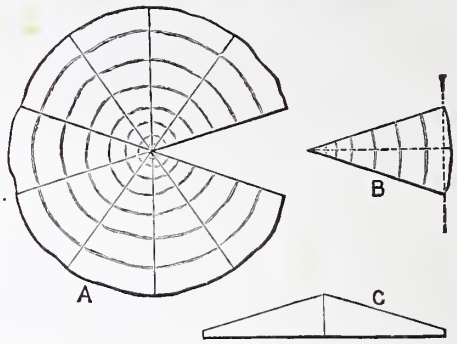



Fig. 1.—A, Section of Sycamore or Pine, cut on the quarter; B, Piece marked for sawing down; C, Ditto, jointed, ready for Use.

required. We will therefore proceed with the construction of our instrument.

It is a matter worthy of consideration that although the science of acoustics has kept pace with other branches of knowledge, the efforts of the great masters have not been improved upon, and the best results have been obtained by following as closely as possible the lines laid down by the Cremonese makers during the seventeenth century. Though opinions differ as to the relative merits of the various outlines and models, I propose to take for granted that the outline, measurements, and *f* holes of "Stradivarius" are the best, and to describe to the best of my ability the methods on which I work, and giving, as occasion requires, all the full-size working drawings, and a short

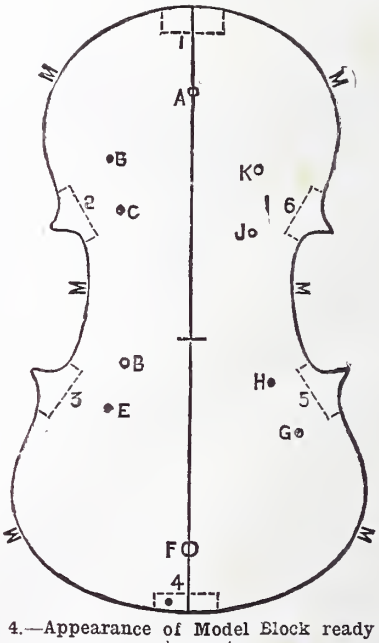



Fig. 4.—Appearance of Model Block ready for sawing out.

description of the tools specially needed when making a violin. I hope, in the pages which follow, to make myself clearly understood; should I fail to do so, it will be a pleasure to me to give, if possible, further explanation on any point which may seem obscure. There must, in dealing with a subject like this in a purely technical way, and free from all romance, be a danger of appearing

tedious; should this occur, I must plead my desire to be explicit as a sufficient excuse.

**Wood for Various Parts.**—It is most essential when setting about making a good violin that you have the very best materials from which to make it. Notwithstanding all the arguments in favour of artificially prepared wood, I am convinced that that which has been naturally seasoned is by far the best, and most likely to improve with age and use.

*Belly.*—For the belly we require a **V** or wedge-shaped block of clean, even-grained Swiss pine, 15 in. long by about 5 in. broad, 2 in. thick at one edge, and tapering to about $\frac{3}{4}$ in. at the other. This block should be cut on the quarter: this mode of cutting is shown in Fig. 1.

This gives the reeds or veins, which are portions of the concentric rings, running vertically through the wood in the direction of its thickness. The same result is also obtained by using the middle board, but in this case the two halves of either back or belly would not necessarily correspond in grain or in figure; and as we are going to work with a half pattern, from a centre line, let us have the wood cut as at B, Fig. 1. It is only when cut on the "quarter" that pine gives the beautiful mottled and silky appearance known as "flower."

The table from which the belly is to be made should, when jointed and planed true (as at C, Fig. 1), be $\frac{5}{8}$ in. thick at the ridge.

Care should be taken when selecting this wedge to see that it has been "riven" or split, so that the fibres have run in their natural direction.

*Back.*—The back is generally of sycamore, cut also on the quarter: the stripes or bars in sycamore show at their best only when cut in this way. These strong bars or waves are termed the "figure." The piece for the back should be 15 in. long, $1\frac{3}{8}$ in. thick at one edge, and about $\frac{5}{8}$ in. at the other. Good back wood is very valuable, and the pieces are therefore cut so fine, that there is very little margin for waste.

*Ribs.*—The "ribs," or sides, are of sycamore, and may easily be purchased in strips, cut for the purpose, 15 or 16 in. long, by $1\frac{3}{8}$ in. broad, and about $\frac{1}{12}$ in. thick. They should not require much cleaning up before being ready for use.

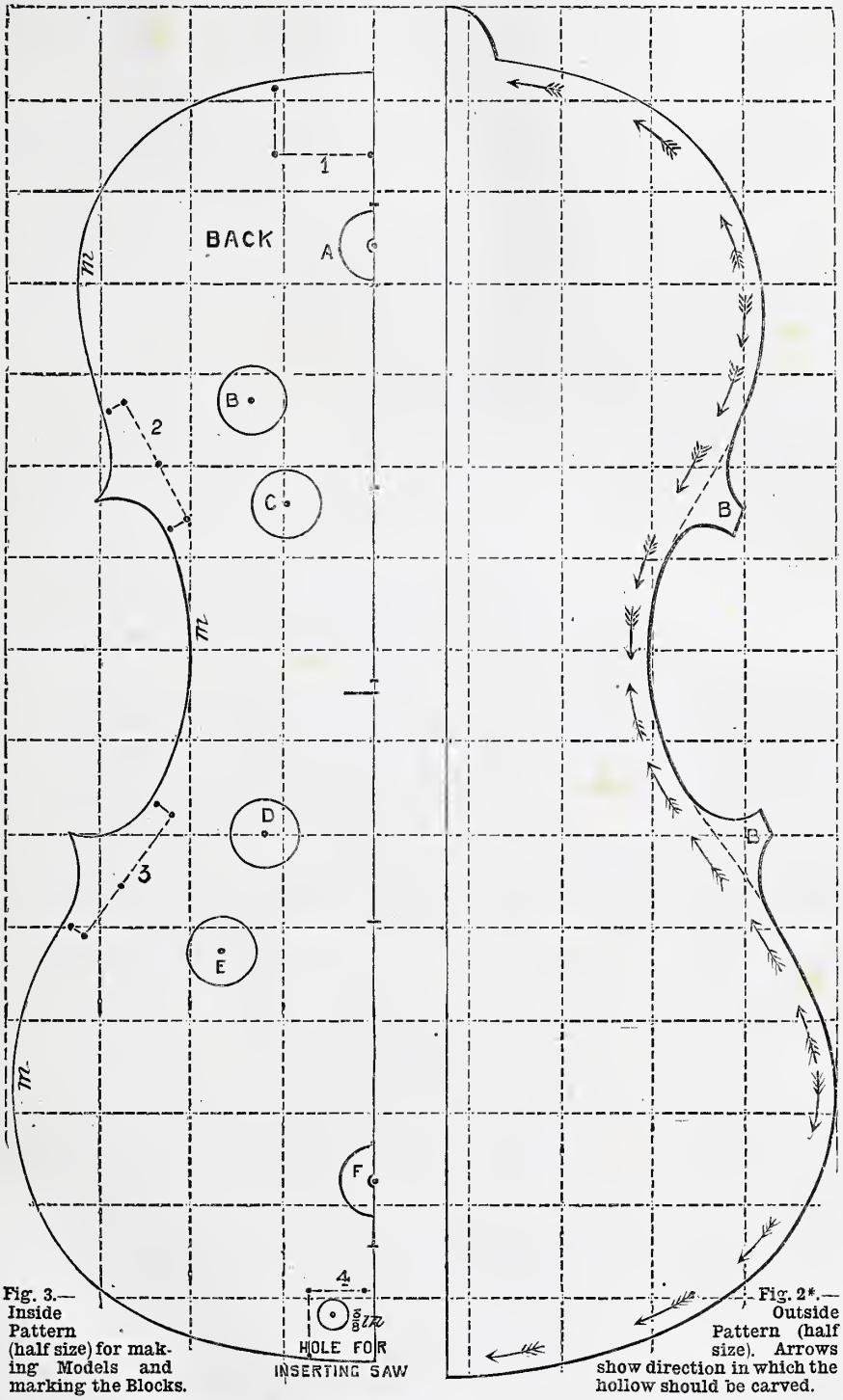



**Fig. 3.—Inside Pattern (half size) for making Models and marking the Blocks.**

**Fig. 2*.—Outside Pattern (half size). Arrows show direction in which the hollow should be carved.**

*Neck and Scroll.*—To carve the scroll is one of the most difficult operations to be encountered when making a violin throughout; and as it greatly beautifies or entirely spoils (as the case may be) the appearance of the whole instrument, I think it would be better for you to buy a neck with the scroll already cut; but as some of my readers may like to try their hand, I shall give, as well as I can, instructions for doing so later on.

*Bass-Bar.*—The bass-bar is one of the most important parts of a violin, and on its dimensions and position depend to a large extent the tone of the lower strings. It is made of similar wood to the belly, and in the rough should measure 11 in. long by $\frac{1}{4}$ in. thick and 1 in. deep, the reeds running vertically through its depth and parallel the whole length of the bar. It should be placed parallel with the joint of the belly, under the left foot of the bridge.

*Sound-Post.* — The sound-post is a round piece of fine-grained Swiss pine, $\frac{1}{4}$ in. diameter, and *about* $2\frac{3}{16}$ in. long. Its proper position (varying as it does in nearly every instrument) is difficult to determine; but it is usually just behind the right foot of the bridge. It should be just long enough to stand firmly before the violin is strung, and the grain should cross that of the belly.

*Blocks.*—These should be made of nice clean pine, an inch thick, from the middle board, if possible, as they will then be on the quarter, and will cut much cleaner. The grain runs vertically from back to belly. They are for affording support to the neck and end pin, for holding the ribs together at the corners, and to strengthen the fiddle generally.

*Linings.*—The twelve pieces of lining are put in to strengthen the ribs, and to give a greater gluing surface for attaching back and belly. They may be made from either pine or sycamore, and are $\frac{1}{16}$ in. thick and $\frac{1}{4}$ in. broad. I much prefer sycamore for linings, as it is not so liable to splinter when necessity arises to have either back or belly removed.

*Purfling.* — Purfling may be bought from violin makers or dealers at about 1d. per foot, and is generally made of two thin strips of wood, dyed black, with a strip of white wood between, the whole being about $\frac{1}{16}$ in. thick and $\frac{1}{12}$ in. deep. Some of the great makers used whalebone for making the black parts of purfling.

**Outside and Inside Models: How to Make Them.**—There are two ways in which a set of violin ribs may be put together: viz., inside an outside model, or outside an inside model. The latter is, I think, much superior to the former, being far handier and safer; but both models may be made from the same piece of wood, and with very little extra trouble. You should procure a piece

* To enable readers to furnish themselves at once with Full-size Working Drawings of all diagrams given half size, as Figs. 2 and 3, such diagrams have been divided into half-inch squares for enlargement on paper divided into inch squares. If any difficulty is experienced in dividing paper into squares for the purpose of making the enlargement, some of Letts's Sectional Paper on the scale required should be purchased.—ED.

of well-seasoned straight hardwood, as beech, birch, or sycamore, 17 in. long by 9½ in. broad at one end, tapering to 8½ in. at the other, and 1⅜ in. thick. Plane this piece perfectly true in length and breadth, and finish it 1$\frac{5}{16}$ in. thick at the broad end, tapered to 1¼ in. at the narrow end. Now make a line down the middle from end to end with a steel marker, or an ordinary bradawl sharpened to a fine point. Afterwards trace the line with lead pencil to make it more legible.

Cut out the patterns Figs. 2 and 3, in zinc or thin wood, taking care to have all the marks on Fig. 3 quite distinct. Place the pattern, Fig. 3 (which in future shall be called the "inside pattern"), exactly to the centre line on the block, and an equal distance from each end, and carefully, but decidedly, trace round the pattern with the marker, following with lead pencil. Then mark through the pattern the position of each block, as shown by the dotted lines in Fig. 3, and also the centres for the holes, A to F. Now turn the pattern over, and mark the other side in precisely the same manner; on the accuracy of this operation the ultimate balance of your fiddle depends. When ready to be sawn out, your block should bear every one of the marks which appear in Fig. 4. With a ⅜ in. bit bore the hole for inserting the saw. The models can now be cut out with a bow saw, but a much better plan is to get it cut at a sawyer's, with a "fret" or a "jigger" saw, making a cut of $\frac{1}{12}$th of an inch, and going exactly round the line, M, M, M, subsequently cutting out the recesses, 1, 2, 3, 4, 5, 6.

The edges of both models should now be trimmed up, which must be done by placing each of the models edgeways in a wood vice, and, using a file, one end in each hand, taking out all the small ridges which the saw has made, still keeping both models square to the side on which the outline was traced. Write distinctly on both models the word *back*: this will avoid much confusion that might otherwise arise. Next, with a ¾ in. bit, bore the holes, A to K. You should now square the centre line down each of the end block recesses 1 and 4, and with a straight-edge make another centre line the entire length of the other side of model. We now have two well-finished models (inside and outside); and before proceeding further, we had better consider the question of what tools we shall require. For this, however, we must wait for the next paper.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Introduction.

Antiquity of Art of Knotting—Cordage, to What Applied—Laying Fibres of Rope—Yarns — Strands — Principle of Rope Making—Réaumur's Experiments on Laying up Fibres of Rope—Size of Rope—Calculation of Strain.

The art of knotting has been said to be "probably as old as human fingers," and there is no doubt that mankind must always have used some kind of knot to join the sinews of animals, fibres of plants, or strips of hide that, in ancient days, formed a substitute for the endless variety of cordage in use in the present day. It is needless to enlarge on the importance of a knowledge of knotting, as hardly a day passes, even in private life, but we have to make a knot of some kind; and, of course, to the fisherman and seaman, whether amateur or professional, the subject is one of paramount interest. This being so, it seems strange that so little, comparatively speaking, has been written on the subject. I trust these articles will go far to remedy this defect, and to supply what I believe to be a real want. Even those of my readers who have not much occasion for working cordage will, I think, still find the subject an interesting one. They will be surprised to find what a large number of knots the skill of man has invented, many of them being highly ingenious, and capable of being used in various ways for decorative as well as useful purposes. The importance of being able to make a knot rapidly and correctly, and, at the same time, the one best suited for the purpose for which it is intended, cannot be over-estimated. Human lives, to say nothing of property, have over and over again been sacrificed to ill-made knots, and I believe there are few things of an ordinary kind that will better repay the trouble of learning than how to work cordage successfully.

The generic term cordage comprehends a vast variety of different kinds of rope, from the cable of a man-of-war to the fine "snooding" of the sea fisherman. It is also composed of a great diversity of materials. The most common substances from which it is made are hemp, flax, cotton, manilla, and coir. It is outside our present purpose to go into the process of the manufacture of rope in anything like detail, but the succeeding pages can hardly be fully understood without some knowledge of the construction of cordage; I shall therefore give a few particulars as to the various parts that form a rope.

If the fibres of which a rope is composed were laid parallel to one another and fastened at the two ends, the combined strength of these fibres would be better utilised than by any other means—in other words, they lose strength by being twisted or "laid up." But, on the other hand, the length of the fibres being at most but a few feet, their utility in this state is very limited, to say nothing of the inconvenience of using them in this way. To obviate this difficulty, the fibres are first twisted into "yarns;" these, again, are laid up into "strands," a strand being formed of several yarns; and, finally, three or more strands are formed into a rope. As I have before said, the strength of a rope is diminished by the twisting of the yarns, and this being the case, it is important the yarns should be very carefully laid up, so as to bring an even strain on every part. This should be borne in mind when rope is chosen. It should also not be laid up too hard—that is, it should only have sufficient twist in it to prevent the fibres from being drawn out without breaking; anything more diminishes unnecessarily the strength of the cordage, and should be avoided.

Ropes are generally made of three strands laid right-handed, or "with the sun," as it is termed aboard ship. They are then called "hawser-laid." If they are made of four strands laid right-handed, they are termed "shroud-laid." A cable-laid rope is made of three hawser-laid ropes laid up left-handed; it therefore contains nine strands. It will be seen from the foregoing that the size of a rope is regulated by the quantity of yarns that compose the strands, and not by the number of strands that it contains.

The principle of rope making is very readily shown by holding the ends of a piece of twine or whipcord, about a foot long, in each hand and twisting it so as to increase the lay. If the twine be now slackened by bringing the hands nearer to one another, a loop will first form in the middle of the twine, and it will continue to twist itself up into a compact cord which will not unlay, as the tension to which the strands have been subjected causes friction between them, which holds them together. In other words, the tendency of each part singly to unlay, acting in opposite directions, is the means of keeping them together when joined.

Some very interesting experiments were made by Réaumur, the purposes of which were to ascertain the loss of strength occasioned by laying up the fibres of various substances, one or two of which I shall give.

1. A thread, consisting of 832 fibres of silk, each of which carried 1 dram and 18 grains, broke with a weight of 5 lbs., though the sum of the absolute strength of the fibres is 104 drams, or upwards of 8 lbs. 2 oz.

2. A skein of white thread which bore a weight of 9 lbs., when twisted into a cord of two strands, broke with 16 lbs.

3. Three threads were twisted together, their mean strength being nearly 8 lbs. It broke with 17½ lbs., whereas it should have carried 24 lbs. These experiments abundantly prove that though we gain in convenience and portability by twisting the fibres, we lose greatly in the strength of the resulting rope.

In speaking of the size of a rope, the circumference and not the diameter is alluded to. Thus, a three-inch rope would be less than an inch in diameter.

It is often required to know the amount of strain that we may fairly expect a rope to bear. I therefore give an useful formula for calculating it.

Multiply the circumference of the rope in inches by itself and divide the product by five, and the result will be the number of tons the rope will carry. For example, if the rope be five inches in circumference, $5 \times 5 = 25 \div 5 = 5$, the number of tons the rope will carry.

When the strain that a rope will bear is alluded to, it must be understood that a steady haulage is meant, for if the strain comes suddenly on a rope, as when a weight attached to it is allowed to fall suddenly, its resisting power is greatly diminished. This is easily demonstrated by giving a sudden jerk to a piece of twine, when it will part at once, though all one's strength, steadily applied, fails to break it. Knots always more or less diminish the strength of a rope, particularly when they are badly made; so that where as much strain as the rope will bear is likely to come upon it, care should be taken to use none but the strongest knots. The Alpine Club, in the report issued by them of some experiments made on ropes, recommend for joining two ropes the fisherman's knot, and for loops the fisherman's eye.* Probably these knots will bear as much strain as any.

If we require to know the weight of any description of cordage, we can ascertain it, if hawser or shroud-laid, by multiplying the circumference of the rope in inches by itself and by the length of the rope in fathoms, and dividing by 420; the result will be the weight in cwts. For example, to obtain the weight of a six-inch rope 120 fathoms long, $6 \times 6 = 36 \times 120 = 4{,}320 \div 420$, makes the weight of the rope 10 cwt. 1 qr. 4 lb.

* Illustrations of these knots will be given with subsequent papers, and will be found, the former in Fig. 11, and the latter in Fig. 16.

The rule for cable-laid rope is somewhat different. In this case, multiply the circumference in inches by itself and divide by four; the product will be the weight of the rope in cwts.

In practising knotting it is as well to use a tolerably firm material, such as whipcord, for small common knots, or, still better, small fishing line—of course, I mean line used for sea fishing. Either of these can be tied up and undone over and over again without injury to the stuff, which is not the case with twine; it is also more easy to see which way the parts of a knot lie in the harder material, and then to find out whether the turns are properly made or not. In the case of more complicated knots, particularly those where the strands of the rope have to be unlaid to form the knot, such as a wall knot or a Mathew Walker, I should advise that three strands of fishing line be used, about a foot long each. If a seizing be put round them in the centre, so as to hold them firmly together, we have a good representation of a rope with the strands unlaid ready for working. A knot can be made and unmade as often as required in this way, without the strands suffering any detriment, which is not the case with the strands of a rope, which, from their loose nature, will seldom bear knotting more than once or twice. I have adopted this plan myself with great success in making the illustrations for these articles. If desired, the knots can be made as above described and kept for future reference. In string also it is better to use hard laid stuff at first, but when these matters are thoroughly understood, knots can be made on any sort of cordage without difficulty.

## HOW TO STROP A RAZOR.

BY P. B. H.

A few years ago I could never keep a strop for a longer period than about nine months, as, during that time, it got so cut up that it was, comparatively speaking, worthless. A kindly hint from a friend some five years ago saved me a deal of expense in strops, as, since then, I have used the same one, and there is now only one cut in it, which was made when quite new, just before the hint was given.

As I am certain a few hints on this subject will be useful to some of the many readers of this journal, I shall endeavour to enlighten them by the following description and sketches.

The regular strop is a flat piece of wood about 1½ in. wide by 12 in. long, with a handle cut out at one end. This wood, with the exception of the handle, is covered on both sides with leather about ¼ in. thick. The surface of the leather of the one side, being covered with some sharpening composition, generally flour of emery, is dark. This side should always be kept moist by every now and again adding a drop or two of oil, and, at greater intervals, a little flour of emery, in order to keep up the sharpening properties. The other side is simply of plain smooth leather for finishing off the razor after being sharpened on the first side.

The method of procedure is as follows:—Raise the strop slightly by placing the end on its case (as shown in sketches), or any other convenient object, so that a complete stroke can be given to the razor. Then, with the dark side uppermost, and the razor in the position shown at B in Fig. 1, draw it upwards, and, at the same time, across the surface of the strop till it takes the position C (Fig. 2).

As on the turning of the razor at this point depends whether the strop is cut or not, care should be taken to follow the directions carefully. There is a great

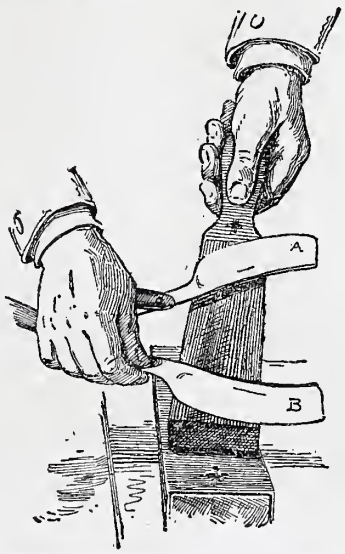



**Fig. 1.—Showing commencement of Down Stroke (A) on Strop, and commencement of Up Stroke (B).**

temptation to lift the razor bodily from the strop at the end of each stroke and turn or reverse it with the cutting edge pointing downwards, which is the principal cause of the strop being cut. The turning should be done at the end of the upward and downward stroke *on the back* of the razor, which should never leave the surface of the strop. During the reversing the razor should be slid sideways on the strop so that the heel rests on it, as at A (Fig. 1), ready

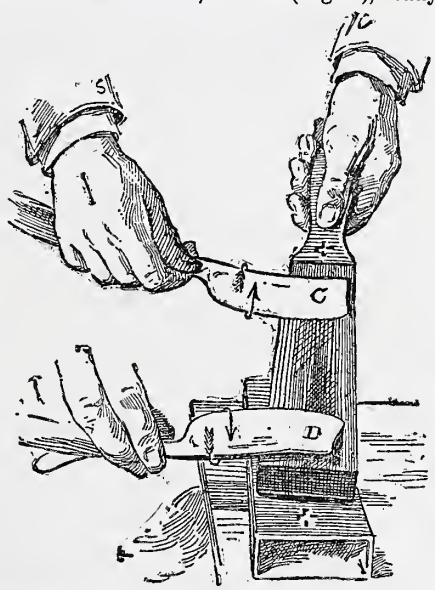



**Fig. 2.—Showing completion of Up Stroke (C) on Strop, and completion of Down Stroke (D).**

for the downward stroke, which is performed as above; the razor at the end taking the position D (Fig. 2), ready for turning in the direction of the arrow, at the same time being pushed forward till it takes the position shown at B, the position from where we started. The blade should never completely leave the strop. After a few strokes upwards and downwards, the strop should be reversed, and the same process performed on the smooth side, when the razor should now be found fit for use. The razor should be held perfectly flat on the strop during the operation. Another great point, in keeping a razor in good condition, is to dry it well with a towel immediately after use, and then draw it a few times over the smooth side of the strop. This takes off any moisture before putting it away. On every good strop and case there is some distinguishing mark to show which way the strop should be put back. I have shown a cross in my sketches. Care should be taken that these two marks always coincide—that is, that the dark side of strop, when put in the case, always touches the one side; otherwise the clean smooth surface of the strop will get emery on it, which will be very detrimental.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Introductory—Crimping and its Inventor.

By the courtesy and practical knowledge of a particular friend, I am in a position to lay before my readers details of a trade different and distinct from that which for many months past I have been permitted to represent.

As most of my readers will doubtless be aware, I have striven my best to give them designs of folding and combination furniture, which, in many cases, I am glad to understand, have met with approval. In making public these designs I have not tendered any excuse for my conduct, nor attempted to defend myself against the friendly, yet unpleasant, accusations of trade acquaintances, who have made remarks to the effect that I have been influencing the trade in a wrong direction, for a certain extent, by giving these designs to the amateur; for the designs being original, I asked neither any body or any thing, except my own conscience, as to what purposes I should place them to; and I have no cause to regret that, with the permission of the Editor, I have given them to the readers of Work.

But as I am entering upon the description of a trade, for correct particulars of which I must rely upon and be indebted to my above-mentioned practical friend, I feel that I must say a few words upon this question of amateur *v.* professional. My worthy fellow contributor, Mr. Clarkson, has mentioned in his articles upon "Bookbinding" (see page 69, No. 57, Vol. II.) that these two classes will never clash, and I firmly believe that as *classes* they never will; but it is an undeniable fact that in many instances members of one or other of these two classes look with contempt, distrust, and very often, I regret to say, hatred, upon the members of the opposite class.

This should not be. Work is a magazine which has been established for the benefit of both bodies, and I am pleased to believe that, through its instrumentality, each body is beginning—in fact, has already begun—to look with a friendly and favourable eye upon the other body.

It is rather late for me to make these remarks concerning Work's mission, but, as I before hinted, I have never taken the opportunity of saying anything of this nature before, for the simple reason that such might have been construed into an

excuse on my part for giving designs to the amateur in my professional capacity.

As an illustration of the harmlessness of the average amateur, I will take an instance from the articles I propose giving under the title of "Wire-Work." Let us suppose I have placed these details before the readers in a plain, straightforward, under-

Fig. 1.—Wire as crimped in Machine.

standable manner (and I am sincere in saying that I trust I shall do so), and that an amateur has grasped sufficient instruction to enable him to make, say, a pair of wire baskets for himself, and that he has decided to make them. Will he not require the material preparatory to the making of the baskets? and will he not have to purchase that material from the wire trade? Certainly. Then whence comes the supposed detriment this inoffensive amateur has created? "Why, from the fact that he is about to make

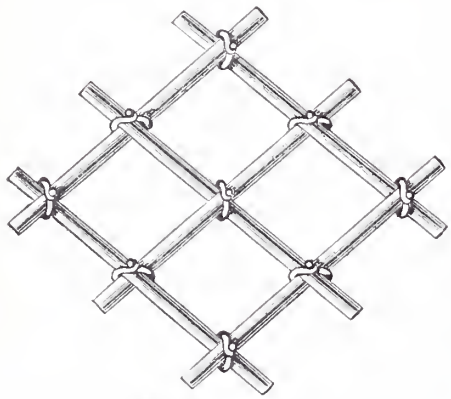


Fig. 2.—Old Method of making Wire Trellis.

articles which he should purchase already made, and thereby encourage industry," I fancy I can hear some disgusted wire-worker murmur.

Now, what does encouraging industry mean? I hide behind common-sense when I say that if people buy what they *want* they are pleasing themselves, and have not the encouragement of industry as their motive. But if they purchase what they do not particularly require, but *may* make *use* of, then they *are* encouraging industry.

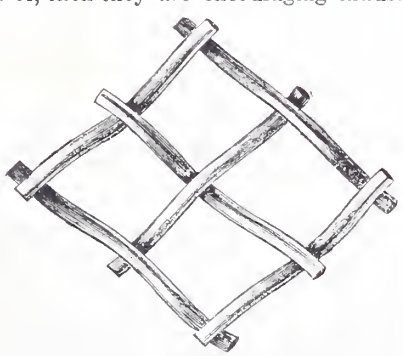


Fig. 3.—Formation of Trellis with crimped Wire.

But this practice is no more to be commended as a stimulus to trade than the purchase of goods at a bazaar—both are but species of charity.

Now, it is a fact that the amateur I am taking as an example may never have dreamt of having a pair of baskets previous to reading my article upon that subject, although he may have seen hundreds during his lifetime; he may make them because he finds pleasure in such work, but when he has made them and exhausted the pleasure of so doing, he will not destroy them, but will find further pleasure in their possession.

The result, then, is that the much abused amateur does not harm any trade he may select to work occasionally at, but, on the contrary, does good to it—very little, perhaps, but still the fact remains.

Then, am I only going to give these details in order that, perhaps, a few amateurs may gain sufficient insight to enable them to while away an hour or so now and again? I don't know. What blissful ignorance! I am going to tell my readers all that my friend tells me and explains to me by experimental lessons. I do not suppose the professional wire-worker to gain much benefit, but I do hope that young beginners in this trade will find my remarks of assistance, as being supplementary to their master's instructions; and I do also hope that many amateurs may experience pleasure from this trade as well as from others.

Many who are in the Birmingham wire trade will remember with respect the name of Mr. Thomas Bellamy, who quitted this life some years back, and who was the inventor and patentee of the crimped or corrugated wire now so extensively used in many branches of wire-working.

His invention consisted of crimping, by aid of machinery, wire intended to be placed together to form fences, garden borders, hen coops, fire guards, etc. The old method of making such things was that of placing the wires over and under each other, and then securing them at their junctions by means of tying with pieces of wire. The amount of labour this process entailed can be imagined by the examination of a piece of work so made, or "put together," as it is technically termed. To simplify matters, Mr. Bellamy stirred his inventive faculties, with the result that he was deservedly enabled to considerably increase his business and his fortune by patenting his ideas.

One end of a coil of straight wire (this sentence sounds somewhat paradoxical and Irish, but my meaning will be conveyed)—one end was put in his machine and drawn through it, coming out at the other side crimped as shown in Fig. 1 and various other diagrams. This was then cut up into the required lengths, which when put together across each other in the same way as the old method, were held together by their own unison, requiring no ties at the junctions, as did the former pattern. After being fitted into their frames, they were as firm and more artistic (if I may be permitted to use the expression in this direction) than were the straight wires. The amount of labour saved by this invention was simply enormous. Whether this fact was beneficial to the trade workers or no I will not venture to discuss, but, in the belief of a notable theologian, who wrote to that effect some time ago in a weekly magazine (which I will not name, for fear of being accused of attempting to advertise), machines are commendable in every trade, by reason of *creating* labour in the particular trades wherein they are introduced, and also in others. In Figs. 2 and 3 are shown the old method and the crimping method respectively.

Various members of Mr. Bellamy's family are still in the same trade, although they have left their native town and are scattered in different directions, and it is to one member to whom I am indebted for my present facilities of giving the following instructions.

I shall arrange the descriptions under two heads—viz., "Plain and ornamental wire-work," and "Wire-work in conjunction with metal mouldings and wood." The first part shall contain explanatory details of the construction of such articles as fire guards, pea guards, rat traps, fences, hen coops, baskets, gas globes, etc., which are composed solely of wire and iron rods; while the latter part will consist of the descriptions of such things as cages, sieves, dish covers, fenders, etc., with which metal mouldings and wood are usually connected.

## FIXING TOPS OF TABLES.

BY H. HINGE.

In making tables for kitchen, dining-room, and all kinds that have any size about them, it very often happens, after all precautions have been taken with the wood that forms the top, in a little while the joints break and open, and what was once a good job now becomes an unsightly thing. The cause of this disaster, of course, is the wood not being dry. What is dry? It has been proved by experience that wood which has been cut years and jointed to form a large top, when it has been in a warm kitchen it has

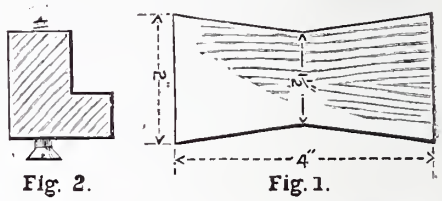



Fig. 2. Fig. 1.

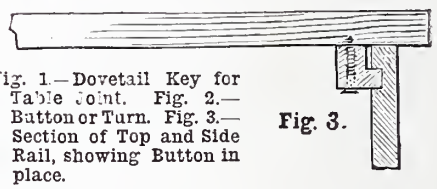


Fig. 1.—Dovetail Key for Table Joint. Fig. 2.—Button or Turn. Fig. 3.—Section of Top and Side Rail, showing Button in place.

Fig. 3.

"gone," the workman has been blamed, and the wood called anything but good. Different ways have been tried both in jointing and fixing the top on, but the following method is one which will allow a top to shrink or go any way without breaking the joints or the top becoming unlevel:—Before the table is framed together, get the rails which go into the legs, and placing them on your bench top edge towards you, inside up, with a plough and $\frac{3}{8}$ in. iron, cut a groove from end to end. There should be about $\frac{3}{4}$ in. of wood clear on the top edge before the groove commences. Serve all your rails like this (if you have any drawer rails in your table, you will see they can be done the same way); frame your table up in the usual way, prepare your top by slip-jointing it, and if you want a really good job put in three dovetail keys in each joint. Those who do not know what a keyed joint is may learn that it is made in the following way:—The joint is made first by planing the edge of the board straight and true till it fits close to its fellow board; it is then glued with good *hot thin* glue, and well rubbed to get the glue out and get it close. After having stood, say ten hours, to set, some keys are made out of $\frac{3}{8}$ or $\frac{1}{2}$ in. oak or mahogany, say 4 in. long, shape of Fig. 1. One of these is then "let in" flush with the top on the under side about 4 in. from the end. Of course, they should fit well on the sides, but a little liberty at the ends is preferable. These are glued in, and when dry, levelled off; in long joints it is necessary to

put in three, four, or five, according to length of top. It is generally acknowledged that this is the best joint for woodwork where practical, having the advantage over all joints which are dowelled or tongued, it being so much easier to get a good close joint. To fasten on the table-top, make, say a dozen, hardwood buttons or turns (Fig. 2). These should be made 1½ in. long out of 1 in. stuff, and notched so that they will fit in grooves in the rails, and room left for a screw to go through into the top. When fixed, which is done by placing the table-top on your bench under side up and putting the frame on the top of it legs up, and placing your buttons into the grooves, send a screw through the other end. Fig. 3 is a section of the side rail, showing the button in its place. It will easily be seen that a top fastened down in this manner can move along the grooves as the wood dries without either warping or breaking the joints and still be fastened down. This method will commend itself at once for many things which require to be held firm and yet allow the wood to shrink for amateur and all kinds of workmen.

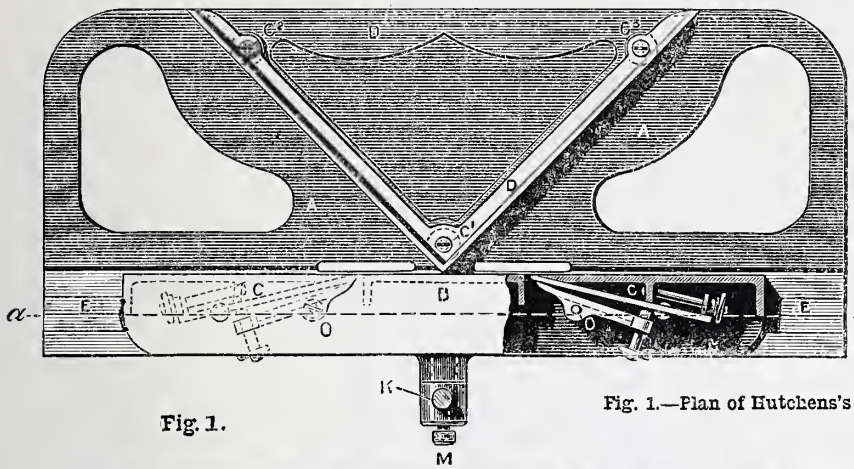



Fig. 1.

Fig. 1.—Plan of Hutchens's Mitreing and Squaring Machine.

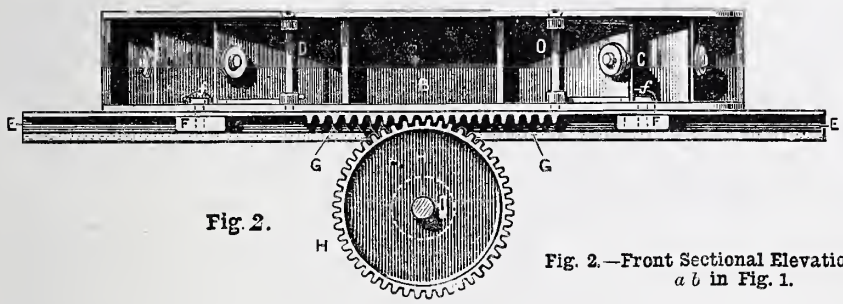



Fig. 2.

Fig. 2.—Front Sectional Elevation on Line *a b* in Fig. 1.

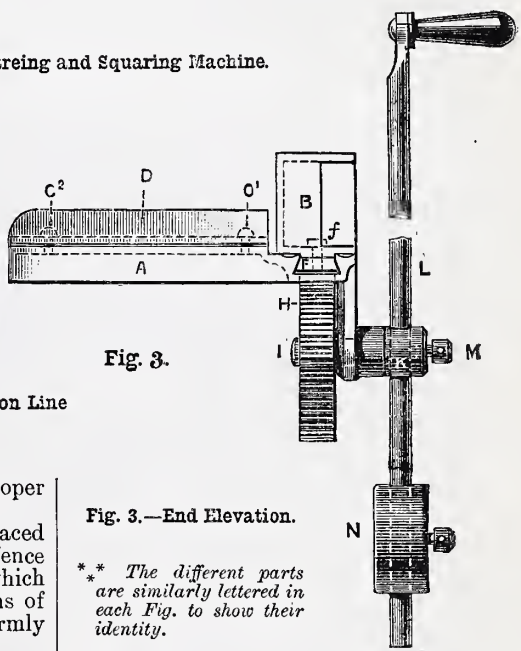



Fig. 3.

Fig. 3.—End Elevation.

*** *The different parts are similarly lettered in each Fig. to show their identity.*

## A NEW MITREING AND SQUARING MACHINE.

BY A "CONSULTING ENGINEER."

I HAVE lately had the opportunity of inspecting a very simple and efficient machine for the above purposes, which has been invented by Mr. Wm. Hutchens, of Penzance, who has applied for and obtained a patent for the same.

The machine consists of a metal bed or sole plate, which supports and carries the working parts and the material to be operated upon, and which is, or may be, placed or supported on a suitable stand at the height most convenient for performing the work. The working parts consist of a movable plane or part of metal or other suitable material, which works on the bed or sole plate over a guide or groove formed therein, which is so arranged by means of suitable cutters as to cut or plane whilst moving in either direction. The cutters are provided with suitable means for regulating and adjusting the depth of cut, and readily removing and replacing them for sharpening or other purposes. On the under side of the moving part to which the cutters are attached a toothed rack is formed, into which a toothed sector or pinion wheel gears. This sector or pinion works on a short horizontal shaft or stud, to which a partially rotating or vibrating movement is given by means of an adjustable lever, and a projecting part or parts on the under side of the part containing the cutters fits into the groove or guide, and so keeps it, when in motion, in the proper position to do the work.

On and to the bed or sole plate is placed and attached the adjustable guide or fence which regulates the angle or bevel at which the material is to be cut, and by means of set screws it may be adjusted and firmly held in the required position.

In the accompanying engraving, Fig. 1 is the plan, Fig. 2 a front sectional elevation on the line *a b*, and Fig. 3 an end elevation, the like parts in each being denoted by the same letters of reference in each Fig.; A A is the bed or sole plate; B, the movable part containing the cutters and arrangements for fixing and adjusting the same, shown where the upper part is broken off; D, the adjustable fence or guide, and the screws, $C^1$, $C^2$, $C^3$, for holding and adjusting the same, which, when set square with the face of the plane or moving part, enables the ends to be squared; E, the groove or guide in which the projections or parts on the plane, or part B, work; F, F, the separate parts, projections, or pieces which work in the groove or guide E, and the screws *f*, *f*, which hold the same in place; G, in Fig. 2, shows the rack on the under side of B, into which the pinion quadrant or sector H gears; I, the horizontal shaft or stud on which the part H is attached; K, socket on end of shaft through which the adjustable lever L passes, and is fixed by the set screw M. The adjustable counterweight and set screw are shown at N in Fig. 3. The parts on which part of the arrangements connected with the cutters work are shown at O, O in Figs. 2 and 3.

By the use of this machine, mitres of 10 in. by 5 in. have been shot with the greatest ease, and it will work on the smallest sizes of material with as much facility as on the larger. It is made in several sizes, to suit the demands of customers, and has been awarded two silver medals at the Falmouth and other exhibitions in the West. The prices, complete, are very moderate, and vary from £5 10s. each, according to the sizes of the machine. It is so arranged that narrower or wider irons may be used in each machine, and it can be seen and tested at Messrs. Engert and Co.'s Picture Frame and Moulding Factory, 75, City Road, London, E.C. I can safely say that it is such a machine as ought to be in every workshop where mitreing of any kind has to be done, as it will quickly repay its cost by the superiority of the work done and the speed and convenience with which it may be carried out. Its utility is obvious, and without doubt it will very soon come into general use.

## HOW TO FRENCH POLISH.

BY DAVID DENNING.

FULL directions for polishing furniture and other woodwork by means of waxing and oiling having been already given, no doubt there are many readers who will welcome the appearance of directions for the more difficult process of French polishing, by means of which the highest possible gloss may be given to suitably prepared wood. At the outset, let it be said, for the benefit of some, that varnishing and French polishing are by no means the same. The one can be done by any person with little or no practice, and is not suitable for any but the commonest articles of furniture, the other cannot be done properly without considerable practice and care; but when skilfully

managed, it enhances the beauty of nearly all kinds of wood. If badly done, it is often rather a blemish than otherwise, so that the beginner, if he be wise, will not attempt to polish anything of value till he has gained some little experience by practising with comparatively unimportant articles. I do not want to discourage amateurs and novices, but it would be only a false kindness to tell them that they can at once proceed to polish well by attending to instructions. However clearly these are given, they cannot give the knack and experience, which can only be gained by practice. Many beginners, I am aware, labour under the mistake of supposing, because they cannot get the same beautiful polish that is seen on the best furniture, that there is something wrong, either with the stuff they are using, or with their method. Without saying that one or the other, or perhaps both, might not be capable of improvement, the defects are probably principally owing to want of practice. The disappointment, no doubt, is somewhat emphasised by having noticed the easy—not to say lazy and seemingly effortless—way in which an experienced polisher brings up the brilliant even gloss. As a matter of fact, French polishing, like playing the fiddle, is not difficult when the knack has been acquired; but this cannot be got at once. The actual directions may no doubt help towards success; but they are unable to do more, and though every effort will be made by the writer to omit nothing of importance, it is quite impossible to foresee every trifling difficulty which individual readers may encounter.

To a certain extent, the polisher's calling has, perhaps, suffered in the hands of amateurs and novices, who have not had opportunities of learning in a practical workshop by the amount of mystery which sometimes seems to enshroud it. To practical polishers, the complicated recipes for stains, polishes, etc., which are often published for the benefit of the amateur seeking information, are a cause of wonderment. They are among the things not generally known in the workshop, but as many of them are elsewhere vouched for, they may be admitted on due report of being useful somewhere.

The ingredients of the various preparations are generally few and simple, and success certainly does not necessarily lie in complication and multiplicity of mixtures.

Although it may be said that, roughly speaking, each kind of timber requires different treatment, the general manipulation is very similar for all. In the main, it consists of coating the wood with a thin film of shellac, either pure or in mixture with other gums and resins, and getting a gloss on the film as brilliant and durable as possible. Before this can be done the wood generally has to be prepared, and various other minor details attended to. For example, the grain, or rather the pores, of open grained wood must be stopped, or, as is generally said, filled, to get a perfectly smooth surface, and to prevent the excessive absorption of the liquid polish. Then there are some woods the appearance of which is improved and enriched by oiling them before applying the polish. This, to a certain extent, darkens them, giving a mellow look, and, as is said, brings up the figure. The different treatment of the ordinary furniture woods will be named in the course of future papers; at present only general treatment can be dealt with. The place in which French polishing is done, or rather the temperature and atmosphere of the place, are of considerable importance. The work cannot be done properly in a cold damp room or outhouse. Warmth especially is absolutely necessary, so that a room which will do well enough for ordinary manual work may not do for a polishing shop. If the place is too cold, the polish as it sets on the wood gets chilled, and becomes more or less opaque and cloudy-looking. Slight chill may, to a certain extent, be cured, but the best way is to avoid it altogether by working in a warm room. By way of forestalling possible inquiries addressed to "Shop," I may as well say that I cannot tell what the minimum temperature should be, and I expect very few polishers could. As a rough guide, it may be said that an ordinarily comfortable temperature of a living room is about the thing. During warm summer weather a fire is not necessary, in the winter time it is. For the rest, if the polisher notices that his polish "chills," he must increase the heat of his room. As chill will sometimes happen in the best regulated shops, it may be satisfactory to know that if as soon as it is observed a moderate amount of warmth be brought near the surface the chill will probably disappear almost directly. A small article, of course, may be taken to the fire, but with anything large this course would naturally be inconvenient. A good plan in such cases is to hold something warm a short distance from the chilled surface, but on no account must it be allowed to touch, or the heat be great enough to burn, the polish. A common plan, but not altogether a good one, for obvious reasons, is to hold a piece of burning paper near the chill. Another cause of chill is from the article being polished being too cold or damp. It is, therefore, always necessary to make sure when a stain has been used that the wood has become thoroughly dry. It may be suggested that an ordinary flat iron is very useful for small patches or local chills.

Not less important is the employment of suitable materials both in the polish and in what, for want of a better word, may be called the tools of the polisher's art. These latter are of the simplest possible description, and consist almost entirely of wadding or cotton wool and soft linen or cotton rags from which the rubbers to apply the polish are made, and a few bottles, etc., to keep the various polishes, stains, and their ingredients in. The exigencies of space, however, require that consideration of these and other matters must be left to a future occasion.

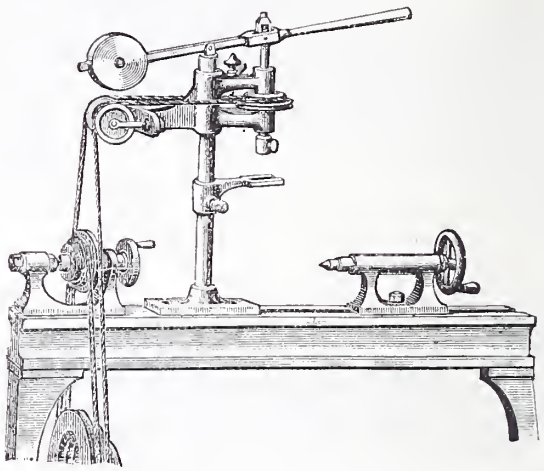
## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 1.—The Britannia Company's Lathe Drilling Machine.

My attention has lately been drawn to the Britannia Company's Lathe Drilling Machine, and it seems to be such a handy appliance, and so desirable an aequisition for everyone who owns a lathe, that I think it well worth while to make special mention of it here. The Britannia Company supply several kinds of drills, well calculated for the performance of all kinds of work, heavy and light; but this, as far as I am aware, is the only one which they manufaeture as a special adjunct to the lathe. Its eonstruction, and the manner in which it is fixed on the lathe and driven by the lathe treadle, as well as the manner in which the drill is held and actuated, and the object to be drilled presented to the drill point, are all so clearly shown in the accompanying illustration, that there is really no occasion for me to deseribe them in detail. All that need be said now is that it can be used on any sized lathe, which is a desidcratum, and driven either from below, if for a treadle lathe, or from an overhead pulley. The price of the machine for lathes up to 6 in. centre is £2 2s. Those who utilise the lathe as a motive power for fret sawing should buy this maehine.

Doubtless many a reader of Work, who possesses the Britannia Company's well compiled and effeetively illustrated Catalogue of Engineers' Tools, Amateur Lathes, etc., supplied, the larger one at 1s., and the smaller one at 6d., will have felt some surprise when he has noted the large number of machines and appliances of



**The Britannia Company's Lathe Drilling Machine.**

various kinds that are manufactured and sold by the Company, many of them—especially the lathes, planing machines, and shaping machines—being of enormous size and power, and well-nigh of boundless capacity. And more than this, he must have thought, if he thought at all, that a Company which turned out such powerful and heavy engineers' tools and machines as these, so numerous and so constantly improved and improving that they are known, like eonviets—I trust the Company will forgive the simile—by numbers and not by names, must be one of considerable importance, possessed of large, well-equipped workshops, endowed and backed with almost inexhaustible resources, and finding daily bread for a very large number of hands. My anticipations in these directions were in no way disappointed when I visited Colchester not long since for the purpose of looking over the Britannia Company's works, at the invitation of the courteous and energetic manager, Mr. T. M. Bear, who is at onee the mainspring and motive power of the whole affair. Nothing but a personal inspection is suffieient to show the magnitude and extent of tho work turned out in the Company's extensive and well-ordered factories, in which are to be seen immense workshops, densely, but not inconveniently, oecupied with a variety of machines in motion—one, a screw-cutting maehine, stretching over the whole width of the principal workshop—fashioning, shaping, planing, and cutting the different parts of the numerous machines on order with a rapidity and ease that would appear simply wonderful to anyone unaccustomed to their action. Indeed, one might say that some hundredweights of iron

introduced at one end of the factory comes out a finished machine at the other. I regret that space fails me to speak more at length of the special machines manufactured there, and the handsome, well-lighted, and capacious drawing-rooms, pattern-rooms, and other necessary offices attached to the workshops. One thing, however, I am bound to mention; and that is the order which prevailed throughout the factory, and the attention every man paid to his work, apparently taking the utmost interest in what he was doing, and in looking to the machine that was working under his care. When scattered here and there among the machines, the hands in the employ of the Company did not appear to be very numerous; but this idea, as far as I was concerned, was soon wiped out when the dinner-hour came, and the bell gave the signal to cease work, and from 150 to 200 men soon gathered from all parts of the workshops, and poured out through the factory gates, without crowding and without undue noise, about three abreast, in a continuous stream, which kept going for some time before the factory was left to the manager and myself, and a dead silence followed, which offered a marked and marvellous contrast to the busy hum of active workers and moving machinery that had prevailed a few minutes before.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**On Learning Marbling.**—F. P. (*Newport*) writes:—"Can you spare me space in which to reply to our friend's (R. A. D.) letter upon the above subject, appearing in page 175 of Vol. II.? My answer to W. H., therein alluded to, is condemned as 'bad advice' by one who, from the general tone of his, nevertheless useful, letter believes himself competent to write thereon. The pith of both W. H.'s query and answer in 'Shop' referred to the *cost* of learning. The *practical* value of all that has heretofore appeared in WORK upon any subject few will question, and the 'value for money' aspect of this wonderful weekly pennyworth needs no consideration. Time again will show how far the writer was justified in allocating to a future series of papers the premier position for '*small cost* and practical usefulness.' Respecting, however, the definite courses that were suggested to the learner, I would ask, Does not 'a clever marbler' imply a capable, experienced, and trained craftsman? If it does not, to the thinking of friend R. A. D., surely he is unfair (doubtless unintentionally) to the writer in inferring and construing the same to mean an *incompetent* worker—one who pretends to imitate that which he has never seen, much less studied; in short, any poor craftsman, down to the paper-stainer's boy, who marbles sixpenny sienna (?) at the rate of some 36 feet by 21 in. per minute! F. P. would give place to no reader of WORK in impressing the necessity of studying from Nature; but the 'matter-of-fact' side and technical aspect must not be overlooked. Is not the name of any great art-worker usually connected with his master? 'Nature' can scarcely be expected to teach an individual how to handle his brushes and tools, and what are the nature, properties, and values of his pigments and vehicles. Carry the inquiry still further, and let me give a definite instance:—I have a friend who is sufficiently an artist (unprofessional) in water-colours to have his work hung at the Academy. Surely we might say such an one can only now learn from Nature! My friend thinks otherwise, since he cheerfully pays a half-guinea to watch a professional master paint for an hour an imaginary landscape or a study of foliage. If there is sense in this action, surely a clever master is no danger to a would-be marbler; and I venture to assert, had R. A. D. been so fortunate as to be the pupil of a clever marbler like Mr. Moxon, Mr. Kershaw, or the late Tom Nichol, in more Northern latitudes, be would be a far better *practical* marbler than he is now—however able he may be. I am honestly obliged to my critic for reminding me of the *translation* of Van der Burg's work; and his information *re* the Technical School justifies his writing. I will only humbly endeavour to offer him some useful information in return. A prominent literary worker and marbler (from 'Nature') of forty years' experience gives an authoritative opinion of the above work, worth quoting as against the patronising laudation of R. A. D.:—'There is a Dutch work, price £2 10s., in which *some of the specimens are fairly good* (my italics), but the letterpress instructions are difficult to follow out, being a translation from the Dutch.' Now a few final queries for my critical friend. If this Dutch work is valuable and worth following, as he says, would not the *personal* instructions of either of the brothers—doubtless 'clever marblers'—be of more value? If there is only 'one class of its kind in the United Kingdom' for the would-be marbler to study at, and that in Kennington Park Road, what are all the poor provincials to do? Can they go into the streets and lanes to study rouge roi, jasper, and porphyry from 'Nature'? And if they could, would not there be *something* still to learn about the manipulation of tools, colours, and the varnishing, felting, and polishing? There are two other good collections also worth mentioning of natural specimens—the Geological Museum in Jermyn Street, London (Marbles), and the Royal Botanical Gardens at Kew (Woods), so that the 'City and Guilds, etc.,' very fine collection (all honour to it, however) is not quite alone in its magnificence. Let me here ask R. A. D., and all other earnest believers in work of any kind, to give the contributors of this paper a 'fair hearing,' or rather reading. Surely R. A. D. could count upon the publication of useful information without misconstruing and wrongly characterising so practical and common-sense an answer as, I believe, I have shown to be that which he condemns as 'bad advice.' If 'marbling' is ever to become as popular again, as a decorative feature in buildings, as it was thirty years ago, I venture to opine that it will not be due to the marble studies and paintings of L. Alma Tadema, and such other gentlemen who may spend time *ad lib.* copying pieces of marble upon paper, etc., at the 'Kennington Park Road' class (excellent imitations although they may be), but rather will it be due to those workers who can apply their imitative faculties in a *practical* manner, and offer, not solely minute and slavish imitations, but as much *natural effect* of colour and figure as the very primary and ever-present considerations of cost and comparative values will allow."

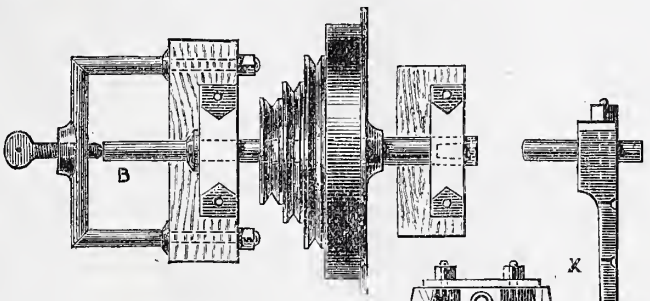



Fig. 2.

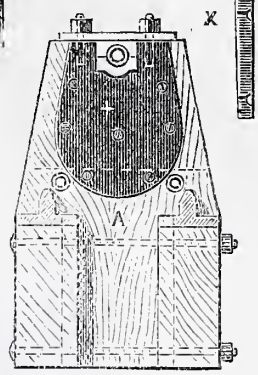



Fig. 3.

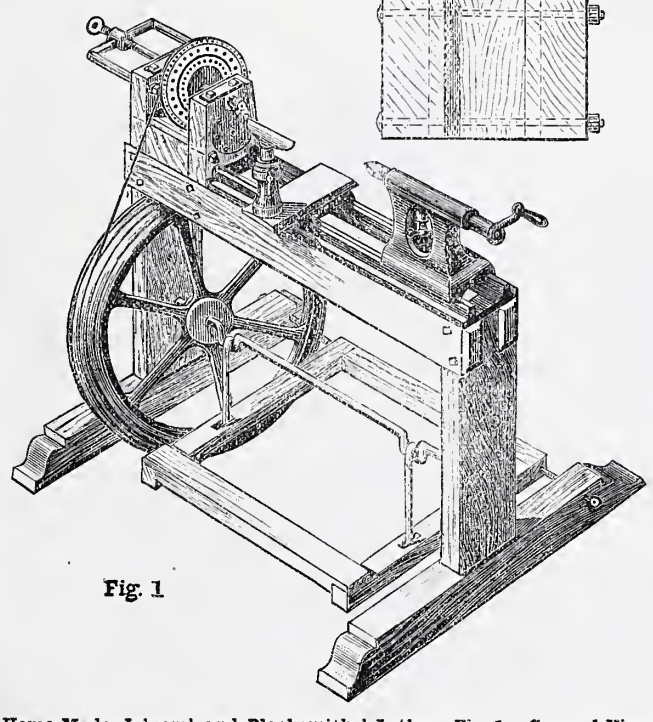


Fig. 1.

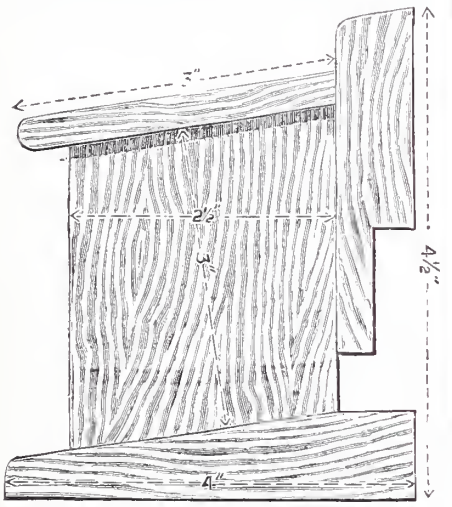
**Home-Made Joiners' and Blacksmiths' Lathe.** Fig. 1.—General View of Lathe. Fig. 2.—B, Plan of Heads; X, Section of Cast-Iron Plates. Fig. 3.—A, Elevation of Front Headstock with Section of Bed.

**Home-Made Joiners' and Blacksmiths' Lathe.**—PRACTICAL JOINER writes:—"Having been a subscriber to WORK since its commencement, I have noticed many inquiries regarding lathes, their construction, etc., especially home-made ones. I have copied one in our shop, made by my father, and which has been in use exactly sixty years. It is drawn in perspective—perhaps not very perfectly, I never having learnt that branch of drawing. I trust my fellow-workmen will be able to understand it. The maker was a joiner in a country village, with, I must confess, a talent for fitting. The lathe is 10 in.; centres partly wood, partly cast iron; the bed is of hardwood plank, 8 in. by 3 in., with a cast-iron top nicely planed, and fitted to the top of wooden bed. This makes an excellent job. The poppet slips beautifully along it. The fixed heads are also wood and iron, the end standard being carried up high enough to form the back bearing; the front ones checked in between the two planks, and a piece of dry wood fitted nicely in between the two, and bolted together, making the whole perfectly rigid and steady. The sliding head is of cast iron, and is the most difficult part to construct. This head was bored out with a flat boring bar, with a piece of half-round wood at the back; after each cut, a piece of thickish paper is put in between the wood, and on the bar, and so on. I bored a small engine cylinder with this same tool, and succeeded perfectly. The mandrel runs in brass bearings; these brasses are fitted into cast-iron plates, the front of which is seen on elevation at A, Fig. 3 (end view of iron bed is also seen here). A section of this plate is also seen in drawing marked X. B is a plan of heads showing the whole construction. The bearings are held down by a flat bar and two nuts. This plate is much thinner where it is fitted into the head than where it supports the bearings. These plates require careful fitting, being kept flush with the top of the wooden heads, and fixed with large screws. The mandrel is 15 in. long, 1⅛ in. thick at front bearing, ⅞ in. at back one, with collar as shown, and back centre to tighten up. The fly-wheel is 30 in. diameter, of cast iron, with a wooden rim fitted compactly and firmly round the iron; the grooves, four in number, are turned on the wooden rim, and being turned on its own axle, ensures perfect truth in running. The top pulley is about 10 in. diameter, smallest speed being 4 in. A brass dividing plate completes it. The main axle is 1¼ in. square, with two cranks. The bed of this lathe is 10 feet long, but the cast-iron part is only 6 feet, the remainder being carried out in wood, fitting well with the iron, as we seldom work so far back. The lathe is capable of very heavy work—such as wheel naves, or hubs, as they are called in England; these are from 8 in. to 12 in. diameter. We also turn all our wheels not exceeding 20 in. on it; it also carries a circular saw, 12 in. diameter, which is one of the most useful tools in a country shop. I have seen the hand or foot-power saw condemned in print. All that I can say is we would not lose ours on any account. The speed and accuracy with which 2 in. deal can be sawn, for instance, into such stuff, would rather astonish the eloquent advocate of the rip saw; it is not only the speed, but they are so accurately done that they can be dressed up with the plane in no time. I know what it is to dress up hand-saw work; as we say down here in Roxburghshire: 'it is nae better than it's caa'd.' Then for cutting tenons

it is first-rate; in order to dress a 12 in. saw lightly, it requires the band from a 24 in. speed to the 10 in. one. But I am afraid I am wandering, or maybe maundering away from my text. Any competent workman would have no difficulty in making such a machine; one man made it, and this in the year 1830, when there were no such tools as can be had now. The general idea was taken from a popular cyclopædia of that time, and, honestly speaking, it has not cost us over twenty shillings for repairs; and the parts which failed were of birchwood, these being the two cross feet and the top pulley. I shall be glad to answer any questions regarding this lathe, if anyone should try his hand."—[This is a capital latbe. It must have been a stunner sixty years ago. In these days, cast iron is so cheap and easily worked, I doubt whether it would be a saving to make such a latbe of wood now. If I am "the eloquent advocate of the rip saw," I should want to know, before modifying my opinion thereon, whether our Roxburghshire joiner can drive that 12 in. saw with his unassisted foot when ripping 2 in. deal for blind slats. He may, perbaps, at a speed ratio of only 10 to 24, which is very slow. Query: Wbat is tbe most advantageous speed for a circular saw driven by *one man?* As, however, PRACTICAL JOINER turns up naves of 8 in. to 12 in. diameter, I rather think he must be in the habit of calling upon one or two others to help bim tread; or, does he use the engine the cylinder of whieh he bored? A 6 in. or 8 in. saw is very hard to drive when cutting 2 in. wood at ordinary speed; do we make a mistake in running our saws so fast?—F. A. M.]

## II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

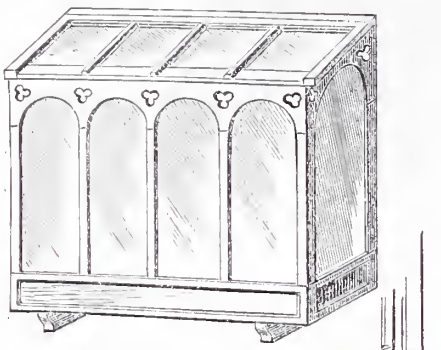
**Hive for Transportation.**—BAR FRAME, J. J., AND OTHERS.—BAR FRAME asks for a description of a hive which would be suitable for moving to the heather by rail or boat; and, as I have such a hive in my possession, a short account of it will probably be acceptable to others as well as to BAR FRAME. It is a twin hive, capable of accommodating a couple of strong stocks, but, if it is thought too heavy in this form, it might easily be made half the length, when it would do for a single hive, and be more easily carried about. Twin hives, however, possess tbe advantages of economising heat, and being almost as easily made as single ones while doing the work of two. To make this hive, I first construct a box of inch stuff, 17 in. by 31 in. internal measurements. It is 9 in. high, and the bottom is nailed on, plenty of good glue being applied to every joint. Before the bottom is nailed on, I cut a doorway ⅜ in. high and 8 in. long out of each end. I also strengthen




Hive for Transportation. End of Porch.

the bottom with three or four cleats nailed across. It is to be understood that the bottom is planed flush with the sides all round. I next prepare the inner sides, which are to support the ends of the frames, and give the hive double walls. These are two in number, 3¼ in. long, ⅝ in. thick, and 8¾ in. high. They are bevelled on top, leaving about ⅛ of an inch to support the frames, or a strip of tin might be tacked on for the same purpose, in which case the inner sides would be 8½ in. high, the tin bringing them to 8¾ in. These sides are next nailed in place, leaving a space between them of 14½ in.; nails should also be driven up through the bottom into tbese sides, to give additional strength to the structure. The ⅝ in. space between the inner and outer sides may now be filled with cork-dust, chaff, or some other non-conductor of heat, and a small strip of wood nailed on top to keep it down. So much for the body of the hive, which will require a well-fitting dummy to keep the stocks apart. The roof I make on the Cowan principle, sloping from 4½ in. to 9 in. in height; in the breadth of the hive, the top is covered with ½ in. boards, placed edge to edge, covered with calico and painted. If three crates of sections are used, a riser 8½ in. high and the size of the body-box will be required. Plintbs break the joints between body-box, or riser and roof. Tbe hive is now complete, except for the alighting board and porch, whieb I make in one. As it is rather more difficult to describe than the body part of the hive, I give an end view of it (see sketch). I first cut pieces, which I may call the ends, to about the dimensions given in the figure, but this can be varied much. I then nail the top and back in place, having previously rebated the place for the doors in the latter; the alighting board comes last, and projects back far enough to support tbe runners. The length is about a foot, and the entire porch is secured to the hive with a couple of screws. It can thus be removed when a journey is in contemplation, and replaced with the greatest rapidity. I have now fulfilled BAR FRAME'S requirements in describing a hive handy to carry about, if the eaves are not made too wide; strong, and with few parts; and able to keep out tbe cold and rain at the heather. If it is made balf the length, it would be still more handy, but heat would not be so much economised. I hope observatory hives will be treated of in due time.—APIS.

**Plant Case for Window.**—DEW.—To give full details for making a case sucb as you require would



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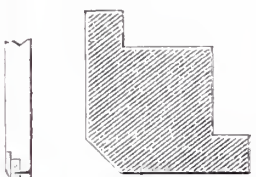

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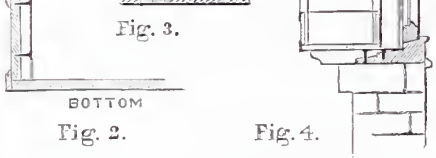



Fig. 2. Fig. 4.

Plant Case for Window. Fig. 1.—Side and End Elevation of Case. Fig. 2.—Section of Box, showing Fitting of Corner Post. Fig. 3.—Section of Corner Post. Fig. 4.—Section of Case and Window.

take up too much of the space available for "Shop" replies, but the following brief description may, with the aid of the sketches, furnish you with sufficient particulars for your purpose. Fig. 1 shows the appearance of the finished case, the lower part of which consists of a box made to fit the width of the window in which it is to be placed. This box is made of ⅞ in. wood, and is about 6 in. deep, the bottom being firmly screwed to the sides and ends. Slips of ½ in. wood, 1¼ in. wide, and having a small moulding or a plain chamfer worked on one edge, are then planted on to the outside of the box, so as to form panels on the front and ends, the piece on the top edge projecting ⅜ in. above the box to form a rabbet for the glass. The corner posts are then fitted in their place by cutting them away as shown in Fig. 2, and fixing them by means of screws. These posts are of the section shown at Fig. 3, and can be chamfered on the edges. Fig. 4 shows a section tbrough the case and window when in position, two brackets being fitted to the window-sill and firmly screwed down to it, upon which the case rests, being also secured at the top by means of two iron straps screwed on the woodwork of the case and window. The roof of the case should come just above the bottom of the top sash, so as to allow of its being pulled down if required. A piece of wood of the same tbickness as the roof is fitted close to the window-glass, and the roof is hinged to it, and can then be opened at the front. The semi-circular tops of the front and end openings are cut out of a piece of ½ in. wood, which is let in flush with the corner posts and bars, trefoils being cut out to lighten the appearance; the glass goes right up behind this wood, and covers the trefoil holes; or a very good effect can be obtained by cutting away the plain glass behind the holes and putting in blue or red glass; if your case is seen from the road, this is worth doing. Of course, a zinc lining is required to prevent the damp injuring the woodwork, and a pipe should go through one corner of the bottom to let away any surplus water. Use yellow deal if possible, and prime thoroughly with two coats of thin white lead before painting. I think these few hints will give you an idea how to proceed, but if you find any difficulty in tbe course of the work, write again.—G. LE B.

**Glazing Cuffs and Collars.**—LAUNDRY.—There are various ways of doing this. Putting a little gum arabic into the starcb is considered to give a nice glaze. Another way is with wax—into a pint and a half of boiling water in a saucepan put an ounce of wax; melt over the fire. When it has stood a few minutes to cool, stir into it half a pound of starch, previously mixed with a little cold water; the wbole to be boiled and stirred for half an hour. The wax starch thus prepared is to be used cold. We believe, however, tbat the glazing substance most used at the present day is borax. Some borax is dissolved in a saucer, the linen is starched in the usual way, an iron is passed over it, a clean rag is dipped in tbe borax and rubbed over the face of the article, and the ironing then finished.—S. W.

**Boot Soling and Welting.**—S. T. (*No Address*).—Round the sole a little wider than tbe last: any way, at the heel or outside joint. The breadth of the feather is decided according to tbe substance of the upper; but for medium work it must be about ¼ of an inch; and to make this feather, a strip of the leather must be taken away, and the lighter you want the sole to look when finished, the more of this you take away at A (Fig. 1). A line should be drawn round about ⅛ of an inch from the edge, and the awl put in here in holing, as B, and brought out at C. Tbis is all done on a board, not on the last, as an insole is fitted. For Question 1 you say a "turned pump." All pumps are turned, but all turned shoes are not pumps, and as you ask in Question 4 if you should start sewing at "the left-band corner of the heel," I conclude you mean what are called "sew-rounds"—that is, it is sewn all round while it is inside out, whereas the heel of a pump is made after the shoe is turned to its right side out. The sole should be tacked to the last with four tacks (the sole being grain side to the last), and then the upper lasted on with tacks, as you would for a welt: only use small tacks, and the tops must be lasted inside out. The sole should be fitted for this class of work to such a nicety (that is, have a very clean-cut edge), that after it is turned and second lasted it should need only to be coloured and ironed. The stitches for a gent's should have about five to the inch, and you should commence stitching at the corner of tbe heel, sew up one side of the waist, round the foreport, down the other side of the waist, and then round the heel. The feather for a broad welt can scarcely be too narrow—in fact, it must be sewn full, or its beauty is spoilt; and after the welt is sewn in, it should be beaten up, not between "two bammers," but with a welt-beater in the left hand and the hammer in the right. A welt-beater is generally made from

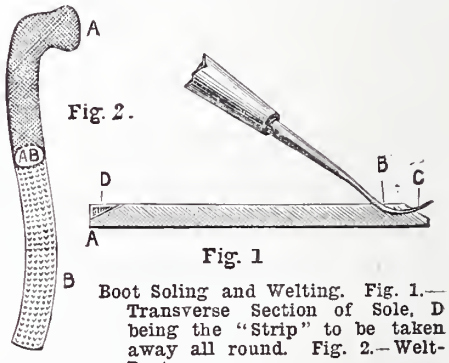



Fig. 2.

Fig. 1

Boot Soling and Welting. Fig. 1.—Transverse Section of Sole, D being the "Strip" to be taken away all round. Fig. 2.—Welt-Beater.

an old rasp, beaten out while hot, and turned over, as in Fig. 2, and A is put between the upper and welt, and B forms the handle.—W. G.

**Shading Marquetry.**—J. K. (*No Address*).—Such shading as you refer to may be done with hot sand, heaped up in the centre of the veneer you wish to shade, if it is large enough. All such work requires "dodging." It cannot be done mechanically. It may also be managed by heating a piece of iron till it is hot enough to brown the wood when held near it. Use either tbe end of the poker or a piece of wire, according to tbe size of the work. I cannot say how your old specimens are done without seeing them, and very likely I should not be able to tell even then, as no doubt old workers had their own methods of doing out-of-the-way jobs like this one, just as they do now. When an operation is a common one, one or more recognised methods are generally practised, because they have been found the best for obtaining a desired result; but in exceptional cases the worker must be guided by his experience. This will sufficiently guide you, whether you are merely asking from curiosity or because you wish to imitate the work. In this latter case you may be glad to know that the shading may be done with ordinary water-colour paint on the surface, after the veneer has been laid and cleaned up.—D. D.

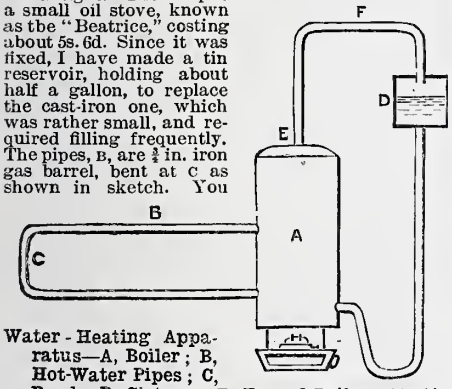
**Fretwork.**—F. G. (*London, N.*).—No elementary articles on this subject have appeared yet, but some are in course of preparation.—D. A.

**Hand Camera.**—E. T. (*Bruntcliffe*).—They vary a little in detail, but both are useful instruments. Abrahams, in Aldersgate Street, has a very simple and workable one—the movement of one lever changing the plate and fixing another ready for exposure.—D.

**Painting Inside of Aquarium.**—JACK OF ALL TRADES.—Try Aspinall's enamel; choose the colour you think will best suit the aquarium and put on three coats, allowing each sufficient time to dry, and do not put in the fish until you have had it filled with water for, say, a fortnight, changing the water every two days during that time. A friend of mine has recently treated an aquarium similar to yours in this manner; it has now been in use about six months and is perfectly watertight, while no apparent harm has been done to the fish.—G. LE B.

**Austin-Leclanché Battery.** — J. A. (*No Address*).—The ingredients and all other accessories required for making and fitting up the Austin-Leclanché Battery can be obtained from Whitney's, the Science Depôt, City Road, London; also of Caplatzi, 3, Chenies Street, Tottenham Court Road, W.C. Either of these will favour you with their price lists for inspection by enclosing postage. The price of Mr. Caplatzi's list is 2d.—H. E. A.

**Water-Heating Apparatus.**—A. H. H. (*Birmingham*).—You do not state the size of the building you propose to heat, but I imagine from your query that it is a small fernery or window conservatory. A friend of mine fitted one with hot-water pipes as shown in sketch, and he is perfectly satisfied with it. I will describe it as he made it, but you need not follow it in all details, as he had the saucepan and lamp by him, and you may have something else that will do as well. The boiler, A, consisted of a two-gallon tin saucepan with the handle removed and the lid soldered down. Any other utensil will do as well, providing you make it water-tight. The lamp is a small oil stove, known as the "Beatrice," costing about 5s. 6d. Since it was fixed, I have made a tin reservoir, holding about half a gallon, to replace the cast-iron one, which was rather small, and required filling frequently. The pipes, B, are ¾ in. iron gas barrel, bent at C as shown in sketch. You




**Water-Heating Apparatus—A, Boiler; B, Hot-Water Pipes; C, Bend; D, Cistern; E, Top of Boiler; F, Air-Pipe.**

can, if you choose, use two bends, or two elbows joined with a nipple to form the bend, but you will find it cheapest and best to have it bent. The boiler must be placed either below or on a level with the pipes, as shown in sketch. You can run the pipes to suit your convenience, providing you take the pipe from near the top of the boiler, and return it to the bottom, as shown. If you run the pipes above the level of the boiler, it will be best to take the pipe from the top of the boiler, E, and run the air-pipe, F, from the highest point in the flow-pipe. You ask for dimensions of tank, but in a low pressure apparatus no tank is required, except for convenience of filling, as there is scarcely any loss of water. My friend used a cake tin for the cistern, and ran ½ in. composition gas-pipe to supply the boiler. The air-pipe is ¾ in. composition, and this must be carried above the level of the cistern. It need not be carried over the cistern if not convenient. The hot-water pipes are tinned at the ends and soldered into the boiler, but if you do not mind a little extra expense, it will be best to solder unions into the boiler, and connect the pipes to them. If you do this you will have no difficulty in making your connections, and will be able to disconnect and re-connect boiler easily at any time. If you find any difficulty, I shall be glad to assist you if you write again.—T. W.

**Bicycle.**—CYCLOS.—Complete sets for making diamond frame safety, consisting of tubes, stampings, hubs, ribs, tires, chain, forks, brackets, saddle, pedals, spring, and every item to complete the machine, can be bought of the St. George's Cycle Company, Upper Street, Islington, London, for the sum of 90s. I cannot say what parts are finished, but should say the hubs and bottom bracket are. Of course, the rims, tires, chain, saddle, etc., are finished. If CYCLOS will write to above address, they will give him a catalogue and list wherein the prices of all rough and finished parts are given. If CYCLOS is not much of a mechanic, he should get as many of the parts machined for him as possible. After that he may have difficulties, but no special ones, providing he reads up a treatise on the subject.—A. S. P.

**Clock Cleaning and Repairing** — P. H. B. (*Highfield*).—You did not enclose the letter you wished forwarded to PRACTICAL HAND.

**Speculum Grinding for a Newtonian Telescope.**—W. B. (*Bruntcliffe*).—I presume that you are acquainted with the principle of the instrument; if you are not, look it up in any elementary handbook on optics. Here is a rough diagram showing the arrangement of the mirrors and lenses. You will see that the light which falls on the large mirror, A, is reflected in a cone, which, before it reaches a focus, is intercepted by the small mirror, and turned aside through the eye-tube, D, to the eye-lens, E. The large mirror, A, called the *speculum*, and the small mirror, B, called the *flat*, will have to be ground and polished. If the speculum is to be, say, 6 in. in diameter (which is a good size to begin with, though you may make one larger or smaller if you wish), then the *flat* will be an oval about 1½ in. in the major, and 1 in. in the minor diameter. For the present, in order that you may set at once to work, let the *flat* drop out of the question, we will confine our attention to the speculum. You will want no tools, properly so-called, at all. What has to be done is this. *Given a flat disc of plate-glass, free from flaw or defect, to dig out one surface of it to a certain parabolic curve.* And if we are to set about getting this parabolic curve in an intelligent manner, and with a prospect of success, we must first make it a sphere. So, for the moment, forget the necessity for the parabola, and state the problem more simply, thus:—*Given a flat disc of plate-glass, free from flaw or defect, to dig out in one surface of it an exact spherical concavity.* The concavity must be such that its section will be an arc of the circumference of a circle, the radius of which will be twice the focal length of the desired telescope. The focal length of a concave mirror is, roughly speaking, the distance from the centre of the reflecting surface to the point where the lines of the reflected rays intersect, or, in other words, to the apex of the cone of reflected light. Thus, with a speculum 6 in. in diameter, for which a good focal length would be 5 ft., the curve of a diametrical section of the mirror must be part of the circumference of a circle 10 ft. in radius or 20 ft. in diameter. You must really master this, because, until you have mastered it, you cannot intelligently proceed. A gauge by means of which you will be able to tell when enough glass has been ground away can be easily made as follows:—Procure a lathe 10 ft. 6 in. long. Through it, close to one end, stick a long bradawl for a pivot, by which one end of it can be fastened to the floor, while part

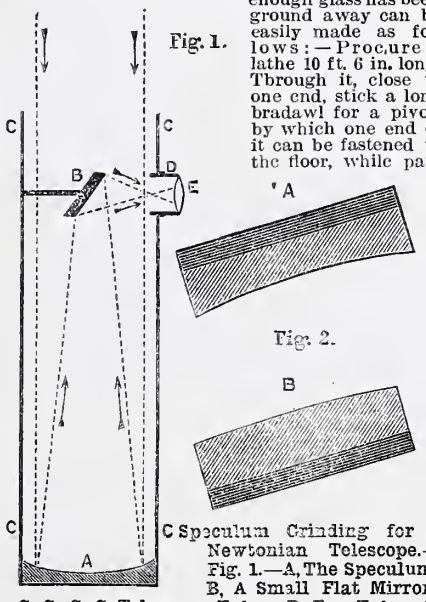



Fig. 1.




Fig. 2.




**C Speculum Grinding for a Newtonian Telescope.—Fig. 1.—A, The Speculum; B, A Small Flat Mirror; C, C, C, C, Telescope Tube; D, Eye Tube; E, Eye Lens. The dotted lines indicate the manner in which the Light from the Object is reflected from the Speculum to the Eye. Fig. 2.—A, Concave Gauge; B, Convex Gauge. In each case the curve is much exaggerated.**

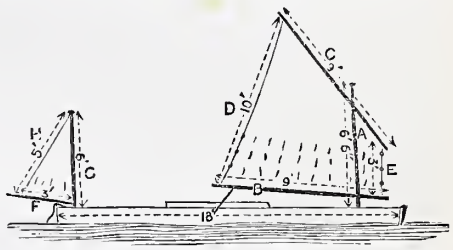
of a circle is described with the other end. In this other end, 10 ft. distant from the bradawl, fix a pointed steel tool. Underneath it, on the floor, place a 7 in. square of stout soft sheet zinc. Then, the bradawl being fixed firmly, the steel point may be made to mark the desired curve on the zinc, which must be cut with great care through the marked line, the curved edge being afterwards neatly worked together with a little wetted emery powder until they fit precisely. The straight-edge of the zinc can then be bent over (as in Fig. 2) and tapped down to keep the gauge rigid. The convex gauge, A, will fit the concave of the speculum exactly, the other gauge, B, we shall want to use otherwise by-and-by. Now for the glass. Get discs of plate glass 1 in., or better, 1¼ in. thick and 6 in. in diameter. You will be able to get them from any large plate-glass merchant, and they will cost a few shillings. The plate-glass people will cut them to a circle, but will leave the edges jagged. These edges must be smoothed down, either on a coarse grindstone, using plenty of water, or by mounting the two pieces of glass in a lathe and properly edging them. How to do this, I will tell you in another note.—E. A. F.

**Extracting Gold from Gilt Buttons.**—NO NAME.—From a jeweller's point of view, it is not worth the trouble and expense, there being so little gold put on. Even refiners do not particularly care to buy them at the low rate of 1s. per lb. I would go into the method of stripping by acid, but there are better methods I fancy in which a gilding battery is employed. Ask G. E. B. of WORK staff.—H. S. G.

**Pump Delivery, Pressure on Fittings, Contents of Tanks.**—TALBOT.—To find the quantity of water delivered in gallons per minute by a pump with a 4 in. barrel, multiply the length of stroke in feet by the number of *effective strokes* per minute, and by 0·5454. For a 5 in. barrel, replace the multiplier 0·5454 by 0·8522. This applies to any kind of pump. If the pump is double acting, all the strokes will be effective, but if single acting, only half of them. To find the pressure per square inch upon any fittings, measure the maximum height in feet of the water level above the fitting and multiply it by 0·434. The *size* of the supply tank does not affect the question. To find the quantity of water in an oblong or square cistern in gallons, multiply together the length, breadth, and depth, all in feet, and multiply the product by 6·25. To find the contents in gallons of a round tank, multiply the square of its diameter in feet by its depth in feet, and the product by 4·9.—F. C.

**Pantograph.**—J. B. (*Southwark*).—As a pantograph can be bought for sixpence, it is not worth your while to make one, for the materials would probably cost you more. You will find some remarks on the subject in "Shop," on page 669, No. 42, of WORK, which may be of assistance to you.—D. D.

**Canoe Sails.**—T. P. (*Islington*).—I submit rough sketch of sail plan that would suit canoe of dimensions given. The best article on canoe sails, etc., is in "Canoe and Boat Building," by Stephens, published by *Forest and Stream* Publishing Company of New York. A licence on the river Thames for a canoe from January 1st to December 31st is £2.—L. Y.




**Canoe Sails.**

**Mother-of-Pearl for Inlaying**—W. B. (*London, E.C.*).—The mother-of-pearl can be obtained from Mr. Henry Chatwin, 30 and 31, Darwin Street, Birmingham. He will also supply you with prepared shell of any thickness for saw-piercing, and will also cut it into shape if you like. The prices will be willingly given on application if details of thickness and quantity required are sent. The tools to work it that you will require are saws and files, all descriptions of which, including the polishing materials, can be obtained of Messrs. Cotton and Johnson, 14, Gerrard Street, Soho, London, W. Here is some idea of the cost: Saw-blades, from 3d. per dozen; piercing-saw frame, from 3s. upwards; file, about 6d., although you can get small ones down to 1½d. each. With these you should be able to get the shell into shape—that is, if you have it already slit to your desired thickness. If you wish to work from the shell direct, which I do not advise, you must go in for a hack-saw as well. With any or all of these tools use water or soapy water. To polish it, when you have done filing it, you must first get rid of the file marks with a piece of pumice-stone, ground flat, and water; then follow on with finely powdered pumice-stone and water, or oil, or better still with sulphuric acid and water. Vinegar will do if the acid is not to hand. The powdered pumice can be applied by means of a cloth lap (see a previous answer on polishing opals, etc.), or a leather buff, to be bought for a few pence at Gerrard Street; or even a piece of rag wrapped round a piece of wood. With this you must obtain quite a regular and smooth, but dull, surface. The next step is with similar tools, *not* the same, but to use powdered rotten-stone with any of the before-mentioned fluids. The final polish is best given with the palm of the hand, on which powdered rotten-stone is rubbed. Fine whiting may also be useful in place of rotten-stone. I think I will close this reply by mentioning a suitable pin or peg to aid you in piercing. You can get one at Gerrard Street. It is a piece of wood some 3 in. wide and 5 in. long, tapering from ¾ in. to ¼ in., and with a piece cut out like sketch. It is attached to a board or table by two screws, and projects some 4 in. from it. With this you should be able to work the thin shell without accident, for you can obtain support in any direction. One last word. Get your shell already polished if you can. The appliances and practice they have give a much better result than you will be able to get. I almost forgot to say that a grindstone will almost be necessary if you work the whole shell yourself. —H. S. G.

**Metals.**—AMATEUR.—You can get quantities of corrosive sublimate of Townson and Mercer,

Bishopsgate Street Within, or of J. Orme & Co., 65, Barbican, E.C. To make a saturated solution, dissolve ½ oz. of the corrosive sublimate in about 2 oz. of hot water. As it cools, the excess of salt will settle to the bottom, the remaining solution being saturated, and can be poured off to use, as mentioned in "Means, Modes, and Methods," page 714, Vol. II. Remember that corrosive sublimate is chloride of mercury, and very poisonous; the white of egg is the best antidote.—F. B. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Briar-Pipe Screws.**—C. W. B. (*Plymouth*) will be glad to be informed where to obtain bone screws for pipe-mounting, ⅜ in. up to ⅝ in. diameter.

**Papier-Mâché Doors.**—H. H. (*Cambridge*) writes:—"I have lately heard that doors of *papier-mâché* have begun to be made in Hamburg. Can any reader inform me whether or not this is the case, and where particulars relating to them can be obtained? It seems to me that such doors would be much less inflammable than doors made of wood, and could without much difficulty be made almost fireproof."

**Carved Wood Bellows.**—CARO writes:—"Can anyone tell me of a wholesale or retail address where I could get some bellows that I have carved nicely made up with brass nozzles and leather at a reasonable price; also where I can obtain similar bellows all ready for carving?"

**Ivory-Carving Tools.**—J. E. W. (*Camberwell*) writes:—"Will any reader please inform me where to get the above tools; also the lathe cutters used by carvers and stick-makers?"

**Turned Wood Cases.**—W. H. (*Stirling*) writes:—"I am in want of some cheap turned wood cases for packing a small phial in—size of case outside about 3½ in. long by 1¼ in. diameter. Can any reader oblige me with address of a maker?"

**Slate Pencil Preparation.**—R. M. (*Braintree*) writes:—"Seeing a recipe given in WORK, No. 102, for a blackboard preparation, I am led to ask for a preparation to be applied to wood or millboard, which could be written on with *slate pencil*. Something of the kind is sold, called carbon slate."

**Mice Cage.**—MART writes:—"Will anyone give me an ornamental design, with dimensions, for a white mice cage?"

**Lace Frame.**—MART writes:—"Will anyone give me a design and dimensions for a macrame lace frame?"

**Paper Machine.**—FOURDRINIER writes:—"Would any reader acquainted with the working of a Fourdrinier paper machine explain how the paper is transferred from the wire to the wet felt?"

**Castings.**—R. M. (*No Address*) writes:—"Will any reader give me some good information as to the best way of making my own castings? I want to make from 1 to 2 cwt. per day. Can I make them so as to be cheaper than 7*s.* per cwt., and what will be the probable cost of same?"

**Square Turning.**—F. W. (*No Address*) writes:—"Can any reader give me information of this kind of work? About what size wheels are used? How are the balusters, etc., fixed; and will the same wheels do for all kinds of work, or are the small articles, such as spindles, done in a different way? Do the turners use a gauge to get the mouldings to correspond on all the four sides?"

**Enlarging Drawings.**—J. W. (*Edinburgh*) writes:—"Would any reader kindly show the correct method of raising a drawing from half to full size; or the reverse, from full to half size? Say the scroll figured (page 760, Vol. II.), enclosed in a square (in rough numbers) 6 in. × 4 in. = 24 square in. If I take a half more each way, say, 9 in. × 6 in. = 54 square in., there is an excess of 6 square in. What is the rule?"

**Bright Steel and Cloth.**—STEEL writes:—"What is the best solution to stick bright steel and cloth together exposed to damp?"

**Battery.**—ELECTRIC writes:—"Would any reader oblige me with full particulars regarding the construction of a dry battery?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Electric Light.**—W. G. (*Erith*) writes, in reply to J. S. H. (*Dublin*) (see page 782, Vol. II.):—"If you have an ordinary bell-push, use a clip to keep the knob pressed down while you require the light. A cheap plug switch would be better, and may be obtained for sixpence; the necessary current may be supplied from two 3 pint agglomerate Leclanché batteries; these can be used exactly the same as in electric bell work, and will light up a 3-volt lamp for several years if only used for, say, five minutes per diem, and the current does not fall off as in the old form of Leclanchés. Of course, as many lamps as required can be used from the two cells, but only one at a time."

**Schooner Rigging.**—TEAK writes, in reply to T. C. (*Manchester*) (see page 782, Vol. II.):—"If T. C. wants a good book on Rigging, etc., let him write to the *Bazaar* Office, 170, Strand, London, W.C., for 'Model Yachts,' by J. Du V. Grosvenor, price 5*s.* 4*d.* by post."

**Cart Materials.**—W. P. (*Withington*) writes, in reply to W. S. (*Preston*) (see page 717, Vol. II.):—"I see that you are inquiring for addresses for procuring material and coach ironmongery for making a Battlesden cart. By writing to Mr. Wm. Cary, Red Bank, and Tomkinson & Co., Oxford Street, both of Manchester, you will be able to procure all that you require."

**Photography.**—C. M. V. (*Forest Gate, E.*) writes, in reply to C. E. H. (*Horwich*) (see page 734, Vol. II.):—"The method inquired for is termed 'Transparleum.' The company who introduced the process was the Continental Novelty Co., Leicester Square, London."

**Joiners' Bits.**—M. (*Bishop Auckland*) writes, in reply to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"The bits used by joiners are shell-bits, centre-bits, American twist-bits, and expanding-bits. Shell-bits are semicircular, with the end turned up to form a cutting edge; they are slower in action, but not so liable to split the wood. Centre-bits have a centre point and two cutting edges, one cutting the side and the other the bottom of the hole. American twist-bits are formed like a screw, with two cutting edges, and a taper screw point; they are very quiet in action. Expanding-bits have a taper screw point, and a movable cutter for various sized holes."

**Cardboard Models.**—C. P. W. (*London, E.*) writes, in reply to J. F. (*Mullingar*) (see page 634, Vol. II.):—"So far as I can learn, there are no very exhaustive works on the subject. The only one I know of forms one of Weale's series published by Messrs. Virtue & Co., Amen Corner, Paternoster Row, E.C., and is entitled 'Practical Instructions in the Art of Modelling in Architecture,' by T. A. Richardson, price 1*s.* 6*d.* It is a very useful little treatise, but only professes to be elementary."

**Transparleum.**—DEAN FOREST writes, in reply to C. E. H. (*Horwich*) (see page 734, Vol. II.):—"In answer to your query, the name of the process of painting photos on glass which you could not recollect, is, I believe, 'Transparleum.'"

**Frosting.**—W. P. (*Withington*) writes, in reply to BETA (see page 734, Vol. II.):—"First clean the inside of the window, and polish it dry; then get some white lead, ground in boiled oil, and a little driers, and paint the window, twirling the brush round to imitate frosted glass. Do not paint too thickly, or you will obscure the light; leave for a few days to thoroughly harden; get the rule, and measure an inch next to the sash, and mark all round; get a straight staff and a blunt bodkin, and run it up on the paint by the side of the staff, thus marking the window all round; this, when well done, gives a nice finish. Stars and diamonds can be done in this way, drawing them first with a blacklead upon the paint; they should, however, be done with a geometrical preciseness, and I assure you the effect both from the inside as well as outside is very pretty. If left plain, it should, however, have a fine border, as already shown, an inch from the sash all round, to take away the plainness of the thing."

**Electric Light.**—H. E. (*London, N.W.*) writes, in reply to J. H. S. (*Dublin*) (see page 782, Vol. II.):—"From twelve to twenty large size Leclanché cells (according to resistance of lamp) will light a small incandescent lamp for from five to ten minutes at a time during a period of from twelve months to two years, according to use. An ordinary electric bell-push, or pressel, can be used, or a two-way switch, as most convenient. This is the least troublesome method."

**Hardened Putty.**—H. E. (*London, N.W.*) replies to J. G. (*Hull*) (see page 782, Vol. II.):—"If only a small quantity is wanted to be kept, put it into a vessel and cover with water. If a tub, pour a thin layer of linseed-oil over. If you wish to soften some hardened putty, knock it up with some linseed-oil with a mallet."

**Hand-Power Circular Saw.**—A. R. (*Scorrier*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"If S. P. has plenty of money to dispense with, let him give it to the poor rather than lay it out in a machine that would be worse than useless to him for the work he wishes to do. If S. P. has no back numbers of WORK, I would advise him to get at least all the numbers of Vol. II., in which he will find both sketches and information how to drive small circular saw benches for cutting shallow stuff. But he must not expect to cut 5 in. deep, unless he has other than hand-power. To drive a circular saw by hand is not work for a man, even in shallow stuff."

**Lacquer for Brass.**—W. P. (*Withington*) writes, in reply to PATIENCE (see page 734, Vol. II.):—"Take 2 oz. of shellac, and dissolve in one pint of alcohol, coloured with turmeric; this turns the lacquer yellow. Clean the brass, and polish well off; then place it in a warm oven or before the fire, and apply this lacquer with a camel-hair brush. Keep the article in a warm place until the lacquer is quite dry, or it will be dull and lustreless."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. C. (*Redruth*); OLD PAINTINGS; J. C. B. (*Gt. Ayton*); C. C.; SELF-HELPER; MACHINERY MARKET; S. E. (*Chelmsford*); R. C. (*Exeter*); GIMEL; C. G. (*St. Albans*); A. M. (*Rochdale*); H. E. L. G. (*Liverpool*); A. B. (*Edenfield*); IRIS; W. C. (*Glasgow*); NEW READER; S. H. (*London, E.C.*); J. H. (*Everton*); A. S. (*Blaydon-on-Tyne*); J. J. F. (*Shaftesbury*); H. G. (*Brentford*); J. L. W. (*Sandown*); E. L. (*Woolwich*); J. S. R. (*Glasgow*); S. C. (*Ashton-under-Lyne*); A. R. B. (*Dublin*); HOROL; J. B. F. (*Eastbourne*); W. T. R. (*Newfoundland*); H. M. (*Liverpool*); W. B. W. (*Wolverhampton*); E. D. (*Deptford, S.E.*); NO NAME (*Manchester*); T. L. D.; H. O. B. (*Manchester*); W. T. G. (*Bristol*); M. T. O. (*Stockport*); F. W. P. (*London, W.*); J. MOV. (*Newcastle-on-Tyne*); ESSEM; A. L. (*London, W.C.*); H. O'C. (*Croydon*); WORKITE; CORINTHIAN; A. V. W. (*Cheltenham*); W. N. (*Finsbury Park*); J. F. (*San Remo, Italy*); F. H. B. (*Barking*); H. F. (*Birmingham*); EMBOSSYRO; T. G. (*Liverpool*); J. C. (*Bedale*); D. C. D. (*Ossory*); J. G. N. (*Manchester*); PIANO STOOL; W. S. (*Rugby*); J. MOA. (*Glasgow*); A. A. (*Edinburgh*); F. S. P.; J. J. (*Kidderminster*); G. C. (*Reading*); J. H. (*London, N.*).

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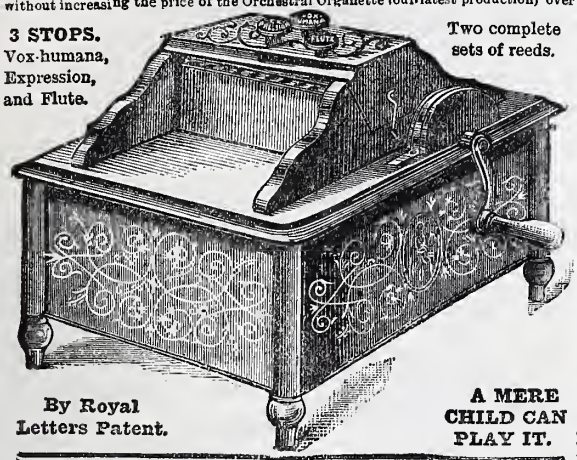

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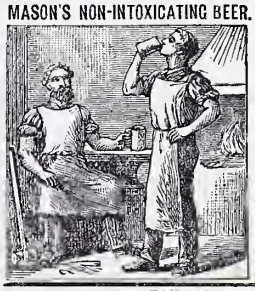

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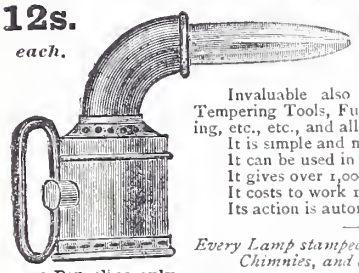

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VOL. III.—No. 106.] SATURDAY, MARCH 28, 1891. [PRICE ONE PENNY.

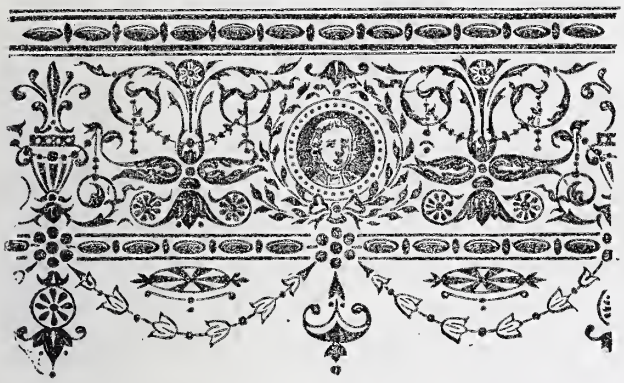

Fig. 2.

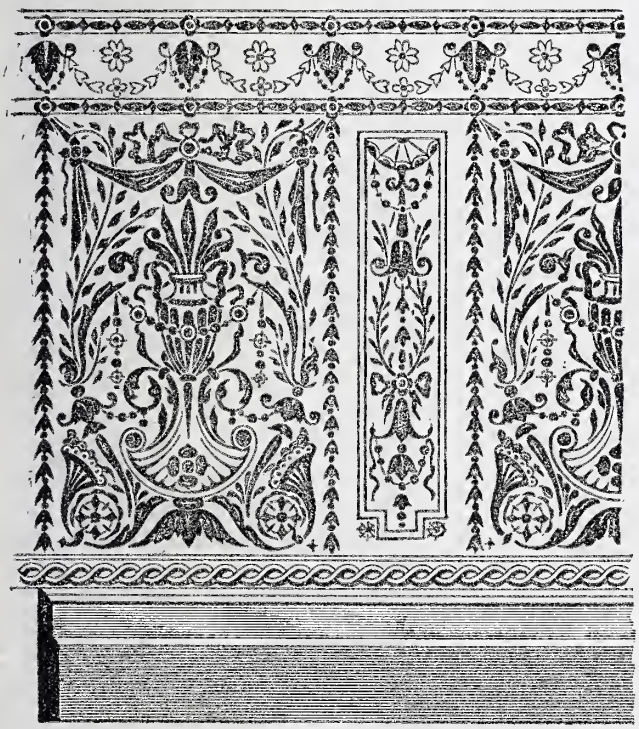

Fig. 1.

Fig. 5.

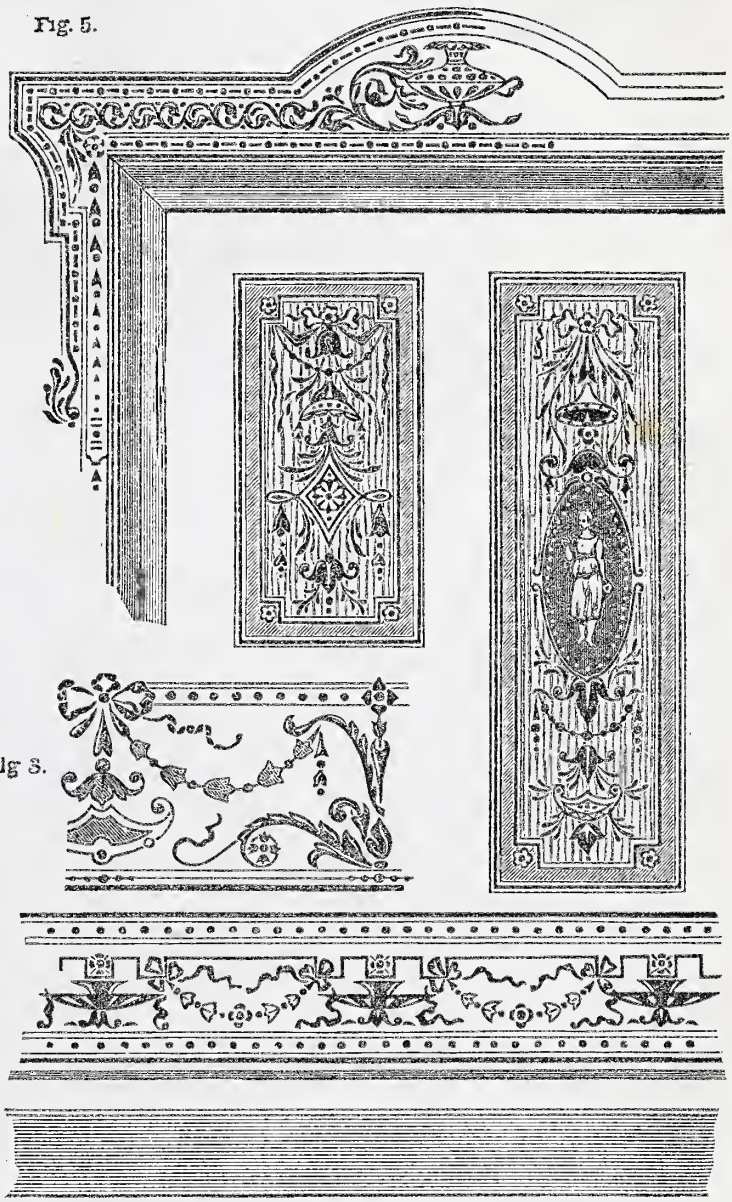

Fig 3.

Fig. 4.

**Stencil Designs for the Decoration of a Drawing-Room. Fig. 1.—Dado above Skirting in Borders and Panels. Fig. 2.—Frieze below Cornice. Figs. 3 and 4.—Designs for Borders. Fig. 5.—Treatment of Upper (A) and Lower (B) Panels of Door and Ornamental Work above Door.**

## STENCILLED DECORATIONS FOR A DRAWING-ROOM.

BY A LONDON DECORATOR.

THE ornamental designs accompanying this paper are intended for use in conjunction with the stencilled ceiling which appeared in Vol. II., page 133 (No. 61) of WORK. As a serviceable introduction to this article, I must therefore strongly advise readers who may take a practical interest in the present effort to carefully peruse the above. In common with the ceiling design, an attempt has herein been made to meet the different circumstances of the worker's ability and requirements.

Contemporaneously with the ordinary householder's "spring cleaning" comes the house-painter's and decorator's "spring season" of work. The present is therefore a very *à propos* time to invite attention upon home embellishment; and whilst I think the work now suggested to be within the capabilities of many amateur decorators, an effort has also been made to proffer useful hints for the professional painter and decorator—both with regard to material used and resultant effects.

In the article upon ceiling design of the "Adams" type, besides explaining the useful adaptability of such disconnective ornament for our purpose, it was advised that the work

be carried out in two or three simple tints. For use with many wall-papers, a blue tint of ceiling design upon a soft cream ground was given as being very effective; whilst further mention was made of executing it in other monotone tints of terra-cotta, etc., where the cream and blue would be unsuitable. "Adams" ornament—so named after the celebrated architects, the Brothers Adams, who introduced it—is at the present time in much use for high-class and costly drawing-room ceilings. In such cases it is usually made in fibrous plaster, and then affixed to the surface. In trying, therefore, to reproduce in flat tints the effect of a delicately modelled ornament in low relief, the relative amount of contrast between the ground and design is a very important factor in the success of the work. On the one hand, we must avoid that extreme which gives a sensation of Pompeian harshness and fussiness—such as we get in simple black and white; whilst, on the other hand, the design must be sufficiently plain for the eye to follow it under all fair conditions of lighting, without the least strain to the sight. "Taste"—that highly convenient jargon in matters of individual selection—can very often be taken as an attribute of common sense; and in the above respect it will be found that decoration which is based upon the latter will generally be conceded to express the best, or "correct taste."

Turning now to the practical aspect of this decorative treatment, we will consider Fig. 1 of the illustration. Judging by the paper-stainers' new designs for the present year, we may safely state that dados for the decoration of drawing-rooms are rapidly "going out" of demand, and that deep frieze decorations are in stronger call. For the drawing-room—"with-drawing" room—pure and simple, where the apartment is but seldom used, and then only for special social purposes, a dado is certainly a superfluous feature. The notion that dados were merely the outcome of a wall chair rail, and not purely a decorative feature, is still as prevalent as it is erroneous; and the intimation that their source can be explored in the ruins of ancient Pompeii comes equally as a matter of surprise to many. Judging again, however, from the common-sense basis, we decide upon these grounds: whether the amount of elaborate work would be sufficiently displayed according to the arrangement of our furniture; whether, if we simply carry the plain treatment down to the skirting, we shall probably have any objectionable dents and finger-marks to catch and worry the eye; whether the height of wall is adapted for a dado; and so forth. This vexed question being perhaps settled in the general affirmative, I give a few instructions for its execution. With regard to these designs, it may be thought that a worker who can draw them large enough to use would probably be able to produce his own design, and *vice versâ*. Such does not, by any means, always apply. The main feature of "Adams" work is a repetition of simple forms in graceful lines; therefore, given this feature, the exact proportion of a reproduction of my illustrations is not a necessity. All wall stencil-work, if it be above the level of ornamental doggrel, must be drawn with direct regard to the size and disposition of the room, hence it follows that, with the exception of ceiling ornaments and simple borders, sets of ready-cut stencils can seldom be applied to an apartment without much re-arrangement and often mutilation of the designs. The dado given is drawn to 1 in. scale, having alternating panels 18 in. and 9 in. wide. The height above skirting to top of border is shown as 36 in.

In applying panelled dado-stencils to a room, we must look chiefly to the dado breaks, such as door frame and mantelpiece make. At these positions the panels must appear intact, and not simply starting at one angle, and finding ourselves with half a panel to put in against the door, where every eye will catch sight of it. The best plan is to measure our wall lengths, and see what size "repeat" will then come in with least trouble. The half of each panel design must be first sketched in on paper with charcoal, and then carefully drawn with all detail—remembering that we are preparing *stencilled* ornaments. In all intersections and connective parts not less than ¼ in. of space must be interposed as natural "ties"; when stencilled, these will but nicely separate the parts, without any appearance of ugly breaks. If we make the tie spaces much less the stencil will not stand the wear.

Both the dado border—a "repeat" 6 in. by 9 in.—and the bottom simple "twist" pattern must be put in after the dado. If we wish to decrease the height of the latter, the base ornament can be substituted by a couple of lines. The "fuchsia" upright margins to panels will best be put in separately, whilst the narrow panel can be easily adapted in width, as necessity may arise, by "humouring" the plain surrounding margin. All main dividing lines should be struck out with chalk line, etc., and the lines put in, lastly, with lining fitch and straight-edge. Two "repeats" of the stencil border will be sufficient to cut, and most convenient for one person to use.

The deep frieze combination of Fig. 2 can either be used as drawn or in parts. If it is wished to have a wooden frieze-picture rail, the same should be placed beneath the bottom straight line of design. If desired, the festoons can be then stencilled immediately beneath the rail, suspending the ornamental lines upon small "nail" ornaments. The main design of frieze has to be repeated on the right hand until the "vase" returns, each medallion being therefore 36 in. apart. If the cameo heads are used, the wall length of frieze must be carefully spaced out, and the medallions properly centred. Instead of the heads, simple circular pateras may be used for these positions, or relief plaques of "Lincrusta" or "Anaglyta" fixed therein. One repeat of the stencil, as shown, will be quite sufficient if we carefully set the wall-space out, stencil in all our left-hand halves, reverse and clean the stencil-pattern, and then complete the alternative sections.

Fig. 3 is a border design, to be drawn 9 in. in height, of a simple but effective design. This may be used as a border above a dado of plain colour, due allowance being made for the extra width. To produce the stencils, we must first draw the half of pattern, as illustration, on paper twice the length; then double the paper, pin it to a table, and mark over the outline with a wooden point and fair pressure. When opened, the impression of the second half will be discernible, and can then be transferred to the stencil-paper. The latter is best attained by rubbing the under side of drawing-paper over with a little dry colour before we outline the impression, and then pinning this inner side down on the cartridge-paper for a transfer of red outline by pressure as before. Fig. 4 is another border of decided horizontal lines, and is suggested for use, nine inches wide, above the wooden skirting in cases where the dado is not used.

The remaining items of our illustration in Fig. 5 refer directly to the door. The panels are proportionately those of the common four-panel door, and are placed in such a position to enable the effect of an "over-door" ornament to be fully appreciated. Where the deep frieze is used, the height of wall must be considerable to permit also of over-door ornament, and not less than, say, a foot of clear filling space should show between the nearest portions of each.

Now, a few notes respecting colours and material. In No. 53, Vol. II. of Work, an interesting illustrated paper appeared, disclosing the claims and merits of a new *tempera* paint, Church's "House Decorator"—or wall decorator, rather. The writer having, like many others, in a varied professional career, paid the purchase-money of some practical experience in connection with "patent distempers" and silicate paints, the contents of the above notice were individually taken with due caution—*cum grano salis*.* During the last few months it has been my privilege to make a pleasing working acquaintance with this new commercial product, now rapidly becoming known as "Alabastine," which is made and supplied by The Church Manufacturing Company, 127, Pomeroy Street, Hatcham, London, S.E.

To the new "Alabastine" tint circular we may now profitably give a little attention in the execution of this decorative work. A very chaste and decorative colour scheme may be carried out in this material upon the ornamental lines of my paper. For the ceiling ground, No. 7 tint may be used. Upon this admirable cream ground let the ceiling design be stencilled with No. 23, or flat paint made to that tint. The cornice may be treated in the same creams and blue. The wall may be coated right down to skirting with either Nos. 16 or 23, which will give an excellent "background" tint for drawing-room wall ornaments, the latter tint being lightened up, if necessary, for a badly-lighted apartment. The stencil dado and frieze must be executed in flat paint-stain (see article in No. 61), made with Prussian blue and raw umber to a sufficiently deep shade of soft blue, toned rather to dulness than brightness in colour. If a darker plain dado be wished, then a thin coat of flat paint of the desired colour, painted over the "Alabastine," would be the best job, and the dado border stencilled with the same colour, a darker line still intervening. For a warm treatment to a room of cold aspect, the Alabastine circular shows equally soft and pleasing tints. The frieze medallions, if painted, should be done in cream monochrome against blue background, the latter outlined with a fine line of gilding or darker blue. Where the ceiling and frieze designs may both be used, the circular panels of the former should be substituted by suggestions of the four "seasons," since the cameo heads of musical celebrities, poets, etc., must be

* Yes, our "London Decorator" objected very much to "Alabastine" when it was first noticed in Work, and I rather think he mentally placed me among the majority of the people of the United Kingdom, according to Carlyle's classification, for daring to predict a future—and a good future, too—for this new decorative material. It has taken only a twelvemonth to show that I was justified in advocating the claims of "Alabastine" to public favour. For the benefit of the readers of Work I may be permitted to say that the "Church Manufacturing Company," whose address will be found above, will readily send to any applicant their prospectus, with specimens of the various tints in which the material is supplied, including the newest additions to which allusion is made in this paper.—Ed.

the main feature of *one* portion only. The best treatment of woodwork would be enamelled-cream skirting, frame and stiles; panels in light-blue tint, flatted and lightly stippled, with ornament stencilled thereon in deep blue, and outlined with either fine gilded line or a deeper shade of blue. In the panel treatment of illustration the margin to panel would be painted a few shades darker than the remainder, and the marginal lines and corner *rose*, with also a bead on panel-mouldings, should be gilded. If something beyond the ordinary is desired for the panels, the worker may obtain a pair of the figure cameo panels made in "Lincrusta," and combine his handicraft therewith by using Alabastine in relief. To this end, cover the panels carefully with a stout white lining paper; paint these, when dry, with one coat of thin oil paint. Upon this mark the position of the panel, then coat in the panel ground with Alabastine, stippled as the flatting. Paint and finish the Lincrusta centre panel, and then work the other ornament on the lines of Gesso work, and according to the directions given with the new circular and the valuable product itself.

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BY A. J. ABRAHAM.

### Printing Surfaces.

Derivation of Term—What Lithography is—Lithographic Limestone—Colour of Stone—Varieties of Limestone—Graining and Polishing—Testing Grain—Selection of Stones—Re-graining, etc.—Other Printing Surfaces—Zinc—Transfer Paper.

*Derivation of Term.*—The word lithography is derived from the two Greek words, "lith'os," a stone, and "graph'o," I write. Chromo-lithography is a further extension of the word from "chro'-me," colour.

*What Lithography is.*—Lithography is the art of drawing on a stone or other substance that is capable of retaining both grease and water, with a fatty or greasy matter, with the pen, brush, etc., in such a manner that when the stone, after being subjected to a treatment of acid, is damped with water and passed over by an inking roller, the drawing has protected the stone from the action of the acid, and has thus preserved its natural properties, which is the quality of receiving printing ink, whereas all the rest of the stone rejects the ink through the interposition of the water, which is antagonistic to grease; so, when an absorbent paper is pressed on the stone, copies can be obtained.

*Lithographic Limestone.* — There are several kinds of substances that can be used for this purpose, such as zinc, wood, etc., but up to the present time nothing has been found possessing the qualities required in greater perfection than limestone. This is found in quarries in several countries; but the best, both in quality and quantity, comes from Solenhofen, in Bavaria.

*Colour of Stone.*—These few hints being more for the use of the artist who draws on the stone, it will not be necessary to enter into the details of its chemical qualities, which really are of more use to the printer than the lithographer; but what it *is* necessary that he should know is that the stone is of different shades of colour, varying from a pale yellowish-white to a dark blue or greenish-grey. Those lighter in tone, being softer in composition, are only suitable for drawing with the pen or brush, but the darker ones being harder in substance, are more suitable for chalk, engraving, and the better class of work.

*Varieties of Limestone.*—Limestone is found varying from a line to several inches in thickness, when it can be easily cut from the surrounding earth. This is generally done in sizes suitable for commercial purposes at the quarries. As a rule, the printer will supply the artist with stones, the charge being by weight, so much per lb. according to the size of the stone, larger ones commanding a bigger price than smaller ones, stones darker in colour more than the lighter-toned ones; and those with a surface on both sides suitable for printing from are very expensive, on account of the difficulty in obtaining a stone that is of an even composition all the way through. These are termed double-faced stones.

*Graining and Polishing.*—When a stone is required for pen or brush work, it is ground level and then polished with pumice or snake-stone, and when required for chalk work, an artificial grain is given to it with ground glass or fine sand passed through sieves having holes of various sizes, according to the texture of the grain required; but as grinding the stone belongs to the printing department, all that the student need tell the printer is the size of the drawing for which the stone is required, and whether it be for ink or chalk work. It is also necessary to know whether a grain with a fine or coarse texture is required, according to the nature of the work, writings and small drawings requiring a finer grain than a larger, bolder style of work; but as the size of the sieves varies so much, and no two men grind the sand in quite the same manner, it would be impossible to state a regular size for any particular class of work; this the student can only obtain by practice and experience. A good plan would be, on trying several grains, and finding one suitable for the work in hand, to ask the printer the number used in graining that special stone, and if for any future work a coarser texture is required, subtract from it, and if for a finer grain add accordingly. This should in every case be done when the artist works with a different printer or grinder to whom he has been accustomed.

*Testing Grain.*—Before beginning his subject the student should test the grain, by making one or two marks with the chalk in different parts of the stone, when, if not found suitable, it can be easily re-grained. If made lightly, these patches do not affect the work, as they can be darkened if a deeper tint is wanted in that place, or taken away altogether if not required.

*Selection of Stones.*—In choosing stones for chalk work, see that the surface is free from veins (in appearance like a pencil-line drawn irregularly across the stone) and chalky spots (in appearance patchy or speckled in colour), as either veins or spots are apt to show when printed; but for pen work it is not of so much consequence, as the stone, being polished, does not exaggerate any imperfections such as veins, which is the case when an artificial grain is given to it.

*Re-graining, etc.* — The stone must be properly grained or polished before starting any drawing, or else old work which has been on the stone sometime may show through any new work that the artist may do. Although this does not come under the artist's supervision, still it is advisable that he should know what the result would be were the stone not properly prepared. It is sometimes necessary to reduce the thickness of the stone $\frac{1}{8}$ of an inch in cases where work has been standing for any length of time, as the ink adheres so strongly to it that it is impossible to remove it; and, of course, the longer it remains on the deeper it sinks, and unfortunately not being perceptible to the eye, it does not show, or, to use a trade expression, "work up," until it is in the printing machine. It is always better to have the stone rather larger than the paper required, in order that in printing the paper does not overlap the stone, else its edge is likely to leave a mark on the paper from the pressure of the machine.

The above subject has been perhaps enlarged rather more extensively than necessary, but as stone plays such a very important part in lithography, it cannot be impressed too strongly upon the student how particular he should be in selecting his stones, and seeing that they are properly prepared by the printer.

*Other Printing Surfaces.*—It is only necessary to touch lightly upon other printing surfaces, as the student having once mastered the art of drawing on stone, will find no difficulty in working upon foreign substances.

*Zinc.* — In reference to other materials suitable for printing purposes, zinc gains the advantage over stone in being lighter in weight, and therefore more easily moved and lifted about. It is not so expensive, and can be printed at the same time with letterpress, which is impossible with stone on account of its size. Being of a dark slate colour, however, it is very trying to the eyes, and unless the artist is sure of his work and able to judge of the different effects whilst it is in progress, he is likely to forget that the colour of the material has to correspond with white paper, and that a tint will only look half the strength on paper to what it does on the zinc, the grey shade of the surface giving an extra tone to the work, thereby softening the whole subject, which will look much harder and cruder on paper. This refers in a certain degree to stone, but not quite to the same extent, it being so much lighter in colour. The general tone of the work is not so much affected. Zinc cannot be used for lithographic purposes to quite the same extent as stone, as it does not possess those natural properties peculiar to limestone, which have been mentioned.

*Transfer Paper.*—This is a paper specially prepared with a grained surface for chalk work, and a smooth one for working with the pen, or brush, but when it is used the drawing has always to be transferred to stone before any printed impressions can be obtained. It is preferable to stone for some purposes, insomuch that whilst all drawings on the latter *must* be drawn the reverse way to the original sketch, any drawings on the above paper can be copied the same way, as they must be transferred to stone for printing purposes. This method is generally adapted for writings, legal circulars, billheads, plans, maps, architectural drawings, etc., but all artistic lithography, such as chromos, etc., should be drawn on the stone.

Having mentioned the above out of several different substances for drawing on, it will only be now necessary to deal with limestone as forming the foundation of all good lithographic printing. I will, therefore, proceed in my next paper to speak about the materials and tools necessary to the lithographic artist.

I may add that the art of lithography is one that admits of high artistic excellence, and that as it can be practised with success, and is in itself remunerative, it is well worth the attention of women, as a vocation from which a good living may be made.

## EAR-RINGS AND OTHER ORNAMENTS FOR THE EAR.

### PRINCIPALLY WITH REFERENCE TO THEIR MODES OF ATTACHMENT.

BY H. S. GOLDSMITH.

INTRODUCTION—MODES OF ATTACHMENT TO EAR—ANCIENT EAR-RINGS—TYPES OF FASTENINGS—FASTENINGS IN INDIAN WORK—EAR-RINGS HANGING TO FRONT.

*Introduction.* — The above limitation is necessary in order to keep this paper within reasonable space. It will deal with a few of the things an apprentice will soon be concerned with. These are the mechanical and technical portions, for at first the artistic merits of the ornament he has to do with will be out of his province.

If he is told to attach the hooks, etc., to the other parts that make up an ear-ring, and he has had a little previous consideration of the matter, it should follow that he will be able to turn out his work in a better form than would otherwise be the case. These reasons lead me to deal with the principles upon which the hooks and other fastenings should be made: first, in order to obtain the necessary security for the ornament; secondly, *in order to show the ornament to the best advantage* — or, in other words, to get them to hang or set properly when worn.

*Modes of Attachment to Ear.* — This kind of ornament attached by means of a hole pierced through the lobe of the ear, we shall find, gives us several classes of attachment, which we will at first divide into two—namely, those in the form of hooks or rings: that is to say, those usually understood by the name of ear-rings; secondly, those called ear-studs. The latter rest *on* the ear, while the former hang below it.

Here in England the ornaments are attached to the lobe only, but in some parts of India the ear is pierced in the upper part as well, in order to wear several pairs of ear-rings at one time; and in addition to that, the ear is sometimes slit and lengthened by wearing heavy solid ear-rings. On the outside of the slit, when the ear has become lengthened, there will be a piece of cartilage nearly as thick as a lead pencil, and this they use to clasp an ornament round, much the same that you would clasp a bracelet round an arm. These ornaments are about three-quarters of an inch long.

One can easily understand that the ladies over there do not mind large holes being made in their ears, as our ladies do, for it is a mere pin-hole in the ear that has to serve us for attaching the ornament, while there the happy jeweller can have a hole in the ear of any size, and in any part of the ear too. Seemingly this is a privilege we have lost, for in our museums there are plenty of so-called ear-rings which would require a slit half an inch in length before they could let the end of the ear-ring pass.

The other division will consist of ear-rings for unpierced ears, and there will be a little to say about them and their modes of attachment.

*Ancient Ear-Rings.*—The great number of modern ear-rings in which joints play a part is in complete contrast to those of the ancients in the British Museum, for there we find Egyptians, Greeks, and Romans taking full advantage of the natural ductility of fine gold, by bending or untwisting part of the ear-ring each time they wished to remove or attach the ornament.

A strong reason why we use joints so much is this:—The gold now worked is of a lower quality—generally very much lower—and all, or nearly all, of its ductility is gone, and in its place we have elasticity, so we cannot, even if we would, twist and untwist an ear-ring hook each time of wearing; for even if the gold would stand it without breaking, still it is not "kind," like fine gold, and would require pliers to turn the ends in with.

It would not be to our advantage to go back to fine gold for ordinary work, and the foregoing is written simply to draw attention to one of the cases in which a property or merit of the metal is used to its full advantage. In what follows we shall find that the elasticity of our present qualities is just as profitably employed as was the softness of fine gold in the old time.

*Types of Fastenings.*—With but few exceptions, most of the simple types of fastenings now in use are to be found at the British Museum, even to that which we now call the German hook; and so that there should be no mistake about the apparently topsy-turvy way this is worn, the Roman has kindly attached a pendant to it, and in so doing he has removed any doubts that we might have about it, as you can see for yourself in Fig. 1.

There are also a few specimens of a bird-shaped ear-ring (Fig. 2), in which the wire is fastened like the common facctted ear-ring (Fig. 3) which we all know.

In South Kensington are some like Fig. 4. This form seems to be made with but slight variation in Normandy, Germany (Bremen), Italy, and Spain, and its fastening is just the same as the Greek bird (Fig. 2).

Fig. 5, however, does not seem to be much followed. It is, as you see, in the form of a monster's head, with a tail formed by a coil of tapering rings. In many of them the spiral coil acts as some sort of a spring, and as a joint as well. This gives a fairly secure and practical fastening, and is used in India even at the present time. My rough sketch is taken from one as arranged in the cases at the Museum, but it would not hang in the ear like that, of course.

Fig. 6, you will note, is of a very strange form to us, although common enough in the East. This fastening possesses at least the merit of security: a state of affairs that can only be obtained this way with a fine gold pin, which, after passing through the pierced ear, is coiled round as shown in sketch.

*Fastenings in Indian Work.*—In Indian work the most general method of fastening an ear-ring, be it the shape of Fig. 6 or any other shape, or for ear-studs like Fig. 7 (this latter is drawn the actual size of many that are worn), is by means of a screw. These screws, of which the details will be shown when we come to bracelet fastenings—for they are too large for us to use for ear-rings—are obtained from double wire, coiled round a mandrel (piece of hard wire), one piece being soldered in a tube to form the female screw, the other being soldered on a peg to form the male screw.

The greater number of these screws run the other way to ours. Is this because the workman finds it comes more natural to him, just as we find a new hand will most likely chase his first screw in the lathe left-handed?

In India, also, is worn an ornament the size and shape of the ear, which is covered. The ornament is, however, perforated so that no serious impediment is offered to the wearer's hearing. Naturally the surface of such an ornament gives a good opportunity for display, and it is taken advantage of to the greatest degree.

They say comparisons are odious, and if we compare the size of ear-rings now worn

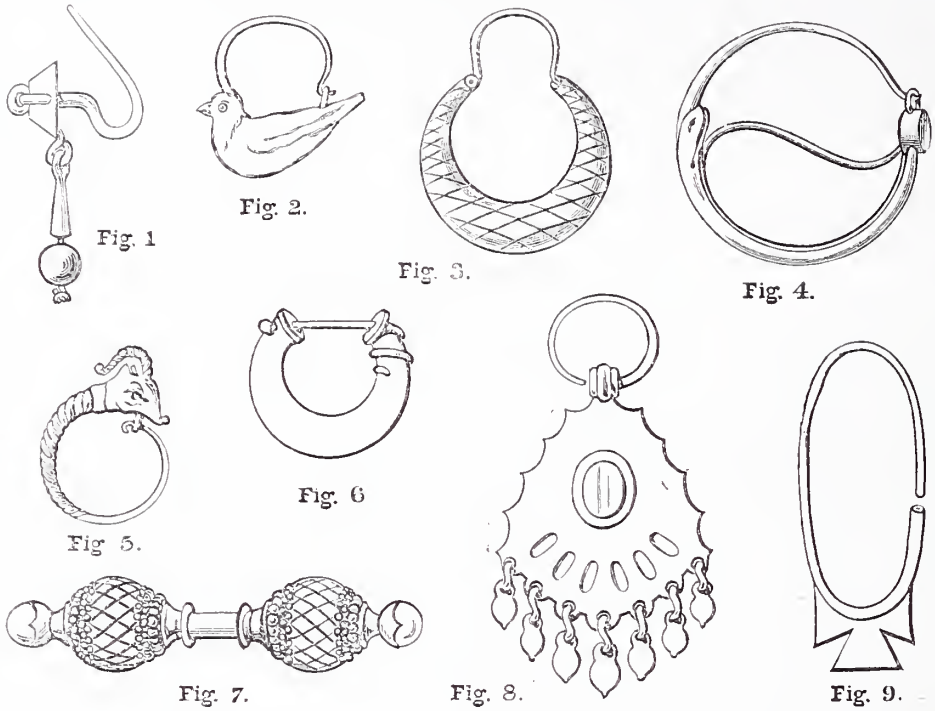



Fig. 1.—Ancient Roman Ear-Ring, with Wire the shape of the now-called German Hook. Fig. 2.—Greek Ear-Ring in the form of a Bird, the Fastening being the same as now used in Modern Jewellery. Fig. 3.—Modern English, with same class of Fastening. Fig. 4.—Modern Continental Form of same class of Fastening. Fig. 5.—Greek with Spring Fastening, the Tail acting as Spring. Fig. 6.—Greek, fastened in the Ear by threading through and coiling Spring round. Fig. 7.—Indian Ear-Stud: on Centre Piece is a Screw, to allow of separation of the End for Insertion. Fig. 8.—Russian Ear-Ring: Wire is attached the reverse way to show Edge and Back too much when worn. Fig. 9.—Sardinian, Ancient: also hangs contrary to the generally approved way.

to those of years ago, there seems to be a very decided tendency towards their gradual extinction. From a trade point of view it is to be hoped that this is not what it means; but as ladies do not in England wear rings in the nose, as some do in India, a mere decree of fashion will be enough to totally extinguish this class of ornament, and "the pearl in the Ethiop's ear" will be the only survival of a once flourishing part of our trade.

*Ear-Rings hanging to Front.*—Before entering on the particular sorts of modern fastenings, it will be as well for us to notice that although very much the greater proportion of ear-rings have their front to show to the front of the ear—that is, at right angles with the ear-ring hook—still there are just a few made to hang just the other way, and to show their edges, and possibly part of their backs, to anybody facing the wearer.

These exceptions are shown in Fig. 8 and Fig. 9, one Russian and the other ancient Sardinian—not but what plenty of others could be drawn, but these are sufficient to remind us that ear-rings are sometimes hung the other way; and to prove the rule which we seemed to learn at school is what exceptions were invented for.

As another curious fact about ear-rings, I may recall a statement made by a writer in a well-known magazine, "That at the time of the wars of Jugurtha it was the custom to wear one pearl ear-ring only, which afterwards became the sign of an acknowledged courtesan."

## A JOINER'S CRAMP AND HOW TO MAKE IT.

BY DAVID DENNING.

No joiner, cabinet-maker, or other artificer in wood but requires the aid of cramps, or, as they are often called, clamps. Comparatively little in the way of framing up can be done without them, and they are useful in a variety of ways—so useful, indeed, as to be indispensable. The amateur is addicted to the use of the best of everything if he has the wherewithal needful for the purchase; if he has not, then he must do without, unless he can contrive or make some substitute. If he can do this, he is still apt to think that he would turn out things of much better workmanship if he only had something nicer to work with. He would prefer to have an iron cramp, such as he will see for sale in the better class tool-shops, instead of the wooden affair commonly used by professional artisans. Perhaps he does not even know of the existence of these, for why should the dealer in tools proclaim the virtues of an appliance which any worker can make for himself, instead of recommending "the very superior article" which he has for sale? As to cramps, these are made of iron, either entirely or principally, and it would never answer the amateur's purpose to make them, even if he could.

I am led to make these remarks as, in the catalogue of a leading dealer who lays himself out to supply the needs of amateurs, several improved forms of cramps are named, but there is no mention of the kind generally used by practical men, although it is as good as any of the newest improvements, so called. As the young and theoretically far advanced young artisan is not above a similar weakness for fancy improvements, I may be permitted to offer him a word of advice to the effect that many a thing of venerable antiquity is quite as useful as the latest novelty. In saying this, I by no means wish to inculcate the principle of "what was good enough for my father and his father before him is good enough for me," for if we were all to act on it there could be no progress. On the contrary, when any new thing is calculated to save time or to facilitate improved workmanship, by all means adopt it. Whether the iron cramp has sufficient advantages over the older-fashioned wooden one to induce us to discard this is a question I do not feel called on to discuss with the small minority who think so. One of them, by the way, has told us in a lately published work that iron cramps are indispensable. Well, let those who think so use them, while others who know better use the equally efficacious cramp about to be described. It is no makeshift, but a good practical cramp, such as, with perhaps trifling variations, will be found in general use throughout Great Britain. As there is no better cabinet work in the world than that of this country so far as construction is concerned, it may readily be supposed that the native artisan does not employ inferior tools. Among these must be reckoned the wooden cramp. It is not difficult to make, and labour and cost will be well repaid by the result.

The form and details given are from some cramps which were being made a few days ago by one of the most experienced and able cabinet-makers with whom I am acquainted, and I know a few of them. I cannot say that cramps are any novelty to me, but when I see a good man at work I always like to watch his methods and what he is doing. My friend Thompson is not one of those narrow-minded men who would keep all his information to himself or those of his trade, under the erroneous idea that it is a mistake to let the outside public know too much; so when I said to him that, while I had been seated on a vacant bench near his, watching and chatting, the idea had come into my mind that it would be a good thing for the readers of this Magazine to be told how to make a really good cramp, he just replied—"All right, Mr. Denning, you can't do better than tell them about these I've got here." The thanks of the reader, therefore, are due to Mr. Thompson; for it may be taken for granted that those he was making were the result of as much careful thought as if an elaborate piece of furniture had been in question—that is to say, that the cramps would not have been made as they are if his experience had taught him that some little alteration would have made them more convenient or better in use. That the model is original in its details I do not say, but it is probably as good a one as could be found.

Fig. 1 shows the cramp, or rather a portion of it, for the bar is shortened off in order not to occupy undue space. In actual construction it can be extended to any reasonable length. All that is really essential to assist in understanding the construction is shown. On examination, the cramp is seen to consist of a bar the lower edge of which is serrated to form a series of stops for the sliding-piece shown on the right, while on the left is a fixed head with a screw through it.

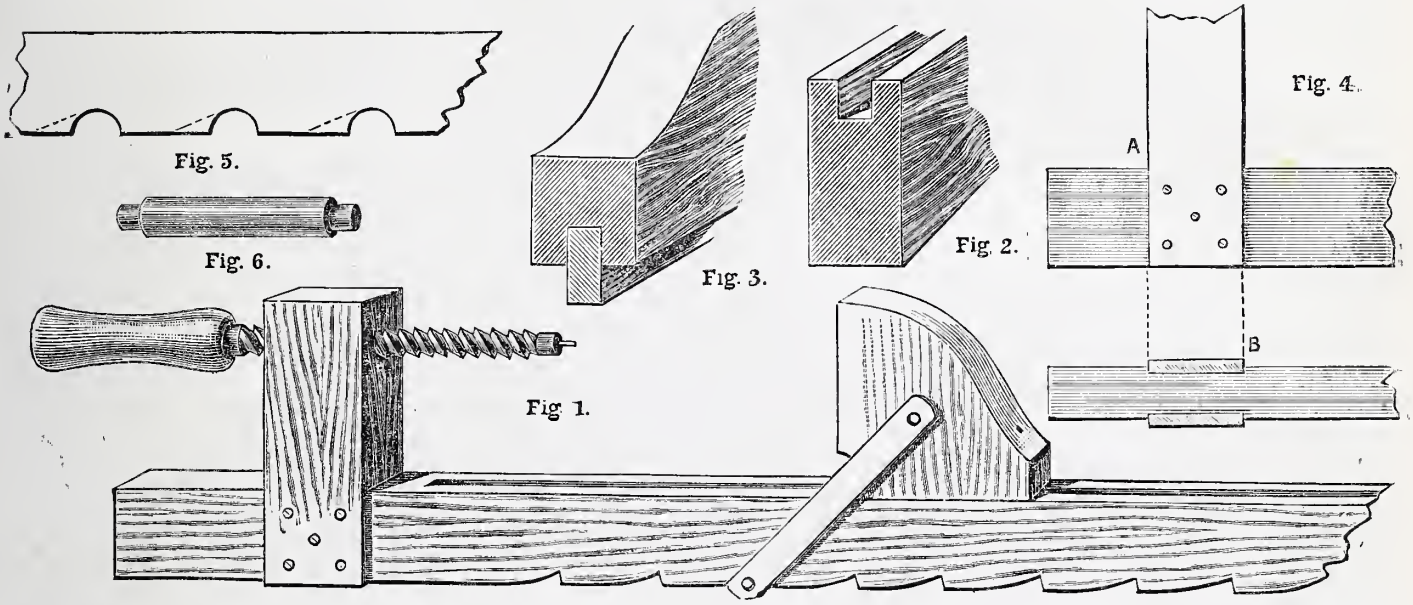



**Fig. 1.—Joiner's Cramp complete. Fig. 2.—Ploughed Groove in Bar. Fig. 3.—Tongue in Movable Piece. Fig. 4.—Diagram showing Mode of fixing Screw Block—A, Side Elevation; B, Plan seen from below. Fig. 5.—Diagram showing Formation of Stops. Fig. 6.—Pin connecting Iron Straps.**

The first thing is to determine the length of the bar, and this will depend on the size of the work that is contemplated. For general purposes about 3 feet will be found very suitable. If larger, the cramp is apt to be unwieldy, though it may sometimes be necessary to have them much longer. Any tough strong wood may be used, but nothing is better than oak, of which a piece of 1 in. stuff about 2½ in. wide will be required for the bar.

The sliding-piece must be of the same thickness. It may be about 4 in. wide and high. The shaping is purely a fancy detail, as for all practical purposes a square block of wood would answer just as well. It will, however, be noted that the grain of the wood is perpendicular instead of horizontal, or parallel with that of the bar, and the reason is that it may withstand the strain with the utmost of its strength when it is in use. The pressure is against the grain instead of with it.

Now, before proceeding further, the upper edge of the bar must have a groove ploughed along its centre, as shown by the sectional illustration (Fig. 2). The depth and width of the channel are not of importance. On the bottom of the sliding-piece a corresponding tongue will be inserted, as in Fig. 3. Those who prefer to do so may form the tongue from the block itself, but the better way is to do it as directed. It is now evident that the tongue acts as a guide to the sliding-block. The fit should be fairly easy, without being too loose to allow of lateral movement.

For the present this end may be left while attention is directed to the other. If several cramps are being made (and one, it will be noted, is by no means a sufficient number to have in a workshop, though in the amateur's workroom it will be better than none at all), it may be as well to get the holes threaded for the screws by the turner. If the maker has a box and tap for wood screws, he will of course be able to do what is necessary without further aid; but it is hardly likely that he will have them, and it may be satisfactory for him to know that he can do without either them or the turner by making use of handscrews. As these are obtainable at low prices at any tool-shop, there will be no difficulty in meeting with what is required. As there are two screws and two jaws in each handscrew, each of these will do for two cramps, and there is practically nothing wasted, although a piece of each jaw will be superfluous.

One of the jaws will do for the fixed block within which the screw of the cramp works, and some care will be required in fixing it to the bar, as at times there will be considerable strain on it. At first sight it may seem as though the bar is simply let into a mortice or hollow cut in the lower end of the block. This might do, but a moment's reflection will show that it will be better to make assurance doubly sure by partly sinking the block in the sides of the bar. It is then held as firmly as possible, and will withstand any strain of which the wood is capable.

Fig. 4, which is a diagram representing this part of the work, will make the construction quite intelligible to those to whom it might not otherwise have been so. When fitting this block, be careful to see that it is perpendicular with the bar, or, at all events, that the screw is parallel with it, and opposite to the solid part of the sliding-block. The fixed block is to be secured in its place by means of two or three screws, but these may as well not be inserted till the notches have been cut in the bottom edge of the bar.

It will be noted that these are not sloped off in a straight line, but that what may be called the teeth are rounded off instead of being carried at a straight bevel from point to point, as in a saw. The reason for this peculiar shaping, which undoubtedly entails more work, is that the points are stronger than they otherwise would be, for the wood runs to a considerable distance back from each. If we wanted to get the utmost possible strength, a series of half-round notches, as shown in Fig. 5, would suffice, but then the worker would labour under the disadvantage of not being able to slip the moving head backwards and check it so easily as at present. What is really done is simply, as it were, to round off the sharp edge at the front of each notch, as shown by the dotted line on the figure just referred to. The straight side of the other is, of course, the natural result of using the most convenient tool—viz., the saw—for making the cut. The points of the teeth may be about 2 in. apart, and the depth of the notch about ¼ in., or just sufficient to act as a stop to the pin connecting the strips of iron which confine the moving block.

There is nothing important about these pieces of iron either in thickness or width, and each maker may choose what is handiest to him. If it is all the same, he may as well use pieces of about the thickness of a shilling and about an inch wide. The proportionate length can easily be estimated by reference to Fig. 1. It must be understood that two of these pieces of iron are required for each cramp, and that they are connected by two pieces of iron rod. One of these engages in the notches, and the other goes through the sliding-block. In thickness the rods may very suitably be about $\frac{3}{16}$ in. to ¼ in. thick, but this is immaterial provided they are strong enough. At each end a shoulder should be turned or filed, the distance between the shoulders being exactly equal to the thickness of the bar. As cabinet-makers are not expected to be proficients in metal-working, Fig. 6 is a representation of one of these pieces of iron.

Holes must be bored through the thin pieces formerly mentioned to fit on to the ends of the connecting pieces, which can easily be fastened in place by riveting, but before this is done the hole must be made in the sliding-block and the iron pin run through it.

Having arrived at this stage, it will be seen that the sliding-block can be moved easily up towards the fixed head, but that when pressure is brought to bear on it from this direction the notches underneath prevent it being pushed back further than is desired. Its action is so simple that surely nothing more need be said about it.

The screw itself will be all the better of a little attention. The first thing that may be objected to about this, if it is a new one, is stiffness in working. This can easily be remedied by rubbing it with a mixture of ordinary blacklead and—no, not oil, for this is apt to cause the wood to swell, and so increase the defect we are trying to remedy—soft soap. This forms an excellent lubricant for the purpose, and may be a wrinkle worth noting by those whose wooden screws of any kind work too stiffly.

It will also be advisable to put an iron point at the end of the screw. Only a small one is necessary. If it projects ¼ in. it will be quite sufficient, and it should be sharp. The easiest way to make and fix the point is to screw a nail into the end of the wood, cut its head off, and then file down fine and thin. A piece of brass tubing put on the end of the wooden screw, the thread of which must be cut away for half an inch or so, completes the cramp, the manner of using which is so evident that nothing need be said about it.

A cramp made as described will be found quite equal for practical purposes to an iron one costing twelve shillings or more. "What will the cost of this wooden cramp be?" "Well, I can't say exactly; but if you wish to make one you can reckon this up as easily as I can, and from the same sources of information—viz., the tool-shops and timber-yards."

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

Introductory—Size and Power of the Engine—Time required to Make it—How to get Help when in Difficulty—A Comparison of Steam, Gas, Hot-Air, and Water Motors, with their Cost and relative Convenience—Work and Power, what they are—Power of Animals and of Man—What is a Man-Power?—What is a Horse-Power?—Connection of Engine with Lathe—Calculation of the Power of our Engine.

*Introductory.*—The engine about to be described is believed to be of convenient size for driving the turning lathe, etc., in an amateur's workshop. Although it is called a quarter horse-power, some would probably reckon it at a half horse-power; it might be either, according to the pressure of steam employed and the speed at which it runs. At any rate, it will be of about twice as much power as the amateur himself, and it will therefore drive any machine he could drive, together with the shafting required to convey the motion from the engine to the machines. The engine, too, is of a very manageable size, with no large or awkward work about it; anyone who has a 5 in. gap lathe will be able to do the whole of the work himself, whilst, if his lathe is of smaller capacity, he will probably be able to do all but turn and bore the fly-wheel.

The construction has been simplified as far as possible without interfering with efficiency, and the engine should be a really useful motor, which will wear well even when put to hard work. Besides, it will form an excellent opportunity for practice with lathe and tools and for learning some of the laws of mechanics.

Before going further, lest any reader should be led to undertake too lightly the task of constructing this engine, without having "counted the cost" in time and trouble, let us pause and consider what amount of labour we are about to undertake. It may, perhaps, be admitted that there is in the complete engine about £9 worth of labour by a workman whose time might be worth, say, 30s. per week of six full days of eight hours each. Now, 30s. per week is £3 per fortnight, and therefore £9 would pay for six weeks' work or thirty-six days, or 288 hours. Let us suppose an amateur would take 360 hours; then, if he works on an average three hours a day, it will take him four months, and if he works but two hours a day it will take him half a year. Let no one, then, begin with an insane desire to see the work finished, but let them first consider whether they will give the requisite time and trouble, and then work away steadily, determined simply to

do each part thoroughly well, and then there will not be many disappointments.

If a reader, having already acquired some little practice in the use of metal-working tools at the lathe and vice, still feels afraid to undertake such a piece of work, he may probably be able to get assistance in one of the two following ways. First, he may be able to find a small working engineer's shop within reach, the master or foreman of which would be willing to give him lessons for one or two hours at a time in the evenings, when work is over. One or two such evenings a week would be a great help to an amateur, who would bring the difficulties he had encountered in his work at home for explanation, and would profit by the extra facilities in the way of tools, machines, etc., afforded by the engineer's workshop, and learn thus how best to complete his own stock. Or, secondly, the amateur might call in a workman occasionally, of an evening, to teach or help him at home. Such lessons might cost from 9d. to 1s. an hour. Of course it will be our endeavour to make such assistance unnecessary by describing every process and operation as clearly as possible; still, there are always some things more easily learnt by a little "showing" than by any amount of description. The workman, however, should not be allowed to do the work himself, but rather to stand by and show the amateur how to do it.

*A Comparison of Workshop Motors.*—The steam engine is not the only motor the amateur may employ to drive his lathe. He may use a gas engine, a hot-air engine, or a water motor; and as each of these sources of motive power has its advantages and disadvantages, a word or two by way of comparison, to enable the reader to choose between them, may be acceptable at this point.

We begin, then, by comparing each of the forms of motor as to their first cost, and we will put the engine we are about to describe as worth (to buy) about £12, and its boiler about £12—say £24 complete. A *gas engine* of the ordinary non-compression type, such as the Bisschop, of two man-power, costs £33. It has no governor, and it may do tolerably well without. There is a small Otto engine in the market, with a governor, for £32, and it runs very silently, whilst the ordinary non-compression kind make a very disagreeable thump, not pleasant to have in a room in a house. A *hot-air engine* will run silently, but it is large and bulky; a quarter-horse costs £35. The *water-pressure engine* may be made with a cylinder and piston, or like a small water-wheel in a case, a jet of water being arranged to impinge upon the floats, like the "Thirlmere" of Messrs. Bailey of Salford. This last would cost but £3 10s., and it is very silent and easy to regulate by hand.

We will now compare the expense of running the four kinds of motor. That of the first three will be very small—about a shilling for a whole day's running. The water engine, however, if run from the town mains, will prove so expensive as to put it out of the question, except in those cases where there is a natural supply of water, under pressure, available.

There are two other considerations which we can take together—namely, in how much time can we start each motor, and how much attention will they require to keep them going? The steam engine here appears at a disadvantage: it will probably take twenty minutes to raise steam ready for starting, and all the while the engine runs, the workman must keep it in mind, and see that neither fire nor water gets low; for the first would cause a stoppage and the second might bring an explosion. Coal must be put on the boiler furnace about every fifteen minutes, and though gas may be employed for fuel, it would probably cost about four times as much to heat in that way. The feed-pump will be set to supply water to the boiler at about the same rate as that at which it evaporates, but this will not obviate the necessity of watching the water-level in the glass water-gauge, to make sure all is right. The *gas engine* can be started in a minute, and but for an occasional oiling it requires no further attention; it makes a disagreeable noise unless it be of the compression type, and that is expensive. The *hot-air engine* will require about fifteen minutes to heat up before it will start, after which it requires but little attention more than a shovelful of coal or coke every half-hour or so; it is bulky and rather expensive, but makes no noise. The *water-engine* is by far the best motor for the amateur; it has but one disadvantage—the cost of the water. With the usual price of 1,000 gallons of water at 1s., the cost of obtaining two man-power comes out about 2s. an hour—more than it would cost to employ two men to turn a wheel! But where there is a natural fall of water to be obtained, then by all means have a water motor: it has no smell, gives out no heat, requires no attention, makes no noise, is started and stopped in an instant, and if the workman left it running he would find it running still when he returned, provided it was not worn out!

In spite of all that has been said in favour of the other three motors, the steam engine is not to be despised. It is quieter than the gas engine, more compact than the hot-air engine, cheaper than either, and better understood; moreover, it can be made by the amateur himself. But, before we begin to describe its construction, we must first give some notions of

*Work and Power.*—"How many horse-power is it?" must, of course, be the question whenever we have to do with anything in the shape of a steam engine. But, first, what is a horse-power? "Oh, the power of a horse," people say, and they seem to fancy that if one took a locomotive of 100 horse-power, and tied 100 horses behind it to pull it back, that the two forces would be equal. But no, there is much more in the question; and we shall never grasp this expression unless we understand that horse-power, like man-power and every other power, *is composed of three elements.*

The *first* element is *resistance* or *pressure*, such as that of a weight.

The *second* element is the *space* or *distance* through which the resistance is moved.

The *third* element is the *time* occupied by the movement.

Suppose a man walk along the ground pulling a rope, and let the rope pass over a pulley and down a well, being attached to a bucket of water or other weight. Let us further suppose that the weight is such as to require all the strength a man can continuously exert. First, let him *stand still*, holding the weight suspended. What power is he now exerting? One man-power, do you say? No, indeed; no power is exerted nor any work done, because there is no distance moved nor space covered. Here we have only one element—resistance or pressure. Secondly, let the man now move slowly forwards, drawing up the weight as he goes, and what have we now? *Two* elements—pressure and space—and these two form *work* which can be measured, and is usually reckoned in *foot-pounds*. For instance, the bucket might hold four gallons of water, weighing together 40 lb., and the man might move forwards 10 ft.; then we should say he had done work represented by 400 foot-pounds. A foot-pound is the amount of work required to raise a weight of 1 lb. one foot high. To obtain in any case the number of foot-pounds of work exerted, we have only to multiply the weight *in pounds* by the space moved *in feet*. Notice, then, that the man would have done the same amount of work if he had raised 10 lb. 40 ft. high, or 1 lb. 400 ft. high, or 400 lb. 1 ft. high. Can we now reckon this work in horse-power or man-power? Not yet; for, observe, we might have told the man to exert his utmost strength and seen him pull up the weight in a moment; or we might say, "Take it easy," and have watched him, leaning gently on the rope, bring it up in a minute, when the power would evidently have been different. This brings us to the *third* element of power—*time*. Work is composed of only two elements, pressure and space; we cannot tell how much power is required to do a given amount of work unless we know in how much time it must be done. A man with a small pump can fill a tank as well as a steam engine if we give him plenty of time; in both cases the same weight of water will have been raised through the same space, and therefore the same amount of work will have been done, but if the work be done in one-tenth of the time by the steam engine, then the engine will have been exerting ten times the power of the man. It only remains to say, the element of time adopted is one minute.

When James Watt made his engines for raising water, it was stipulated that they should be able to do the work of so many horses. A steam engine is intended to produce power in return for a certain amount of coal, and, evidently, it is necessary to have some standard of comparison by which power can be measured; that standard is usually the *horse-power*—that is, the power required to raise 33,000 lb. one foot high per minute, which rule includes the three elements of weight, space, and time. It would amount to the same thing to say that a horse-power is the power required to raise 1 lb. 33,000 ft. high per minute; or, we might say, it requires one horse-power to do 33,000 foot-pounds of work in one minute. This is doubtless rather a high estimate of the power of a horse, which few horses could exert for more than three or four hours at a time; and here is inserted from "Molesworth's Pocket Book" another estimate of the power of the horse and of other animals (including the human variety), which they can exert continuously through an eight hours' day:—

| | Lbs. raised 1 ft. high per min. |
|---|---|
| Horse | 21,000 |
| Ox | 12,000 |
| Mule | 10,000 |
| Ass | 3,500 |
| Man, as in rowing | 4,000 |
| Do., on tread-wheel | 3,100 |
| Do., turning a handle | 2,600 |

3,000 foot-pounds per minute will, then, be about the power with which the amateur drives his lathe, going up to 4,000 for a short time when a hard piece of work must be done. As to what is a *man-power*, some allow five men to a horse-power, some six, some eight, and some ten. Until authority decides this point, we will assume to ourselves all the authority we can command, and state with the utmost decision that, so far as these articles are concerned, one man-

power is, and shall be, that power which is required to raise 4,000 lb. one foot high per minute, making it about equal to one-eighth of a horse-power; so that we may call our engine either one-quarter horse-power, or two man-power.

*Shafting required.* — An independent workshop motor, whether worked by steam, gas, hot air, or water, will involve shafting and belting to connect the motor with the lathe and other machines to be driven; and as a lathe should properly be arranged to run both ways, forwards and backwards, the shafting is not quite such a simple matter as might be supposed. One way out of the difficulty is to make the engine with a link-motion reversing gear, and to bring the strap from the engine straight on to a pulley on the crank-shaft of the lathe; but this pulley and strap would be most likely in the way, and as the turner would have to go to the engine to move the reversing lever, he would not have that instant control of his lathe to which he was accustomed when using the treadle, and might probably get disgusted with his engine and go back to the old plan, for want of proper conveniences in the way of connections. He must have perfect and immediate control of the revolutions of his lathe, and be able to start, stop, reverse, in an instant, without leaving his work, or he will go back, for ordinary work, to his treadle again. Another way to avoid the shafting is to attach the engine to the lathe direct, and one may often see nowadays a powerful tool in an engineer's shop with a little engine of its own attached to it to drive it, so that it can run when all the main shafting is still. It would not be wise to attach a steam engine to a small light lathe, but to a good strong 5-in. centre metal turning lathe an engine may be fixed, either outside the right-hand standard or under the bed over the right-hand crank, and, when fitted with link-motion and the reversing handle brought up to the workman's hand, it will form a very convenient arrangement—self-contained, and therefore easy to remove, under complete control of the turner—whilst any other machine, such as the grindstone, might be driven from a pulley on the crank-shaft of the lathe. Thus no shafting or belting would be needed, and the steam and exhaust pipes would be led round the back of the lathe from the boiler. The plan is inviting, and working drawings have been made of it as suited to the writer's own 5-in. gap lathe (by Milnes of Bradford). However, considering that a special case such as that would not be so good to begin with, and also that a horizontal engine of the ordinary type would be more generally acceptable, these plans were abandoned for the present in favour of the more usual form, though it will involve the requisite shafting.

*Calculation of the Power.*—If the previous remarks on horse-power have been understood, this will not be difficult. We must begin by ascertaining the three elements of power—Pressure, Space, and Speed.

*Pressure.*—The pressure which drives the engine is the force in pounds with which the steam presses upon the piston, driving it to and fro in the cylinder; it is estimated in pounds per square inch. We will adopt a *maximum* pressure in the boiler of 50 lb. per square inch, and we must not reckon on more than an average of, say, 30 lb. per square inch in the cylinder. It will probably require a pressure of about 5 lb. per square inch to overcome the friction of the engine itself. To allow for throttling by the governor, friction of the engine itself, and other small sources of loss, let us take the average pressure on each square inch of the piston to be 25 lb. Now, the rule for the area of a circle is, square the diameter and multiply by ·78; the diameter of our cylinder and piston is 2 in.: $2 \times 2 \times \cdot78 = \text{area} = 3\cdot12$, say 3 square inches. Multiplying 3 square inches by 25 lb., we get 75 lb. for the average pressure on the piston, and thus establish the first element of the power.

*Space and Speed.*—The other two elements, space and speed, we will take together; and supposing that the engine shall be regulated by the governor to run 150 revolutions per minute, and since the stroke is $4\frac{1}{4}$ in. long, during each revolution the piston will travel a distance of two strokes, or $8\frac{1}{2}$ in.; multiplying $8\frac{1}{2}$ by 150 revolutions, we get 1,275 in., which divided by 12 gives 106 ft. travelled by the piston in *one minute.*

Now, we have only to multiply together our three elements, 75 lb. × 106 ft. × 1 min., to obtain 7,950 foot-pounds per minute as the power, near enough to 8,000, which we have decided to call two man-power, and not far from $\frac{33000}{4} = 8{,}222$, the true quarter horse-power. One pound more added to the average pressure per square inch would raise the 7,950 to 8,408.

A simple rule to obtain the approximate effective power of a small engine, such as that with which we are dealing, would be: Multiply the speed of the piston in feet per minute by the total pressure on the piston, and the result is the power in foot-pounds per minute; divide this by 4,000 and we get the man-power; divide by 33,000 and we get the horse-power—the effective pressure on the piston to be estimated at from half the highest boiler pressure to two-thirds.

It is hoped that this explanation of the way to obtain the power of a small engine will prove so simple that every amateur engineer will thoroughly understand what work is, what is power, and how to calculate them. It only needs to be stated that we have been dealing solely with *actual effective* power and not with "nominal" power, which latter is an arbitrary or commercial term of no interest to the amateur.

## OXFORD FRAMES.

BY F. CROCKER.

SETTING OUT—REBATING—SIMPLE TOOLS FOR REBATING—CHAMFERING—PUTTING TOGETHER.

MOST wood workers, both professional and amateur, have at some period in their career tried their hand at Oxford frame making, and in most cases have found out that it was not as easily done as they at first supposed.

To make a good frame requires skill and taste, for, like everything else, to be satisfactory it must be made well, and the plainer it is made the better should be the workmanship.

The object of this paper is to describe a few varieties of the Oxford frame and how to make them (or at least how I should do it) without going into minor details, such as planing and sawing, which have been dealt with in other articles.

Having procured our timber we commence to make our frame. We will suppose, by way of illustration, that it is to be made of oak, for a picture 10 in. by 7 in. This will require four pieces, two being 14 in. long, $\frac{5}{8}$ in. by $1\frac{1}{8}$ in., and two 11 in. long, also $\frac{5}{8}$ in. by $1\frac{1}{8}$ in. I prefer Baltic to English oak for the purpose, as it is more easily worked, and in small pieces looks quite as well.

Face and edge, gauge and plane to size, then set out two pieces with a $6\frac{1}{2}$ in., and the other two with a $9\frac{1}{2}$ in., opening (this allows for a $\frac{1}{4}$ in. rebate); mark round each piece with the scriber or pencil (perhaps the latter is best, as the scriber, if not carefully used, leaves a deep mark, which has to be planed or scraped out) and square; put one on the other as shown in Fig. 1 and mark for halving, taking care that the members of the frame which are upright go right through on the face. Halve together in the usual manner, and we are ready for rebating.

Now, perhaps, a few words as to the easiest method of doing this will not be out of place. The best tool for the purpose (supposing we have no machinery) is a fence router such as a coach builder would use. One of these would cost from 4s. 6d. to 5s. 6d., therefore are out of the reach of the ordinary reader. Some use a rebate plane or fillister, but in that case the rebate is carried right through and filled up at the end by gluing a piece in after the frame is made. Unless the wood be very hard the rebate may be made with a cutting gauge. The ordinary cutting gauge will not be of much service for the purpose, but if the reader will make one as I am about to describe, he will find it useful for this and a great many other pieces of work where a stopped rebate is required. It will also be found useful for cutting off a number of parallel pieces of thin wood.

Procure two pieces of ash or beech, one 2 in. by $1\frac{3}{4}$ in. and $6\frac{1}{2}$ in. long (A, Fig. 2), the other $\frac{7}{8}$ in. by $1\frac{1}{8}$ in. and 6 in. long (B, Fig. 2). The sketch, Fig. 2, will describe the method of putting together; A is mortised to receive B, which may be driven backwards and forwards as in an ordinary gauge and fixed securely in any position by driving in the wedge, C. The cutter, D, is made out of a broken $\frac{1}{4}$ in. chisel or piece of steel, and is secured by means of a wedge shown in section (Fig. 3). A recess is made at E, Fig. 2, to allow the cutter to work close for a narrow rebate. It is rather an awkward-looking tool, but those who test its usefulness will pardon this. It is used as an ordinary gauge would be, but as the work is harder the tooth requires guiding with the finger and thumb of the left hand. In some cases you can take this piece completely out by gauging on both sides, but in others you have to use the chisel. A boxing router, or old woman's tooth, will be found useful for clearing out the rebate. A simple one, made out of a piece of wood and a chisel blade, is shown in Fig. 4. This is another tool which will be found useful for a variety of purposes, and will soon pay for the small amount of labour spent in making it. In fact, the rebate may be made with this tool alone by screwing a piece of wood on the face of it to act as a fence.

We now come to the most important part of our frame—viz., chamfering. Various tools are used for this, such as the drawing knife and spokeshave, but I prefer a sharp paring chisel, and a bull-nose or thumb plane. Some would use a pocket-knife and a bit of glass, but I hope the readers of WORK have got beyond that stage.

In Fig. 5 two of the commoner methods of chamfering are shown. Figs. 6 to 10 show various methods of finishing. Fig. 7 may be marked with a coin; the others will require a cardboard or veneer templet. In the centre of the rails a diamond is sometimes left (Fig. 6), or the pattern at the

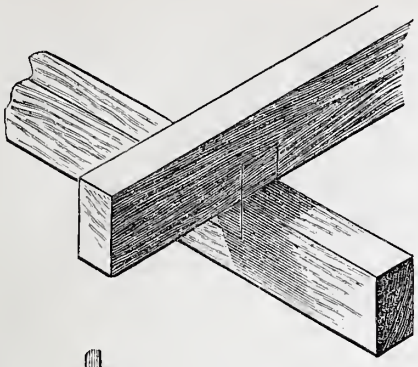


Fig. 1.—Diagram showing Method of setting out Halving.

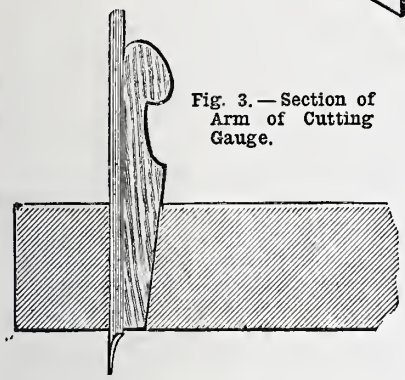


Fig. 3.—Section of Arm of Cutting Gauge.

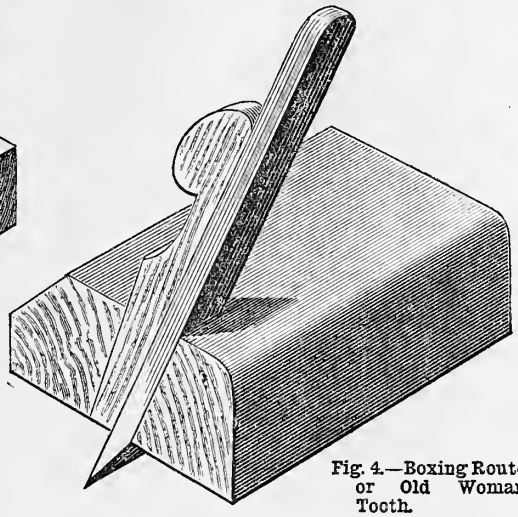


Fig. 4.—Boxing Router, or Old Woman's Tooth.

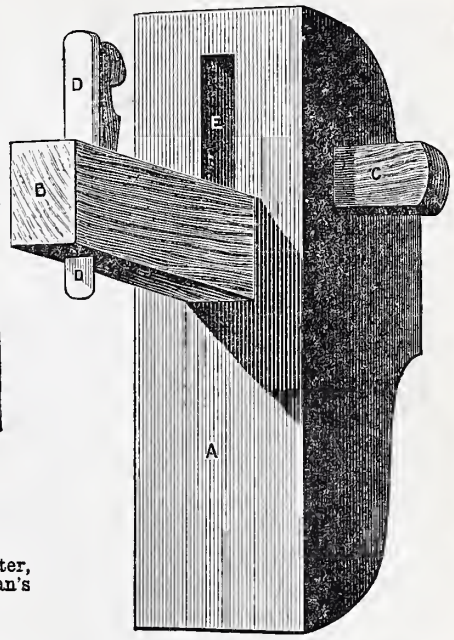



Fig. 2.—Cutting Gauge for Rebating.

Fig. 11.—Zig-Zag Ornament to vary Chamfer.

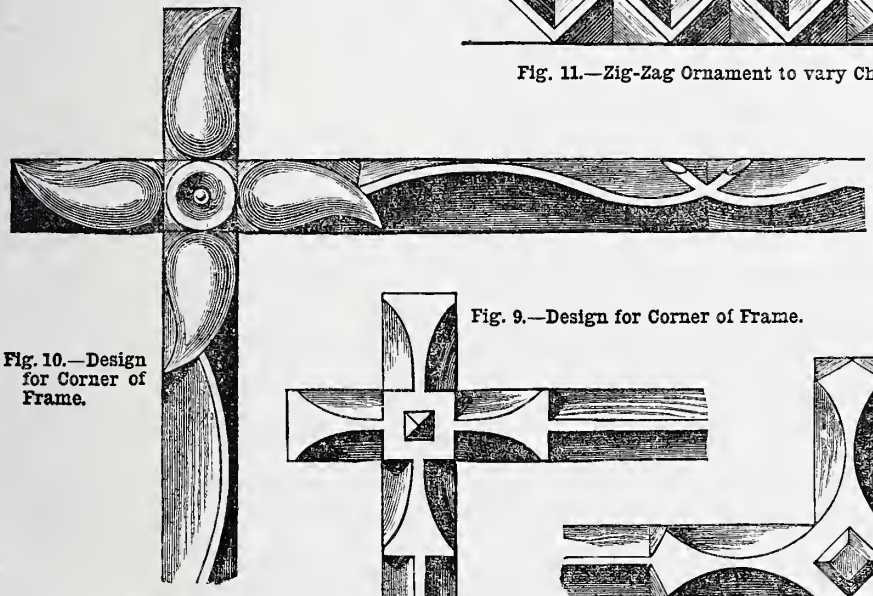


Fig. 10.—Design for Corner of Frame.

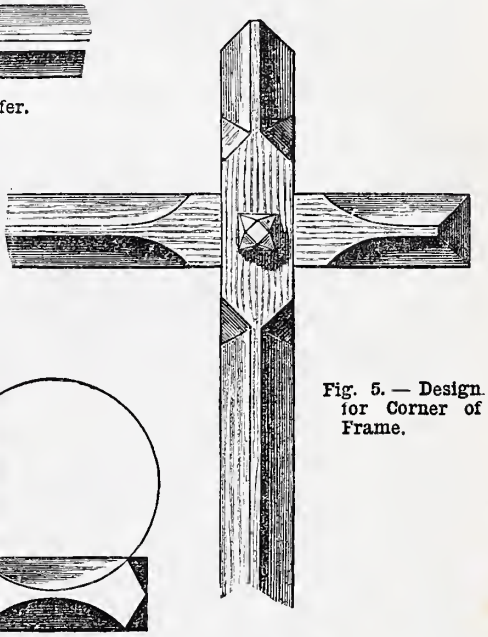


Fig. 5.—Design for Corner of Frame.

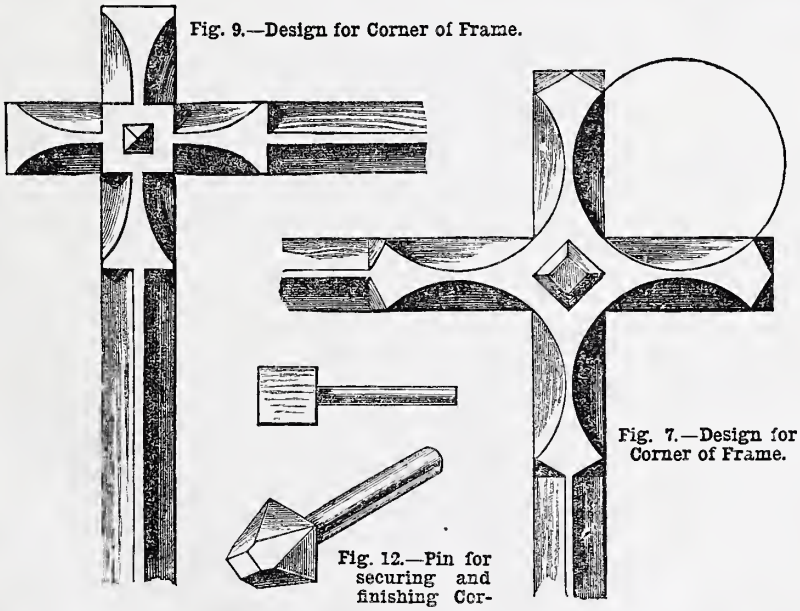


Fig. 9.—Design for Corner of Frame.



Fig. 12.—Pin for securing and finishing Corner.

Fig. 7.—Design for Corner of Frame.

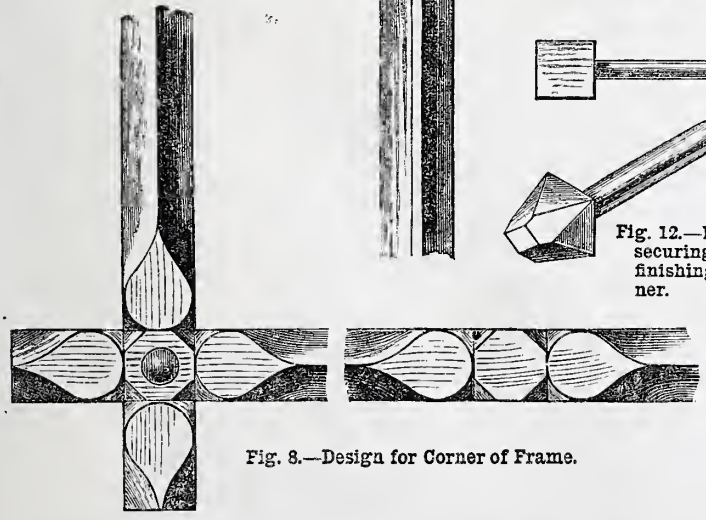


Fig. 8.—Design for Corner of Frame.

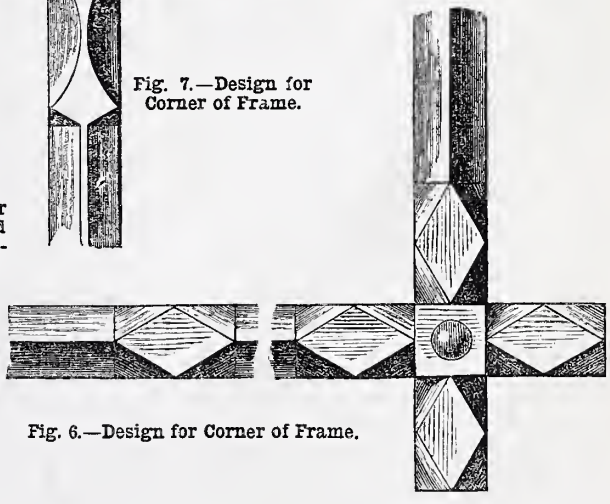


Fig. 6.—Design for Corner of Frame.

corner may be repeated (Fig. 8). Fig. 11 shows a method of varying the chamfer with a zig-zag made by notching a piece out on each side with the chisel. I merely give these as suggestions; other methods may be hit on without much trouble.

An important point in finishing is to avoid the use of sand-paper as much as possible, it takes the sharp arrises off, and makes the work look slovenly.

After chamfering, the frame may be glued together, but if you are not used to it glue has a peculiar knack of getting into the corners and leaving an unsightly brown stain.

For my own part I prefer putting the frame together, boring a $\frac{1}{8}$ in. hole in the centre of each corner, and fastening by means of a rosewood or black oak pin as shown in the sketches. This pin goes right through and is glued in. Fig. 12 shows the method of making this pin. The head is first made square, then the corners are taken off with a chisel. Occasionally a conical-headed one is employed, which may be turned. Different forms are shown in the various figures. Some finish the corners with a brass-headed nail, but I think this gives the frame a poor appearance.

I do not think it necessary to say anything about the final processes of varnishing and putting in the picture and back—these are minor details; but if there is any point on which I am not clear, I shall be happy to answer any questions in "Shop."

## MEANS, MODES, AND METHODS.

The Editor will be glad to receive communications for this department of Work. There must be few who, in the course of their experience, have not picked up many a hint and wrinkle which they have found to be useful to themselves in the prosecution of their respective trades or hobbies. Those who have thus got hold of "something worth knowing" are requested to make a note of it and pass it on, that it may be put into general circulation and so prove helpful to many.

### Reliable Cement for Lamps.

Powdered alum forms a simple, while at the same time thoroughly reliable, cement for attaching the brass rim to either glass or earthenware lamps.

The mode of procedure is as follows:—

(1) Thoroughly clean both rim and neck of lamp from everything of a greasy nature.

(2) Invert the brass rim, and fill its cavity with powdered alum, and place on the top of a hot range or stove.

(3) When the alum begins to get pasty (*not liquid*) with the heat, insert the neck of the lamp, press firmly into place, and remove the whole from stove, and set aside to cool. In about five minutes the lamp will be ready for use. The cement is thoroughly reliable, the oil apparently having no effect whatever upon it, and has the advantage over plaster of Paris that a lamp can be set and ready for use within five minutes, and if the vessel should meet with an accident, the rim can again be removed by re-heating, and adjusted to another vessel without all the trouble usually associated with such a job. W. H. W.

### Trueing a Buckled Circular Saw.

The following method I have seen used with success:—Immediately the saw commences to run wild, lift the wood you are sawing off the bench, and take a block of wood some 3 in. square, and rub the "end grain" against the side of the plate, moving it backwards and forwards with a firm pressure against the saw. *You must do it while the saw is warm,* so do not stop it.

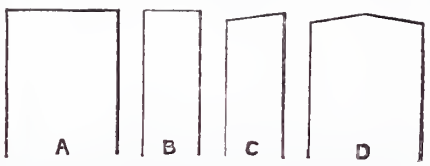
Turner.

### Boring Square Hole with Centre-Bit.

This is a workshop trick, and done in the following way:—Get a piece of stiff paper and fold it once, and put the folded edge up between two pieces of wood, say 1 in. thick, 3 in. wide, and 6 in. long. Pinch them altogether in bench screw, then with a centre-bit—say 1 in. bit—bore down (putting the point of bit into the paper between the wood) $\frac{1}{2}$ in. deep. On taking out paper and unfolding it, a square hole will be found in it. H. H.

### Trimming Flat Lamp Wicks.

As all those who burn oil lamps must be aware, a lamp wick of the flat variety should not be cut perfectly flat across, but should be slightly higher in the middle. To do this is generally a difficult task, especially




**Trimming Flat Lamp Wicks—A, Wick; B, Wick doubled before cutting; C, Wick doubled after cutting; D, Wick trimmed complete.**

after the wick has been some time soaking in oil; but if, instead of cutting it from side to side, the wick is first doubled down the middle and then cut through the two thicknesses towards the centre, a neat job will be the result. W. H. W.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

### 2.—The "Frederick Crane" Chemical Company's Specialities.

Both professional and amateur brass and other metal workers and finishers will be glad to hear of some new lacquers and substitutes for lacquers which, while fulfilling all the requirements of the old form of lacquers, are easier of application and superior in results. Such will be found in the specialities manufactured and supplied by the "Frederick Crane" Chemical Company, 22, Newhall Hill, Birmingham. The defects of ordinary lacquer are well known, and also the difficulty of applying it in many cases, especially on large surfaces, amateurs especially finding that after they have completed a nice piece of brasswork, the lacquering of it often presents an insuperable difficulty. The lacquers manufactured by the above firm are called "Zapon," Brassoline, and Ferroline. The most important of these is zapon. This is a perfectly colourless, transparent enamel, which can be applied either by "dipping" the article in it or by brushing it on in the same manner as ordinary lacquer, with the exception that heat is not a necessity. It sets perfectly smooth, and is very hard and not easy to scratch; it also has the property of drawing up its own drip. From experiments that I have made with it, I can confidently recommend it, and bear out the statement of the manufacturers that an amateur is more likely to make perfect work with zapon than a skilled workman with lacquer. It is also claimed that articles coated with this lacquer or enamel will stand any climate, are proof against flies or other insects, sea air, salt water, and noxious vapours—qualities which certainly recommend it as being most valuable for export trade. The prices of zapon are as follows:—zapon, for dipping (colourless), 21s. per gallon; brush zapon (colourless), 21s. per gallon; diluting liquid, 15s. per gallon; brush zapon (gold colour), 21s. per gallon.

Brassoline.—This is also a capital lacquer. It is worked like ordinary lacquer, but is superior to it in many respects. For instance, it will not cloud, however damp the atmosphere; it is perfectly waterproof; all brush-marks smooth out in drying; and the loss by evaporation is small. No heat is required, and therefore the novice can use it as well as the professional. It is made in several varieties, the most useful being gold, and antique brass. Price in each case, 12s. per gallon; thinner, 8s. per gallon. Short as is the time that these lacquers have been in use, they have gained a good reputation, being used by some of our leading firms in the brass goods line, notably Messrs. Benham & Froud, Evered & Co., Tonks, Limited, and many others, who speak highly of it.

Ferroline is a lacquer or preservative for ironwork and bright steel goods, useful for ironmongers and others who keep a stock of bright iron and steel goods, and who will appreciate an article that will obviate the necessity for the constant care and looking after that such a stock involves. It can be applied with or without heat, with a brush or by dipping. It is clear and transparent, and does not change the colour of the articles to which it is applied. Prices as follows—

| | | | |
|---|---|---|---|
| Ferroline, | Grade KK | per gall. | 12s. |
| ,, | ,, thinner | ,, | 8s. |
| ,, | No. 30 | ,, | 5s. |
| ,, | ,, thinner | ,, | 5s. |
| ,, | Grade HH | ,, | 5s. |
| ,, | ,, thinner | ,, | 5s. |

KK is the hardest and finest; No. 30 is not so hard, but has a heavier body than KK, and is especially designed for articles to be much exposed to atmospheric influences. HH is like No. 30, but thinner, designed for cheaper class goods.

Several other articles are also manufactured by the firm, amongst them being a Japan termed Negroline, in black and brown shades; Enameloid, a dead black for iron, brass, tin, or zinc; and Protectaline, a negative varnish for photographers. These I have not tried, but if they are equal to the before-mentioned, they will be found useful for those requiring such things. I might say that smaller quantities can be obtained, and should think that ironmongers and others who cater for amateurs and mechanics requiring such things would do well to stock these specialities.

### 3.—"Success, and the Way into It."

I have received a small pamphlet bearing this title from the Secretary of the Y.M.C.I.S., or, to give the name in full, the Young Men's Christian Industrial Society. Further, the address of the Secretary is 51, Old Bailey, London, E.C.; and from him all information respecting the Society and the establishment of branches may be obtained. It seems to be an attempt to bring about a combination of prayer-meetings and technical teaching as being, in the eyes of the promoters, the most likely arrangement to help our young men onwards and upwards. Surely there is a time for all things, and this being so, it seems neither desirable nor necessary to resort to this commingling of things sacred and secular. The promoters of the idea regard with suspicion the Volunteer Movement, Science and Art Classes, the Lecture Hall, the Club, the Public Bath, and the Gymnasium, as tending to deteriorate rather than improve young men. Most people entertain a contrary opinion.

The Editor.

## SHOP:

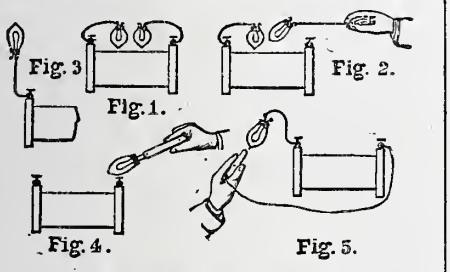
### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Experiments in Electricity.**—H. A. H. (*Tunbridge*) writes:—"The following experiments were published in the *Electrical Review*, and appeared originally in a foreign scientific journal:—(1) 'By attaching two curved wires—each supporting an incandescent lamp—to the terminals of the secondary circuit of a Rhumkorff coil (Fig. 1), we observe an approximation of the two lamps at the moment of the passing of the current. The phenomena is particularly marked at a distance between the lamps of from three to five millimetres. Care must be taken that the supports shall be very flexible, and for this purpose a copper wire one millimetre in diameter, and insulated with gutta-percha, will be very suitable. It is likewise important to avoid direct sparks between the lamp sockets. It is necessary to the attraction that there should be a discharge traversing the lamps and compelling the approximation. (2) By suspending one of the lamps (Fig. 2) and holding the other in the hand, the attraction between them will be the same. (3) A lamp placed upon the terminals of a Rhumkorff coil (Fig. 3) will become luminous, and it will be only necessary to approximate a lamp to a terminal to obtain gleams of equal brilliancy (Fig. 4). (4) Suspend a lamp by a flexible wire to one terminal (Fig. 5), and approximate to it any point in connection with the other terminal, and an attracted and sustained gleam will be observable.' Knowing that the current from the secondary circuit of a Rhumkorff coil partakes of the nature of frictional electricity, it occurred to me to try the experiments upon a Wimshurst influence machine, and I found that the experiments could be repeated upon it. Vacuum tubes can be shown also from a Wimshurst by connecting one end to one conductor, and the other end to the other conductor, and disconnecting the Leyden jars if it is found they retard the rapidity of the discharge. If instead of using the conductors they are taken away with the combs, the lamp will glow if held close to the glass plate while revolving. Vacuum tubes can also be illuminated by holding one end to the glass plate and taking hold of or touching the other end; indeed, the light ceases where the tube is held by the hand: it does not seem to make any difference to the illumination whether the platinum wire or the glass is held to the machine. I have also found that a momentary flash of light is obtained by rapidly approaching an excited glass or ebonite rod to a lamp or vacuum tube, and another flash by rapidly taking it away; in fact, a lamp or vacuum tube seems to act towards an excited glass or ebonite rod as a galvanometer does to an induced current in a closed circuit: upon approaching the rod there is a momentary flash, and all is dark; upon taking the rod away there is again a momentary flash and again all is dark. It is astonishing how little excitation a lamp or vacuum tube requires to make it show light; merely rubbing with an ebonite rod a piece of silk or a piece of cloth is sufficient. If you put either of them into an ebonite tube and rub the tube outside with any non-conducting material, they will show light, and after rubbing a minute or so, if the tube is tapped with the finger, they will light up opposite to where the finger touches. You may surround the vacuum tube with indiarubber, and place it in an ebonite tube, and the effects are the same as when the indiarubber is not there; the thickness of the dilectric does not appear to make any difference to the induction charges."




**Electric Lamps and Terminals.**

**Model Electro-Motors.**—Mr. George Edwinson Bonney writes:—"I regret that a mistake has been made in the illustration, Fig. 59, page 757, Vol. II., showing how to wind the F.M. cores of a Manchester dynamo. The winding on the right-hand core should be shown coiling round the core in the opposite direction to that shown in the illustration. I am very sorry such an oversight should have occurred, as I fear it will mislead some readers. Will you kindly publish for me an acknowledgment of my error?"

**Window Cleaning.**—H. B. S. (*Liverpool*) writes:—"Kindly correct two mistakes in my answer to C. T. (*Ashton-under-Lyne*) on page 766, Vol. II. of WORK. The first is a vital one to the question. Instead of 'hydrochloric,' read 'hydrofluoric;' and instead of 'H. B. B.,' read 'H. B. S.'"

**Erratum.**—In the reply to J. S. (*Aberdeen*), WORK, No. 109, page 780, on "Diamonds for Boring and Cutting Rocks," the word in brackets (carbonate) should have been "carbonado."

**H.P. Formula.**—W. H. T. (*London, S.W.*) writes:—"PUZZLED (see page 718, Vol. II.) has fallen into an error by assuming that P. in the formula he quotes is the boiler or initial pressure. It refers to the average pressure throughout the stroke, which depends upon the point at which steam is cut off. The point of cut-off in the stroke being known, the average pressure can be obtained theoretically by formula, and practically by taking an indicator diagram. The engine in question no doubt cuts off steam very early in the stroke, and the expansion is very considerable."

### II.—Questions Answered by Editor and Staff.

**Sheet-Iron Stampings for Dynamos.**—A. S. K. (*Sheerness*).—Sheet-iron stampings in any quantity may be obtained from vendors of dynamo castings, who will supply laminations for the armatures of dynamos made by them. The names and addresses of vendors of small castings may be found on pages 645, 678, and 766, Vol. II. of WORK. Write to any or all of these, stating your requirements, and ask for estimates.—G. E. B.

**Banjo Hoop.**—Banjo.—You might solder the ends of a piece of sheet metal together, making it the exact size of outside diameter of wooden hoop and cutting it a little wider than the hoop. Slip hook inside metal, then hammer the metal over the edges of wooden hoop: this is a very primitive method. A properly made hoop has the edges spun over steel wires; the wooden lining is put in afterwards, making it fit tight against metal hoop by using a mould of wood or metal and by cramps. See the Nos. of WORK for July 27, 1889; November 3, 1890; Nos. 70, 75, 79, 81, and 93 for other information. I can supply you with a hoop. You will find my address in the advertisement column.—J. G. W.

**Inspectorship.**—J. J. (*Argoed*).—The qualifications necessary to pass the examinations for an architect as required by the Royal Institute of British Architects are of a very different character to those required by the Sanitary Institute for an Inspector of Nuisances. From your letter I infer that, to a certain extent, you think the above studies are analogous, and that it does not matter which you pass, as it were, but you will at once see from the short description of the requirements of both institutions I give below that there is a vast difference between them. The examination of the Royal Institute of British Architects is divided into three stages to qualify the student as associate. Those for 1891 are as under:—First stage, or preliminary examination—to qualify for registration as probationer, R.I.B.A. Fee, one guinea. Occupies two days of about five hours and a half each, and embraces the following subjects:—(1) Writing from dictation. (2) Short English composition. (3) Arithmetic, algebra, and elements of plane geometry. (4) Geography of Europe and history of the United Kingdom. (5) French, German, Italian, or Latin; one language to be selected. (6) Geometrical drawing, or elements of perspective: either subject to be selected. (7) Elementary mechanics and physics. (8) Freehand drawing from the round. Second stage, or intermediate examination—to qualify for registration as student, R.I.B.A. Occupying two days of written examination and one day of oral examination. Fee, two guineas, on application with certain testimonies of study, accompanied by a certificate from a member of the Royal Institute, or other person of recognised position. This examination embraces the following subjects:—(1) The orders of Greek and Roman architecture, their origin, development, and application. (2) The several varieties of classic ornament. (3) English architecture from the Conquest to A.D. 1500, and the successive developments of the styles. (4) The characteristic mouldings and ornament of each period. (5) The nature of ordinary building materials, as stone, brick, tiles, timber, metals: and their qualities and defects. (6) The calculation of strengths of materials and resistance from data and formulas given. (7) The elementary principles of construction. (8) Elementary physics, as applicable to building. (9) Mensuration, land surveying, and levelling. (10) Plane geometry applied to actual work, projection of solids, and development of surfaces. Third stage, or the examination in architecture. To qualify for candidature as associate. Occupying five days. Fee, three guineas on application, with such probationary work as may be decided by the examiners. This examination embraces the following subjects:—History of architecture (to be illustrated by sketches). The leading characteristics and history of the principal styles of architecture. The special characteristics and history of any one of the following periods which the candidate may select, namely:—(*a*) Greek or Roman architecture; (*b*) architecture of Italy or France from the tenth century to the end of the fourteenth century; (*c*) architecture of Italy or France from the beginning of the fifteenth century to the present time; (*d*) architecture of England for some one century between the years 1100 and 1700 A.D. Mouldings, features, and ornament (to be illustrated by sketches):—As characteristic of architectural styles generally. As characteristic of the special style which may have been selected by the candidate in his probationary work. In this work the candidate will be expected to show a thorough acquaintance (graphical and historical) with the style and period selected by him, though such knowledge will not exonerate him from being required to show acquaintance with the details of other styles. The words "architectural style" may be understood as meaning Greek, Roman, Byzantine, Romanesque, one period of Gothic (English, French, German, or Italian), Renaissance, or one of the transitional varieties. Sanitary science, strength of materials, shoring, etc.:—Drainage, sanitary arrangements and requirements. The application of formulas for calculating the strength of materials. Shoring and under-pinning, and dealing with ruinous and dangerous structures. Plans, section, and elevation of a building:—The detailed arrangement of a building for a given purpose: as, for example, a parsonage for a town parish; a residence for a surgeon or other practitioner; a set of offices—to be filled in upon a skeleton plan (to a scale of ½ in. to a foot); a plan of one upper floor and of the roof, with details of the principal constructional arrangements; the section and elevation (to a scale of ½ in. to a foot), with constructional and artistic details to a larger scale. For the guidance of the candidate, a short statement of the requirements will be set forth. Materials, construction, etc.:—The nature and properties of building materials, including their decay, preservation, quality and strength, and their application in building. The principles of construction as applied in practice to foundations, walls, arches, vaults, roofs, floors, and partitions. Specifications and methods of estimating cost:—A specification of the work necessary in one or more trades for the building described above. Manner of specifying for other trades, and methods of estimating the cost of any building. Professional practice:—The general conditions usually appended to a specification and contract. The fifth day is devoted to an oral examination. Examination for Inspector of Nuisances:—Occupies a portion of two days, the first day being a written examination of about three hours, and the second an oral examination, with one or more questions, to be answered in writing if deemed necessary. Fee, three guineas if in London, but when the examinations are held in provincial towns, one guinea extra is charged. The examination embraces the following subjects:—The provisions of the Acts and Model Bye-Laws relating to the duties of Inspectors of Nuisances. A knowledge of what constitues a nuisance; methods of inspection of dwellings, cellar dwellings, dairies, milk-shops, markets, slaughter-houses, cow-sheds, and nuisances especially connected with trades and manufactories. The physical characteristics of good drinking water—the various ways in which it may be polluted by damage to supply works or in houses, and the means of preventing pollution. Methods of water supply. The characteristics of good and bad food (such as meat, fish, milk, vegetables). The Sale of Food and Drugs Act. The regulations affecting persons suffering or recovering from infectious diseases. The principles of ventilation, and simple methods of ventilating rooms. Measurements of cubic space. Disinfectants and methods of disinfection. A knowledge of the general duties of the office, and methods of keeping the necessary books and records. Writing and spelling. The proper conditions of good drainage. The advantages and disadvantages of various sanitary appliances for houses. Inspection of builders' and plumbers' work. Scavengering and the disposal of refuse.—E. D.

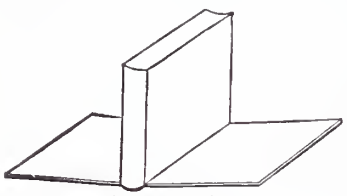
**Incubator.**—W. M. (*Plaistow*).—The well-piece of incubator as shown in the drawing (see No. 89, page 589) is open at bottom, and it is intended that the water of boiler should flow in and out—that is, rise and fall with the changes of the temperature. If you take the scale of the drawing it will give you the dimensions of the float sufficiently near.—C. M. W.

**Incubator.**—No. 305.—Full particulars of a simple and effective Incubator were given in No. 89 of WORK.—C. M. W.

**Villas and Cottage Plans.**—J. M. B. (*Dumfries*).—These, together with full detailed estimations, will be given in WORK as soon as opportunity offers, and some suitable writer and designer well up to the subject is forthcoming.

**Binding.**—Ruler.—Papers on the above appeared in Vol. I. Look them up and read them over. If you write to the publishers for the Index to Vol. I., you will be able to find out for yourself, and you can order the numbers from a newsagent, or direct from Messrs. Cassell & Co., Limited. However, I will try and give you sufficient information to enable you to do quarter-bound work in this column. I presume that it is cheap account-books you mean. The books are taken from the sewer, and if the end-papers have not been sewn on, the first operation is putting these to the book. This is done differently, according to the style of the book. We will suppose

for the sake of lucidity that we have a 3-quire foolscap, ruled special, with a printed heading. This is plain and tradesman-like; being a ruler you will understand it so far. The book has been sewn on three tapes or slips: this is the sewer's business, and you as a binder need not trouble why it is so. Now for the end-papers. You take two sheets of the same paper—these are left off by the ruler from the job—and fold them; next you lay them down upon a wrapper or waste sheet, and glue one page; you lift this and lay it upon the first page of the book, with the fold even to the back of the book, taking care that the slips are put back out of the way. You now glue the other sheet, and having turned the book, you put it down upon the last leaf in the same way. You must rub these down very carefully with the heel of your hand. The next operation is pasting down the slips. This is done by laying the book on the bench with the back towards you. Taking a little bit of paste on the forefinger of the right hand, placing the thumb of the left hand on the outside of the slip, you now rub the paste upon the inside of the slip, and with the thumb stick it down upon the book. The three on one side are treated in the same way; the book is turned over, and the other side done ditto. Now glue the back, and allow it to become nearly dry, taking care while gluing that the glue gets well in between the sheets or sections of the book. Now get two pieces of straw-board—about 2½ lbs. to the board will be heavy enough—the size of the book. Lay them down, and glue or paste them, and place them evenly upon both sides of the book, keeping them about ¼ in. from the back, and put the book in the press, between two pressing boards. I should have told you, just before putting on the boards, to give the book a few taps with the hammer along the back, but do not allow it to become round. After the book has become sufficiently pressed, which will be in a few minutes, take it out and ask the foreman to cut out a back for it. He will likely give you a strip of sheep or skiver. You take this and pare the two long edges of it, paste it, and having again glued the back of the book, you draw the back on as tight as possible, allowing as much of the leather to come over on one side as the other. A sheet marble paper is cut in two, glued, and put on the sides; it is now laid aside to dry, after which it is cut round, and the book is done. This is what is called quarter-bound flush. Quarter-bound, cloth sides turned in, is not much more difficult. In this case you will want four sheets for end-papers, and they will likely be sewn on; but if they are not, glue two of them as before, and put them to the book as already described, and tuck the other two inside of these by lifting up the first leaf of each. Paste down the slips, and glue the back as already directed. Cut the fore-edge now, and *round* the back in this case; cut the ends, and sprinkle or marble the edges. Now cut the boards, but this time you will have to cut them very exact. They should be ¼ in. longer than the book, and ¼ in. less than the book in breadth. This will allow them to project ⅛ in. all round over the book; this is called the square of the board, and will allow ¼ in. at the back for the joint as in the last-mentioned case. Put them on with paste as before, and press. The back that you will get to put on this time will be the same breadth, but about 1 in. longer. Pare it all round, paste it, and draw it on, gluing the back. After it is drawn on, it must be turned in. To do this, lay the book down upon the bench in the position shown in sketch. Hold the fore-edge tightly with the left hand, and with the thumb of the right hand turn in the leather to the inside of the board, breaking the end-paper to allow the leather to go into the back without creasing. When the other side has been done, shut the book, and rub the leather well with the folder to make it stick to the back, and rub the leather well into the joint. Now get two pieces of cloth for the sides, cut them evenly, glue them, and lay them up to the leather; rub them down with the hand, cut the corners with the scissors, and turn them in to the inside of the board. When the sides are dry, the end-papers are pasted up. This is easily done. Lift up one board, and paste the first page of the end-paper all over, shut the board, turn the book over and lift the other board, and paste the other end-paper; shut the board, and put the book into the press again. When it is dry, it is taken out, and your work is finished. —G. C.



Bookbinding: Position of Book on Bench.

**Shocking Coil.**—A. J. S. (*Edinburgh*).—Full illustrated descriptions of shocking coils will be given.—G. E. B.

**Medical Coil.**—W. B. (*Manchester*).—We have not yet given an article in WORK on "How to make a Medical Coil," but an illustrated description of one will be included in a series on induction coils. I do not know of a book giving the instructions you desire.—G. E. B.

**Screen.**—A. O. (*Manchester*).—You do not say what size you want to make the screen. Presuming the whole of the wood is to be covered, the framework may as well be of pine, say, 1 in. stuff. Set the wood out so that the three frames will be of exactly the same size. Either halve or mortice and tenon the joints, and if the screen is a high one it will be better to have a cross-rail about midway between the top and bottom. If you want the folds to move in any direction, you must use the "double-action" screen hinges, unless you are contented with canvas on webbing hinges—*à la* clothes-horse—to which I may refer you in case you do not know what is meant. If a simpler form of hingeing will suit, use ordinary butt hinges.—D. D.

**Fairy Bells to Piano Works.**—ADMIRER.—To make a fairy bells is perhaps one of the simplest musical instruments you can make. You require one to accompany the piano; therefore, you must have it tuned in unison with the notes on the piano. If you will kindly glance at the sketch (Fig. 1), you will find that the middle C is marked thus—X. This is the middle or pitch C on your piano, or is the same note as a C tuning-fork. This is the highest note on your fairy bells, and is consequently the shortest string; the other notes follow in rotation, first to the right, eight notes to C, then commence on the next bridge at B, and tune to the left seven notes with the longest string, C. Over the bridges you will find the sizes of the wire and the number of notes in brackets. Fig. 2 shows the top, which slides in a groove; Figs. 1 and 3 show how the string is adjusted, and Fig. 4 shows the loop at the end of string. Take a large sheet of paper and make it like Fig. 1, and bend it at the dotted lines at right angles, and you will see at a glance how the fairy bells are made. When you are perfectly clear as to how it is formed, commence operations. Make it of ⅜ in. pine; glue the side pieces (after grooving for the top to slide in) to the bottom, and drive a few needle points in to further secure it. Now make the bridges of beech; these are 1 in. in height, and 1½ in. wide. Glue these on after cleaning the bottom with glass-paper, and put three ¾ in. screws in each bridge from underneath. At the bottom end there is a bridge made of beech, 1 in. wide and 1½ in. thick; this is rabbeted out (see Fig. 3) so that the round-head screws go through that the wire is looped on, while underneath the bottom bridge is a slip of beech 1 in. wide glued on; this is a support to it, and prevents the liability to warp. When you have completed the woodwork, varnish the whole of it with two or three coats of white hard varnish, and bore holes for wrest-pins; you will need 1 oz. of each size wire: cost about 4d. per oz.—T. E.

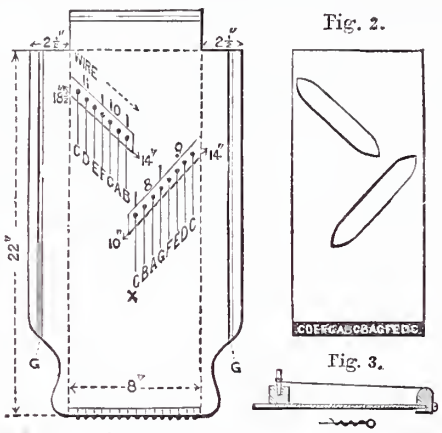



Fig. 1. Fig. 2. Fig. 3. Fig. 4.

Fairy Bells to Piano.

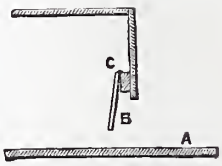
**Graph Composition.**—A. B. C. (*Wood Green*).—All graph compositions are much the same in their ingredients, though no doubt each manufacturer has his own favourite receipt which he is hardly likely to divulge. You will therefore understand how it is the exact composition of the graph you name cannot be given. The following is, however, an excellent recipe, and will no doubt suit you:—One ounce each of crushed loaf sugar and Nelson's gelatine, two ounces of sulphate of baryta, six ounces of glycerine, and four ounces of water. Melt the gelatine as if it were glue in the water, and while quite hot add the other ingredients, taking care to mix them thoroughly. When this has been done, pour into a shallow tray. When cold, the graph is ready for use. The great trouble will probably be caused by air-bubbles in the mixture; these must be removed by pricking before it hardens.—D. D.

**Lantern, etc.**—J. MCB. (*Sheffield*).—That a magic lantern worth £30 can be made for £5 by a beginner is doubtful, but with care you should make one that will be serviceable without incurring any very serious outlay. A good deal, of course, will depend on the way in which you buy your materials, and the amount of assistance you require. If you get the assistance of a carpenter, he will naturally have to be paid for his time, which may or may not be an important item in the cost of production. As you do not appear to have had much experience in mechanical work, you will find it better to attempt something simpler than a biunial lantern for a commencement. If you are inclined for joinery, as you seem to be, the construction of several easily-made articles of furniture has been described in WORK, and you would no doubt gain much profitable experience by making them. It is not easy to answer your second question satisfactorily, for you must be the best judge as to whether it is worth while to take lessons in carpentry to enable you to make things described in WORK, or not. If you have absolutely no knowledge of your tools or their manipulation, you would save time in learning them by taking a few lessons; but most of the descriptions are so full and lucid, that you ought to experience no great difficulty in following them. Naturally, you must not expect your carly attempts to result in anything very first-class. Should you resolve on going in for wood-working, you will find the articles on "Artistic Furniture" in Vol. I. well worthy of your study. They have been of great use to beginners. I am sorry to say that I do not know of any book on the penny whistle. For flageolet music, inquire of any music seller in your own neighbourhood.—L. I. P.

**Book on Metal Turning.**—LEARNER.—Apply to Messrs. Whittaker & Co., Paternoster Square, London, for the book on the above subject.

**Magneto-Electric Machine.**—MAGTELO.—The principal parts of the machine may be obtained from Messrs. F. C. Allsop & Co., 165, Queen Victoria Street, E.C.—G. E. B.

**Trap for Pigeons.**—W. B. (*Bridlington*).—The commonest arrangement for your purpose is a sliding door, pulled by means of a string. Of course, this requires to be watched, which is not always convenient, and the arrangement shown in the annexed diagram may suit you better. The pigeon alights on the outside sill, A, and enters the cot; in doing so, it has to pass the flap, B, which is made of light wicker-work, hinged at C with a piece of tape, and forms no hindrance to entrance; but, once in, the bird cannot get out again, as the flap will not yield to pushing from the inside. I lately saw a dovecot with every hole fitted with this arrangement, which the owner said worked well. In this case there were catches by means of which the wicker flaps could be kept up out of the way, if so desired. I may advise you in trapping pigeons to be careful not to get hold of anyone else's birds, or you may get into serious trouble.—G. LE B.




Trap for Pigeons.

**Bariquand Distance Register.**—KILOMÉTRIQUES.—I cannot glean any particulars respecting this make of distance register, but suppose from the exterior appearance of the engravings that it does not differ materially from others of its class. A train of wheels inside the instrument causes a set of discs to revolve before the openings in the sides or top of the case. These discs have numbers printed or stamped upon them from 1 to 0, and are speeded in the following manner:—The first disc records single revolutions of the actuating wheel up to 10. One revolution of this disc moves the second disc forward one notch, and this registers 10. When the second disc has made one revolution it moves a third forward one notch, and the three together then register 100. In this way any number of discs may be actuated. The actuating wheel is fixed in the nozzle shown at the side of the instrument, and this is moved by the wheel of the vehicle. The action is much like that of a gas-meter.—G. E. B.

**Current from Shunt-Wound Dynamos.**—C. N. (*London, S.E.*).—Taking up your line of reasoning, suppose we have a shunt machine capable of running 200 incandescent lamps of 16 c.p. The total output of the machine would probably be 11,200 watts. The maker of the machine would design it to give this output at a certain pressure, and would wind the fields with wire having a resistance calculated to balance the likely resistance in the lamp circuit. Whilst this resistance is maintained, a sufficient portion of the current will pass through the coils of the field magnets to magnetise them. If the resistance is lowered, an insufficient portion of the current will pass through the field magnet coils. If the resistance is raised, as by taking off part of the lamps, a larger portion of the current will go around the fields, and this will raise the E.M.F. of the current; but this cannot harm the lamps, because they resist the passage of current quantity (as expressed in ampères), and it is this more than E.M.F. that will destroy their filaments. Fusible cut-outs are inserted in lamp circuits to guard the lamps from accidental over-rushes of current.—G. E. B.

**Wheels for Back-Gear.**—R. T. (*Paisley*).—A wheel of 5¼ in. diameter and 60 teeth is not of the same pitch as a pinion of 2 in. diameter and 20 teeth; therefore, the wheels will not work together. Test this by dividing the number of teeth in each by the diameter:

$$\frac{20}{2} = 10 \text{ pitch}: \quad \frac{60}{5\frac{1}{4}} = \frac{60}{\frac{21}{4}} = \frac{80}{7} = 11\tfrac{3}{7} \text{ pitch.}$$

These are what is called the diametral pitches of the wheels—that is, the number of teeth for each inch of diameter. If the pitch, measured round the circumference, be the same in both wheels (as, of course, it must be if the wheels are to work together), then there must also be the same number of teeth to each inch in the diameter of both; whereas, in the case of the pinion there are 10, and in the wheel 11⅞. I find the detailed description of a 4 in. lathe in numbers 1121, 1123, 1125, 1128 of the *English Mechanic*; if you

obtain these four, you will have just what you require, including drawing and description of the nut for clamping the pulley to large gear wheel. I dislike this plan for a small lathe, and prefer to have a nut on the mandrel to the left of the small gear wheel, by means of which the pulley can be firmly screwed against the large gear wheel; you make a narrow cone fitting at the rims of both, and between their bosses on the mandrel you can place a spring washer to keep the rims apart when revolving separately. This requires no balancing, as the other does; it allows you to turn the inside of the pulley to equalise the weight all round; there is no looseness or rattle, and the front of the large gear wheel is left free to be drilled as a division-plate. The following wheels are suitable:—Wheels, 54 teeth, diameter, 5⅝ in. bare; pinions, 18 teeth, diameter, 1¾ in.; pitch on pitch line, $\frac{1}{12}$ in.; distance between centres, 3$\frac{11}{16}$ in.—F. A. M.

**Dividing the Circle.**—MECHANIC.—You propose to mark a plate off with dividers, and then centre-punch and drill; but remember your drill may "run," and not continue exactly on the spot where you first placed it. Dividing the circle is a very interesting subject, and many different plans have been adopted for doing the work accurately. If you have not already done so, I think you should read the papers in WORK, Nos. 10 and 14 of Vol. I., on pages 153 and 213. In the *American Machinist* of September 25th, 1890, is an extremely accurate method of originating a division-plate, but it is too long to describe in the "Shop" columns of WORK. Another plan is described in the *Scientific American* of March 8th, 1890, and of this I will try to give you an idea. Suppose you wish for a circle of 240 holes on a 10 in. circle: diameter being 10 in., the circumference will be 31·416 in., and the holes will be 0·1309 of an inch apart. Take a little block of steel about 1 in. wide, ¾ in. thick, and 1½ in. long, and file it so that its cross section will form a L (see Figs. 1 and 2); drill the two holes *a* and *b* 0·1309 in. apart, and fit a steel pin, c (Fig. 1), into one of them. Now obtain a strip of spring brass, say $\frac{1}{16}$ in. thick, ¾ in. wide, and about 30 in. long, one side of which must be fairly straight; lay the end of this in the angle of the L-piece, and, running the drill through one of the holes, bore it through. Now you can pass the drilled hole over the peg, run the drill through the other hole, and drill another; by keeping the edge of the brass close to the fillet on the L-piece, you get the holes parallel with the edge; continue drilling till you have made in the brass strip 241 holes, one more than the required number; thus you will have the holes *equally spaced*, and you can spring the band into a circle and put a peg through the first and last hole. To solder it in that position, we may chamfer the ends, and keep the peg in till the solder is set. Now you have probably guessed that we have only to turn a disc of wood so that the band of brass can be pushed on tight, and fixed with a few small screws, to get a pattern divided circle, from which our first row of 240 holes can be drilled. To drill any less number of holes for the other rows, cut the same band shorter, and use it again by turning down the wooden disc. You will, of course, have to mount your plate so that it will have to turn with the drilled band, and arrange a driller to act upon the plate while an index peg is dropped into the several holes. I say nothing about the form of the drill, shape of peg, size of holes, etc., because all that is treated at length in No. 10 of WORK.—F. A. M.

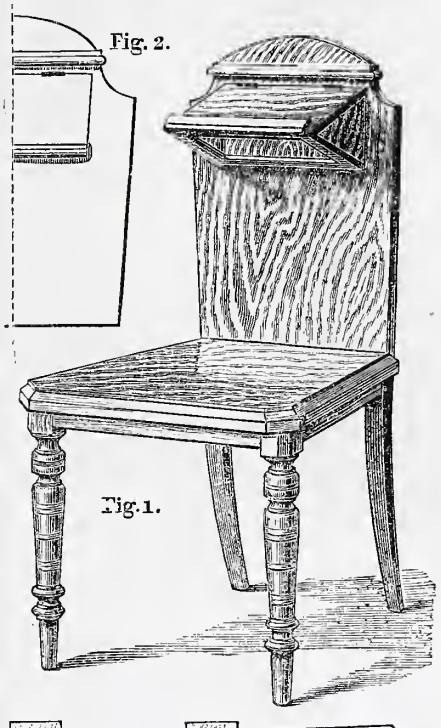
Fig. 1. Fig. 2.

**Dulcimer Wire.**—DEMENTED.—You can procure the wire necessary for stringing your dulcimer of Messrs. Chilvers & Co., St. Stephen's, Norwich (see page 645, Vol. I.). Steel wire will not do for the lower notes, as it is not heavy enough for the purpose.—R. F.

**Piano Wrest-Pins.**—J. H. (*Wednesbury*).—You should examine the wrest-plank or block as you name it, and see if it is sound and not split. If it is split, it will require to be renewed. If it is sound, you might try a little powdered resin in the hole where the pin is placed; if it is not very loose, this sometimes makes them grip if there is any grease that has found its way on the pin. But you should look at the bottom of the piano also, and see if there is anything pulling away. If they are very loose, and the wrest-plank is sound, procure a larger pin.—T. E.

**Musical Box.**—G. F. (*Walsall*).—In reply I shall be most happy to supply all additional information required, but I do not write to bring grist to my shop, as some do in a contemporary journal—such as engine models (the parts), telescopes and microscopes, etc., then offer the parts to fit up for sale. Wheels you can get cut to order, also main-springs, fans, etc., at any watch and clock material shop—of Cohen, Leeds; Barton, Liverpool; or Nicholson or Reid, Liverpool. But for a *new* comb or barrel you will have to send *number* of box to maker in Switzerland or Germany, as the case may be, choosing your tunes. Cost about 30s., and carriage for either comb or barrel. I am glad you are pleased with WORK—so am I. I am at present over three thousand miles away, hence delay in reply.—J. S.

**Prayer Desk and Chair Combined.**—F. U. (*Hereford*).—Your query for "a prayer desk and chair combined," certainly speaks of a good idea for something truly useful for the purposes required of it. It is a common mistake with some men that the possession of an idea is the completion of an invention. I have discarded many stray ideas indeed lately, simply because in putting them to practical test they were found to be unworkable in some respects. I mention this because some would have inserted in their letters such phrases as "this is my own idea," "I am sure the world will benefit," which you happily have refrained from doing. Only lately a trade acquaintance of mine was struck with an "idea." He commissioned me to work it out for him. His method, as was satisfactorily explained to him, was complicated and unworkable. After a few hours' hard study, I arrived at a very simple result—the simplest results *nearly always* require the hardest forethought—and it was acknowledged by him to be very useful for its purpose. A few days afterwards, however, I called upon him and found him very exasperated. Down in a lower corner, in very small letters, I had humbly inserted my name. Now, although his name was attached in very large characters as the intended manufacturer of the article, he was annoyed to think that he could not claim the whole honour of the invention, which he as good as told me he desired to do. He may, or may not, have worked the "idea" out without my assistance, but he was one of many of the kind who are greedy of things mental as well as material. You say you want something "wherein the back of the chair could be made to form the prayer desk whilst the seat would be used for kneeling upon." I am afraid it would be difficult to have a chair of ordinary height to answer the purpose if you wish to kneel upon the *seat*. This one could be made use of comfortably and conveniently if you kneel in front of it, resting your *arms* upon the seat. I presume this is what you mean; and I also suppose you want something with an ecclesiastical appearance. You could insert the desk part into a bought chair. The pattern is optional. If, however, you wish to make it completely yourself, have the seat 15 in. in front and 14 in. at back, 15 in. long, and 18 in. from the floor. Join the legs and back feet together by means of a narrow framing. Dowel the seat to the leg blocks as in Fig. 5. The back might be in one piece, connected to the back feet as in Figs. 6 and 7, so that a groove is left for the insertion of the back edge of seat, which should be shaped as in Fig. 8. The back can be from 16 in. to 18 in. high. Side sections of desk part are shown in Figs. 3 and 4; A and B will not be wanted very thick. You will see how they are hinged. If made as shown, all will lay quite flat when so desired, and can be instantly adjusted by drawing out the bottom end of A; that end of B which is at the top part of Fig. 3 falling down as in Fig. 4. To close it, push B upwards. For appearance' sake, have a moulding on the end of B which shows in front of chair. This will also be found very handy for keeping the leaves of the book down. You must have B long enough to allow it to project a little beyond the bottom edge of A as in Fig. 4. It must not fit too tightly, otherwise you will not be able to get it out of chair back. It is really a pity that correspondents will not give fuller particulars. I have presumed you are a member of some congregation; but it may chance that you are a leader or preacher. In the former case, this will suit you; in the latter, it will not be found so useful. If, however, you do not think this will suit, write again, stating, *as all should do*, everything that bears upon the subject.—J. S.



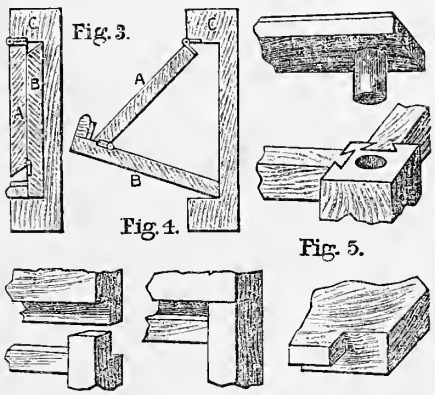
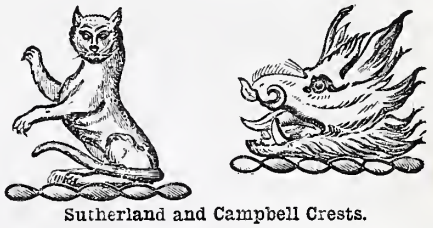





Fig. 6. Fig. 7. Fig. 8.

**Prayer Desk and Chair combined. Fig. 1.—Chair, showing Desk adjusted. Fig. 2.—Half of Back, with Desk closed. Figs. 3 and 4.—Sections of Desk down and up respectively. Fig. 5.—How to unite Seat to Leg Blocks. Figs. 6 and 7.—How to join Back and Back Feet. Fig. 8.—Back Edge of Seat. Letters show correspondence of Parts.**

**Hammered Metal.**—A. G. (*Hanley*).—Copies of the Milton shield are allowed to be sold in plaster, or in any other material, as the original is national property, placed in South Kensington Museum for the benefit of the nation at large. I have not heard of the antique head of Medusa being produced in plaster. If I were doing the job, I should purchase


Sutherland and Campbell Crests.

the head, and when done with, have it gilt, and try to dispose of it; you would then probably not be out of pocket by the transaction. I send rough sketches of the "Sutherland" and "Campbell" crests; could you not model from these? You would probably find it very difficult to obtain them either in metal or plaster of a suitable size for your work.—F. R. H.

**Æolian Harp.** — AQUILUS. — In tuning the harp the notes must be in *perfect unison*, not a shade difference either sharper or flatter. The exact note to which to tune it depends in a great measure upon the length of the string, but the best results are obtained from a low tension. For instance, if AQUILUS makes his harp 32 in. in length over all, which is the usual length, then the vibrating length of the string between bridges would be about 26 in., and this might be tuned to the note C, the third C counting from the bottom of the piano. The higher the tension—that is to say, the tighter the strings are—the stronger the current of air necessary to set them in vibration.—R. F.

**Water Delivery.**—TRYING.—There can be no reliable table, as the loss by friction varies with the length of pipe, but you will find it quite easy to calculate from the following formula:—

G = number of gallons delivered per hour.
L = length of pipe, in yards.
H = head of water, in feet.
D = diameter of pipe, in inches.

$$D = \tfrac{1}{12}\sqrt[5]{\frac{G^2 L}{H}} \qquad G = \sqrt{\frac{(15\,D)^5\,H}{L}}$$

The above is known as Hawksley's formula, and you will find it most correct.—T. W.

**Time Alarum.**—A. F. S. (*Stamford*).—Respecting the simple time alarum described by H. F. S. on page 699, Vol. II., a small electric bell quite good enough for the purpose may be bought for 4s. 6d., and this may be rung with current from a two-celled No. 2 Leclanché battery, costing from 3s. to 4s. more. These can be obtained from any dealer in electrical materials. Perhaps a local ironmonger will get them for you. The end of the switch-bar may be left uncovered, or the noise may be deadened with a bit of leather if you object to it.—G. E. B.

**Dynamos.**—J. P. (*Colne*).—The illustrations in my articles on "Model Electric Lights" are not drawn to scale; but in the illustrations of dynamos, the parts are shown proportionate. I have not attempted to show how the castings are made, because these are sold at a low rate by dealers, and it will not pay an amateur to make them. An amateur buying a set of castings need only know the particulars set down in the tables I give of their sizes. He need not know the dimensions

of the pole-pieces, nor the thickness of the web of the armature, as he will not have to make these parts. As a general rule, a dynamo will only give out half its designed current when driven at half speed. Double cotton-covered copper wire averages 2s. per lb. up to No. 22. Finer sizes command higher prices, and these may vary with vendors and districts.—G. E. B.

**Battery Carbons and Zincs.**—J. P. (*Colne*).—Select the carbon plates of a size to go easily into the jars, with quite ⅛ in. space between the edges of plates and sides of jars. The plates should be ¼ in. in thickness, and as long as the jars are tall. They may be obtained from dealers in electrical goods at prices varying from ½d. to 1d. per square inch. The zinc should be not less than ⅛ in. in thickness. The plates may be as wide as the carbon plates, but should be ½ in. shorter—that is, the bottoms of the carbon plates may well hang down ⅜ in. below the bottoms of the zinc plates. If your $\frac{3}{32}$ in. zincs are good and well amalgamated, they may be used in a chromic-acid battery, but will not last so long as plates made of thicker zinc.—G. E. B.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Paper for Screen.**—J. M. (*London, S.W.*) writes, in answer to SCREEN (see page 765, Vol. II.):—"I obtained a most suitable paper for the purpose at a much reduced rate from a wall-paper warehouse, the pattern of which had gone out of date, and have no doubt SCREEN would be able to do the same if he asked for an old paper, and gave the purpose for which he wanted it. Japanese paper is much too expensive."

**Pig-Scalding Tub.**—HAMMER AND DRIVER writes, in reply to J. G. (*Hull*) (see page 782, Vol. II.):—"If J. G. is not a cooper, I would advise him not to try his hand on a large oval tub, for there are hundreds of coopers that would fail in the attempt. The tools required are heavy and expensive, and of little service, except for coopering. Probably a bark or square would answer his purpose, and at the same time be much easier of construction. If so, he will find 6 ft. 6 in. by 2 ft. 6 in., and 2 ft. 4 in. deep, a nice size, inside measurement. It can be made of best red deal, free from shakes, sap, and dead knots, and must be dry. The narrower the boards, the longer it will last, boiling water having a tendency to warp deal. It should be bolted with iron bolts throughout, and the sides should overlap the ends about 3 in., and the ends be shouldered into the sides about ½ in. Make carcase first, being very particular as to joints being square and dead, and rush the joints from end to end. Rushes suitable may be had from any cooperage. They should be opened by inserting thumb-nail and drawing rush along, and spread out as flat as possible, but he must not grease them, as stated in a back number of WORK. Screw each part well together, levelling the joints with a piece of wood and heavy hammer as he proceeds. When carcase is together, he must be sure and true the bottom edges, for herein lies the making a good job. He should next make the bottom, allowing 1 in. over outer measurements; firmly bolt together, and true the side—that will be inside of bark; rush the bottom edges of carcase, and bolt bottom on to it; three pieces of scantling crosswise on bottom will lift bark of ground, and lend to its stability. A plug should be fitted as near to bottom as possible to empty, and his job will be complete. Being no draughtsman, I hope the above is sufficiently clear to J. G. without sketch. ⅜ in. bolts will be strong enough if a square does not suit him, and if he feels disposed to try and make an oak tub, and will repeat his question, I will endeavour to describe the making of an oak oval tub or kinmel."

**Hand-Power Circular Saw.**—W. G. (*Southport*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.:—"As a regular user of a circular saw, I would advise S. P. to abandon the idea of being able to cut 5 in. stuff on a circular saw bench, driven simply by manual power. My saw bench is driven by a ½ h.p. gas-engine, but even with the saw in the best of trim, it is very slow tedious work, cutting stuff 3 in. thick. If neither steam, gas, or water-power is available, S. P. would find a bench such as he wishes to make a disappointment."

**Soldering.**—B. T. W. (*Leeds*) writes, in reply to NORTHERNER (see page 734, Vol. II.):—"NORTHERNER should make his hard solder of two parts sterling silver, one part pin-brass or brass wire, taking care to keep his brass under weight. Melt on a piece of charcoal, drop on his work-board whilst hot, and flatten with iron stake. To make it thin for using in small pieces, I have found from experience that solders should not be rolled. NORTHERNER is trying rather a particular job when he goes in for soldering Geneva bezels, as most of them are little better than 9-carat, and as thin as tissue-paper. The best way is to spring the broken parts together—not bind it at all. Use borax in lump, rubbed on a bit of slate wetted with water, and use sparingly on part to be soldered only. The secret of hard soldering is knowing what heat the article will stand before melting, and that can only be come at by experience."

**Curing Skins.**—W. N. (*Tottington*) writes, in reply to IDEM SONANTIA (see page 631, Vol. II.):—"First see that the skin is fresh; put it into cold water for twenty-four hours; and if it is full of blood, put ½ pint of salt in. Then take out and flesh it—that means, take the inside skin off altogether—not fat altogether, for there is a second skin to all skins which must come off, or you cannot cure it to be soft. When this is done, for rabbit or hare or cat skins, take ½ lb. alum and ½ lb. salt, and boil in one quart of water; then let it cool down until lukewarm. Into this put your skin—for a small skin six hours is long enough—then take out and hang up to dry, and as it dries take it down and keep ratching it all round, and you will come at it in time."

**H.P. Formula.**—BRASS writes, in reply to PUZZLED (see page 718, Vol. II.):—"I do not see how you get your formula to work out to about 200 h.p. I make it come over 1,000 h.p.; but this is due to an error in your formula. You have omitted, in your formula, to take into account that the stroke should be calculated in feet, not in inches. Units of work are calculated in feet, and to do this in your formula 75 would have to be substituted for the 9 in. in the numerator, or 12 have to be multiplied into the denominator, thus:—

$$\frac{2 \times 78{\cdot}54 \times 9 \times 80 \times 350}{33000 \times 12} = 99{\cdot}96,$$

bringing the h.p. down to 99·96. There is still a great difference between the brake h.p. and the h.p. as above. How this is to be accounted for is hard to say, but is the 80 lb. pressure the pressure in the boiler or the mean pressure in the cylinders? If it is the pressure in the boiler, then the mean pressure in the cylinders would probably not be more than 50 lbs.; but it is useless guessing at it. The only way to get the correct mean pressure is to have the engine indicated (the process of which a very good description was given in 'Shop' a few months ago). If 80 lbs. is the mean pressure, then, as the song says, 'there's something gone wrong with the works,' or the brake test is not correct. The indicated h.p. will always be greater than the brake h.p., and the ratio between the two is called the 'modulus,' or the efficiency of the machine. The one may be termed the gross power and the other the net power, the difference between them being due to friction, leakage, or other causes."

**Paint for Tickets.**—J. H. (*Monkwearmouth*) writes, in reply to A. J. S. (*Moseley*) (see page 601, Vol. II.):—"If A. J. S. intends going in for tin ticket writing, he will do well to try the following plan:—After getting the tins ready, give them a coat of 'medal brand' or 'Foochow' enamel. I have not tried the latter, but the 'medal' I always use myself for white tickets; they require two or more coats of enamel. A white ticket, black figure, and French grey shading, with a black line round outside edge, is the best. A dark ticket with white enamel figures never looks well. The best job is always the white ticket and black figures. Tin tickets, as a rule, do not pay, as tradesmen will not give a proper price for them. We do as few as possible of them. If A. J. S. wants any more information, I will tell him to the best of my ability. I send a specimen ticket to the Editor done with the enamels. The above makes a better job of them than dipping them in varnish colour, and letting them drain. Will any of the numerous readers oblige me with instructions for making a machine for cutting cardboard? as cutting it on a table hacks the table top all to pieces."

**Transparlcum.**—L. E. (*London, E.C.*) writes, *re* inquiry by C. E. H. (*Horwich*) (see page 734, Vol. II.) in WORK about "Photography":—"Your correspondent probably means 'Transparleum.' The method is as follows:—Paste the photo (unmounted) on the concave side of a crystoleum glass; rub it down with sand-paper on the back till all the paper is removed, but without scratching the film that bears the photo; cover this film remaining on the glass with spermaceti wax, evenly rubbed on, and then paint with oil-colours. The background, flesh tint, hair, etc., should be painted on another glass, which is then placed over the first, and the two joined together at the edges by strips of paper. Do not forget that all the work is done on the concave side of the glasses."

**Plate Rack.**—C. B. (*Tonbridge*) writes:—"On seeing your answer to J. N. (*Erith*), No. 102, page 812, regarding rods for plate rack, I venture to think a plan of mine may prove acceptable to some of your correspondents. Instead of using wood rods, which are apt to rot, I tried bamboo canes, usually sold for flower stakes; they are about 4 ft. long, and cost about 2s. 6d. per hundred, and I have found the plan most successful."

**Violin Materials.**—M. (*Bishop Auckland*) writes, in reply to J. E. (*Chatham*) (see page 814, Vol. II.):—"You can obtain violin materials and tools from Mr. Hill, 72, Wardour Street, W. I believe there is a book on the subject, published by Messrs. Ward and Lock."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A. K. (*Edinburgh*); AN ARDENT READER; W. G. (*London, W.*); F. P. (*Tottington*); J. H.; DECORATOR J. W. (*Manchester*); T. P. J. (*Manchester*); A. J. A. (*Rouen*); A.W. (*Exmouth*); CONTRIBUTOR; APPRENTICE MASON; M. J. C. (*Glasgow*); AMBIDEXTER; J. M. (*Manchester*); HOOP-BENDER; B. C. (*Nottingham*); J. K. (*Leeds*); RAINFORD; UBIQUE; H. G. W. (*Bath*); E. D. S. (*Rye*); J. W. M. (*Halifax*); J. D. (*Holyhead*); WAX; T. R. B. (*Blaydon-on-Tyne*); WANTS TO KNOW; W. J. (*London, N.W.*); SHOEBLACK; F. E. H. (*Islington*); A READER; HORA; J. M. (*Newcastle-on-Tyne*); LIVERPOOL; A. F. (*St. Leonards-on-Sea*); J. W. R. (*Westminster*); X. L. U. M. (*York*); D. R.; TERPSICHORE; DRAUGHTSMAN; A. C. W. (*Bermondsey, S.E.*); R. J. A. (*Seacombe*); TYRO; R. S. E.; S. L.; M. P. (*London, S.W.*); F. W. S. (*London, W.C.*); GRADUATE; C. A. O. (*Chatham*); H. J. W. (*Romford*); F. C. P. (*London, W.C.*); J. G.; G. (*London*); CONSTANT READER; A PLASTERER; DELTA; GLENIFFER; J. L. (*Somerton*); BLACKSMITH; F. S. (*Manchester*); H. S. (*Liverpool*); OLD SUBSCRIBER; J. N. (*Surrey*); JOINER; A. T. (*Nottingham*).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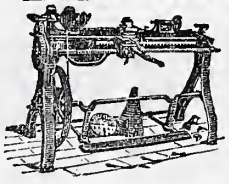

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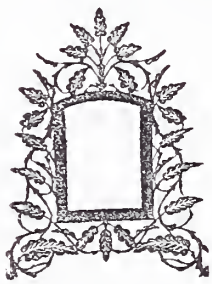

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# WORK

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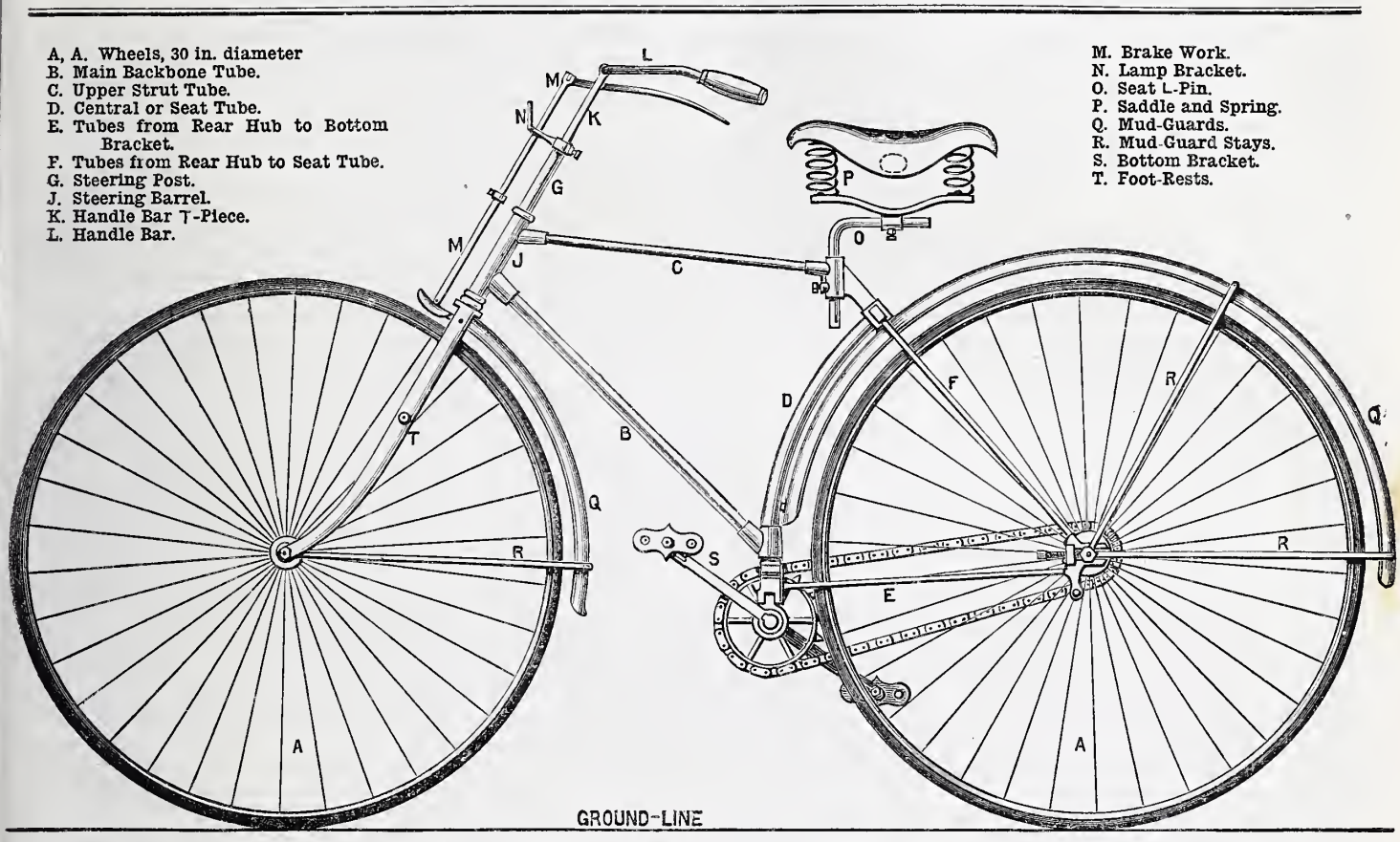



Fig. 1.—Diamond Frame Safety Bicycle. (One-tenth full size.)

### THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

INTRODUCTION—DESIGN AND PARTS—MATERIALS—WHEEL HUBS—SPOKES, ETC.—SOLID PARTS—PARTS THAT MAY BE PURCHASED—SPEED—RULE FOR GEAR-UP—NECESSARY TOOLS—LATHE—FORGE—ANVIL—VICES—GRINDSTONE—SCREWING TACKLE—RATCHET BRACE—SMALLER TOOLS—HOME-MADE TOOLS—LATHE CHUCKS, GAUGES, ETC.

*Introduction.*—It is proposed in a series of papers to describe the practical construction of the pedo-motive machine now well known as the "Safety Bicycle."

It may be inquired in the outset, Whence the name safety bicycle? for there is no bicycle—or tricycle either, for that matter—absolutely safe. The bicycle so called is only safe by comparison with that known as the "ordinary," and in that comparison it is certainly very much safer; but an absolute safety bicycle is not yet in existence, nor is it ever likely to appear. However, the name has become conventional, and we must stick to it in describing what we call the "Diamond Frame Safety Bicycle."

It is a curious fact that the original bicycle, with its wooden wheels and iron tyres, bore a striking resemblance to the modern safety: it had nearly equal wheels, from 30 in. to 36 in., connected by a backbone and fork similar to the modern cross frame; it was driven with cranks on the front wheel, and was not geared up; whereas the modern safety is usually driven by cranks and chain from the rear wheel, and may be geared up to any extent.

*Design and Parts.*—I propose describing a machine of my own design and make, and while the frame bears a general resemblance to many, it is different from any known to me. A reference to the accompanying drawing of the complete machine will show this, and that the frame exactly as it is shown is "not to be found in any of the books." There are several details which I claim as good things, and which will be described in due course. The drawing of the machine here shown—which I may say, for convenience of illustration, is one-tenth full size, or on a scale of $1\frac{1}{5}$ in., or 1·2 in. to 1 ft.—will be frequently referred to in future papers. The reader, therefore, who essays to construct his bicycle from the instructions given in this series would do well to keep the part of WORK containing the drawing at hand, or make an enlarged drawing from it, or, better still, a full-size working drawing on a board about 4 ft. 6 in. by 3 ft. 6 in., and lettered or figured for reference. In the drawing Fig. 1 the various parts of the diamond frame safety are as follows:—A, A, two wheels: in this case 30 in. diameter; B, main backbone tube; C, upper strut tube; D, central or seat tube; E, two tubes, one on either side, from rear hub to bottom bracket; F, two tubes, one on either side from rear hub, joining seat tube D at junction of upper tube C; G, steering post joined to the crown of the front fork H; J, steering barrel, either fitted plain on to the steering post G or having balls at both ends—in this machine it will be shown in detail fitted with cone surfaces; to this barrel are attached the two tubes B and C; K, handle bar T-piece, made to adjust by sliding freely in the steering tube G; L, handle bar, with horn handles; M, brake work, consisting of lever under handle bar, spoon immediately over the wheel tyre, and connecting tube and rod; N, lamp bracket; O, seat L-pin; P,

saddle and spring; Q, mud-guards; R, mud-guard stays; S, bottom bracket, which carries the driving shaft, chain wheel, and cranks; to this bracket is attached the tube B, and also the two tubes E; T, foot-rests, one on either side of the front fork.

*Materials.*—Having named the *principal* parts of our machine—for it will hardly be credited that in a machine of this sort there are over 320 parts, counting the chain as one part—we may now turn our attention to the materials of which these parts are composed.

*Wheel Hubs.*—The wheel hubs are gun-metal, having steel caps fitted in the ends where the balls run. The pins, or axles passing through these hubs, are steel, and are fitted with hollow cones. These cones and the caps, together with the balls, are all made very hard, so as to stand wear.

*Spokes, etc.*—The spokes are of best steel wire, specially made for this purpose. The wheel rims are crescent steel or hollow steel, as the case may be. Rubbers best red or grey.

*Solid Parts.*—The solid parts, such as bottom bracket S, steering barrel J, and C, are steel stampings or malleable castings. The L-pin O is a bit of round steel bar $\frac{5}{8}$ in. thick. All the tubes are weldless steel, 18 Birmingham wire gauge. The mud-guards are made from light sheet steel rolled to size of wheels, and hollow in section. The mud-guard stays are light rods, either round or flat, as may be preferred. The front fork is hollow weldless steel tapered and curved at lower ends, and joined to a crown piece at their upper ends.

*Parts that may be purchased.* — The following parts are usually purchased ready made from makers or dealers:—Hubs, to be bought bored, tapped for spokes, and plated; cranks and pedals, finished and plated; chain in lengths; saddle and spring, or both in combination; horn handles; rubbers for tyres, pedals, and foot-rests. Then the accessories are lamp, tool-bag, spanners, oil-can, etc.

It may be mentioned that hubs can be bought in the rough, and fitted up by the mechanic himself; and the same with bottom brackets, pedals, cranks, etc.

*Speed.*—It is a puzzle to many non-mechanical minds how the safety bicycle, with its small wheels, usually 30 inches, can be so speedy as the large-wheeled ordinary, for it is a fact that many people cannot be made to understand how the chain in combination with two different size wheels has the property of gearing up the small wheel to equal its big brother of the ordinary. Of course, anyone with but a small modicum of mechanical brain can see it. It is also a fact that thousands of riders of the safety can tell you what their own machine is geared up to, because the agent or maker told them, but they cannot by rule of arithmetic demonstrate for themselves the gear-up of their machine. The rule is a very simple one, as will be seen presently, and I insert it here for the benefit of those to whom it may be useful.

*Rule for Gear-up.*—The rule is to multiply diameter of driving wheel by number of teeth on chain wheel (that is, the wheel that is mounted on the bottom bracket shaft), and divide result by number of teeth on chain wheel of rear hub. Say the driving wheel is 30 in.; teeth on large chain wheel, 18. Multiply 30 by 18—result, 540. Divide 540 by 9—answer, 60. Nine is the usual number of teeth on the hub chain wheel, and in the following three examples 9 is used as the divisor:—

(1) Driving wheel .. .. .. .. 30 in.
Large chain wheel .. .. .. 18 teeth
Hub chain wheel ... ... .. 9 „
Then $\overline{30 \times 18} \div 9 = 540 \div 9 = 60$ in.
The machine is geared up to 60 in., or double that of the 30 in. wheel.

(2) Driving wheel .. .. .. .. 30 in.
Large chain wheel .. .. .. 16 teeth
Hub chain wheel .. .. .. 9 „
Then $\overline{30 \times 16} \div 9 = 480 \div 9 = 53\frac{1}{3}$ in.
In this case the machine is geared up to $53\frac{1}{3}$ in.

(3) Driving wheel .. .. .. .. 30 in.
Large chain wheel .. .. .. 14 teeth
Hub chain wheel .. .. .. 9 „
Then $\overline{30 \times 14} \div 9 = 420 \div 9 = 46\frac{2}{3}$ in.
In this case the machine is geared up to $46\frac{2}{3}$ in.

If you continue reducing the number of teeth in the lower or forward chain wheel, keeping the hub chain wheel the same—namely, 9—you are gradually lowering the gear. Bring down the number of teeth till both wheels have the same number, 9, and of course the machine is not geared up at all, and is what is called geared level. Multiplying a sum by 9, and dividing the result by 9, leaves the sum just as it was—thus, 30 in. $\times$ 9 = 270, and 270 $\div$ 9 = 30.

The above rule is easily carried in the memory or in a note-book, and anyone can easily tell the speed of a machine by taking the diameter of the driving or rear wheel, counting the teeth on both chain wheels, and then multiplying and dividing as above.

*Necessary Tools.*—Before commencing the construction of our bicycle, some mention must be made of the tools required. The proper place to conduct such a piece of work is the mechanic's shop, whether the regular business mechanic or the amateur, as these papers are intended for both. It cannot be expected that the trained mechanic—say, a machinist—who has never made a bicycle or looked into its mechanism can know all about it without a little instruction, any more than the amateur mechanic who may have confined his efforts to the making of model engines, electric machines, and such like. The working mechanic may have to his hand most of the tools required for bicycle construction, and, having possibly more practice in their use, may make better progress with his machine than the average amateur. Unless he is what is called a gentleman amateur, his stock of tools is, as a rule, very limited, and many of them only a makeshift for the purposes they are put to. So for the benefit of the amateur with limited means I will name the tools he cannot well do without, unless he means to bother outsiders to do this and that operation for him. The indispensable tools are:—

*Lathe.*—A turning lathe, back speed, with slide rest. The back speed is for turning iron, and the quick speed for brass and wood turning. The slow speed is also used for heavy drilling, and quick speed for small drilling.

*Forge.*—A small forge for brazing and light forgings, sharpening, and tempering drills, etc.

*Anvil.*—A small anvil fixed to a bench; or, better still, a small-sized smith's anvil on a block.

*Vices.*—A large strong leg vice attached to a substantial vice board, bolted through the wall for firmness. A good parallel bench vice, 3 in. or $3\frac{1}{2}$ in. jaws; also one or two hand vices, different sizes.

*Grindstone.*—A grindstone, not less than 14 or 15 in., in a metal trough, is a most useful tool for setting up turning tools, drills, etc.

*Screwing Tackle.*—As to this, I use two die stocks, one having pairs of dies $\frac{3}{4}$ in. fine thread, $\frac{3}{4}$ in. and $\frac{5}{8}$ in. Whitworth thread; the other having dies, Whitworth standard, $\frac{1}{2}$ in., descending by $\frac{1}{16}$ in. to $\frac{1}{4}$ in.; and these I find serve nearly every purpose in the trade. For nipple screwing I use a small die stock, with five pairs of dies from $\frac{1}{8}$ in., rising by $\frac{1}{32}$ in. to $\frac{1}{4}$ in. Then for spokes I use the ordinary small size five-hole screw plate, and the one-hole plate supplied by makers and dealers, usually with two taps, for each size of spoke. Common spokes, not butted, have heads on them when bought, and consequently no spoke heading machine is needed; but butted spokes have the butt larger than the holes in the rim, consequently they must be passed through the rim from the inside before a head is riveted on. For this purpose a heading machine is used: it is a ponderous affair, costing four or five pounds, and buying it, except for makers and repairers, is out of the question. I have not one of these, but use as a substitute (a makeshift, if you like) an instrument that does the work fairly well. It consists of two steel plates which clamp the spoke, and, being held firmly in the vice, the head is hammered into shape. I will give an illustration of this instrument in its proper place.

*Ratchet Brace.* — A ratchet brace, for boring out broken spoke stumps and for many other purposes, is necessary. I use one of these with a small three-jaw cheek that holds drills from 0 in. to $\frac{3}{16}$ in. I invariably use twist drills for this tool. I use also twist drills, from $\frac{3}{4}$ in. downwards, for the various borings in the lathe.

*Smaller Tools.*—As to these, they are such as are to be found in any mechanic's kit—callipers, pliers, wire-cutting nippers, centre and other punches, an assortment of files, wrenches, spoke grips, nipple keys, and numerous other little things that suggest themselves to the tidy workman.

*Home-Made Tools.*—One of the qualifications of a mechanic is the making of many of his own tools. In this many clever mechanics are nothing short of inventors. I have several machines I never should have possessed but in this way. One of these is a small vertical driven by foot. It has a bracket and division plate, for drilling hubs from four holes to forty. I have another machine which screws spokes with three turns of a small wheel, and does the work more rapidly and more accurately than anything I know of. Another machine of my own construction is used for grinding and polishing with emery-wheels; another for bending tubes. I may have occasion in the course of these papers to describe at length some of these machines.

*Lathe Chucks, Gauges, etc.*—Of course, much work may be done without these machines: thus, hubs may be drilled in the lathe; spokes may be screwed by simply gripping them in the vice, and fixing the screw plate to the end of the ratchet brace, filing up and polishing by hand without the grinding machine. Every mechanic, however, who can possibly afford it should provide himself with a couple of chucks for his lathe—one a four independent jaw chuck, and the other a two-jaw chuck, to hold small pieces of work, such as pins, and to hold the twist drills from 0 in. up to $\frac{3}{4}$ in. or so. Either of the chucks referred to can be bought for about 55s. About the most useful article I have is the Birmingham wire gauge plate. For sizing wire, drills, pins, and other purposes, it saves a large amount of time. Stubbs' letter gauge is also used for sizing twist drills, etc., but being costly, its use may be dispensed with.

## ELECTRO-GILDING BROOCHES, CHAINS, RINGS, ETC.

BY GEORGE EDWINSON BONNEY.

INTRODUCTION — TOOLS REQUIRED — BATTERIES: DANIELL'S BATTERY, WOLLASTON'S BATTERY, SMEE'S BATTERY, GASSNER DRY BATTERY— THE VATS — THE GILDING SOLUTION — INFERIOR GILDING SOLUTION.

*Introduction.*—Jewellers in a small way of business in country towns and other out-of-the-way places, have little trinkets handed to them to be repaired and electro-gilt or electro-plated. As it is not always convenient to send these little jobs to London or to Birmingham, there may be some who will be glad to know how they may be done at home in their own workshops. There may also be a few amateur metal workers who may be glad to know how to gild or silver a few little trinkets and other knick-knacks for their lady friends and relatives. To meet the possible wants and wishes of such readers as these, I have written a short series of articles, showing how such little jobs may be done at home with a few tools, many of which can be made by the working jeweller or the amateur metal worker.

*Tools required.*—In the catalogue issued by Messrs. Canning and Co., Great Hampton Street, Birmingham, the following list is given, under the head of "Watchmakers' and Jewellers' Gilding and Silver-Plating Outfit":—Two 6 in. Daniell batteries in box, 1 lb. sulphate copper, 1 pint sulphuric acid, 1 pint gold solution, 1 porcelain gilding vessel, 1 Bunsen burner, 1 pint rich silver solution, 1 porcelain vessel, 1 pint copper solution, 1 duplicate vessel, 3 stands for holding vessels, 8 oz. cyanide potassium. The whole, packed in box, with book of instructions, for £6.

This will give some idea of the tools required; but this is not all. In addition to the articles above mentioned, there will have to be such things as brushes to clean the goods before being plated, and polish them afterwards; wires to suspend the goods in the plating solution, various cleaning solutions, and vessels to hold these; and last, but not least, a plate of each of the metals mentioned, to form an anode in each of the solutions. Therefore, although I give the above list as a sample of those submitted to the intending plater, I beg leave to prepare one myself, and give a detailed account of each article required.

*Battery.*—As we shall electro-deposit a coat of silver on a piece of metal from a solution of silver, we must have a generator of electricity—that is, something in which the electricity can be made as wanted for the work. The cheapest and most simple method of doing this, for the purpose now under consideration, is to make up an electric battery, or a voltaic generator of electricity. There are quite a host of different electric batteries in the market, but there are only a few suitable to this work. Daniell's battery is mentioned in the above list. This is made up of a stoneware pot in which stands a cylinder or a plate of copper, and a pot of porous earthenware inside this, containing either a bolt or a plate of zinc. The outer containing pot is charged with a saturated solution of copper sulphate, and some crystals of this are suspended in the pot to keep the solution in a saturated condition. The porous pot is charged with water made acid with sulphuric acid, in the proportion of one part acid to fifteen parts of water. The zinc must be kept coated with mercury, and must not touch the sides or bottom of the porous pot. The porous pots or cells, 6 in. in height, will cost about 4d. each. The outer jars may be salt-jars, or even wide-mouthed pickle bottles. Any sheet copper, however thin, will do for the cylinder. The zinc may be also in the form of a cylindrical roll of sheet zinc, but this should be at least $\frac{1}{8}$ in. in thickness. The Daniell battery is very constant. Whilst the sulphate of copper solution is kept saturated and the zinc kept in working order, the current will not flag at all during the day; it is therefore most suitable for silver-plating and gilding, but it is very troublesome to keep in working order, unless kept well at work and employed every day. As a jeweller or an amateur may not have daily jobs to do, a troublesome battery is an inconvenience, for time can badly be spared in cleaning up the parts and getting them in working order whenever a little job comes in.

The Wollaston battery is the least costly and least troublesome, but it is also most inconstant, as its current is apt to rapidly fall off after being set to work. However, as it recovers its strength after a few minutes' rest, it is a handy battery for such short jobs as generally fall to the lot of the country jeweller. It may be made at home as follows:—Get some three or four open-mouthed jars of glass, stoneware, or porcelain, of any size from one quart to one gallon, the larger size being preferable. These jars will serve as battery cells, no porous pots being required. Next get some three or four plates of rolled zinc, just large enough and long enough to go in the selected jars. Clean the plates well in hot water containing some washing soda, then rinse them in clean water. Pour some water in an earthenware baking-dish, about enough to cover a zinc plate; then pour in carefully about one-tenth quantity of oil of vitriol. In this mixture immerse the zinc plates, one at a time, and pour on each a small quantity of quicksilver. Spread the quicksilver over both sides of each plate with a mop made of tow containing a few brass wires, and then coat them perfectly. This is termed "amalgamating the zincs." The acid mixture may be used with some more to work the battery, and the excess quicksilver can be used over again.

These zinc plates will be suspended to a cross-head of wood (each plate between two plates of copper in each cell); so we must now prepare the wood supports. These should be cut out of hard wood to the shape shown at Fig. 1, so as to enclose each zinc plate between two pieces of wood, the plates fitting in the recesses cut for them. The wood should now be well varnished, or, better still, well soaked in melted paraffin wax. Each zinc plate can then be enclosed between two wooden supports, these secured to each other by long brass screws passing through both, and the plate held up by a binding screw on the top, as shown at Fig. 2.

We must now get a pair of copper plates to each zinc plate, and these should be of the same size as the zincs, or they may be a little larger than the zinc plates with advantage. They may be of any thickness. If they can be cross-scored with a file, or have a rough coat of electrotype copper deposited on them, they will work all the better for the treatment. It will be better still if they can be coated with platinum, but this will necessitate the use of a battery and a platinum solution, which is costly. The copper plates may be secured to the cross-heads on each side of the zincs by very short brass screws, care being taken not to let any of them touch the zinc plates; or they may be clamped with brass clamps sold for the purpose, as shown at Fig. 3. This method of connecting the battery plates has the advantage over others of portability, since it is always quite easy to unclamp the plates to clean them, and reverse the zinc plates so as to wear both ends equally.

The battery jars are charged with an acid mixture, made by pouring one part by volume of sulphuric acid (oil of vitriol) into twelve parts of water, and allowing it to cool before using. The plates are suspended by the wooden cross-heads in this mixture. When it is wished to increase the pushing force of the current, the copper plates of one cell are connected by a length of No. 16 copper wire to the zinc plate of the next cell, and so on through the whole series of cells, taking in as many as may be wanted. When a low-tension current of large volume is desired, all the copper plates of the cells are connected together by one set of wires, and all the zinc plates by another set of wires. The cells may be placed in a wooden tray or in a shallow box, and all the cross-heads may be secured to a long bar of wood, which may be suspended to a support above, or to an arrangement for lifting all the plates out of the cells when the battery is not wanted. This arrangement will also be found to be most convenient for controlling the current, as its volume can be lessened at any time by exposing a less surface of the plates to the action of the battery acid. When the battery is not required for use, the plates should be lifted out of the cells, and if they are not likely to be wanted for a few days, they should be well rinsed in an abundance of water, to free them from acid. It will be necessary to take out the zinc plates occasionally, clean them, and freshly amalgamate their surfaces. This must be done at any time if the plates give off a hissing noise, and appear to be blackened by the acid.

The Smee battery is employed by small electro-platers and gilders. This battery is made up in a similar manner to that just mentioned. Platinised silver foil, soldered to copper frames, is used instead of copper plates for the negative elements, but in all other respects the battery may be made like the Wollaston just described, and will give similar results, with this exception—its action is longer sustained after being connected to the work, because it does not so soon polarise.

When a jeweller wants a battery to just do a few gilding jobs or to merely flash on a thin coat of silver to hide defects or discoloured patches, and is only likely to use the battery for a few minutes at a time during the day, I strongly recommend the Gassner dry battery. This battery needs no attention in the way of setting up or cleaning, as it is always ready for work, and will furnish current sufficient to gild a brooch, scarf pin, or even a bracelet, or to silver-plate such an article with a thin coat of silver. The large double-carbon square cells should be selected for this purpose, and the battery should be made up of two of these cells in series. They cost about 4s. 6d. each cell, and will last about two years, without renewal, on such intermittent work as I have just described. If used for big jobs, taking more than ten minutes in the doing, the battery will soon be exhausted. If the Gassner battery is selected, it will not be necessary to provide a sulphuric acid solution, since no solution of any kind will be required to work this battery.

*The Vats.*—These are the vessels to hold the depositing solutions of gold, of silver, or of copper. Gilding solutions are worked

hot, at a temperature varying between 140° and 180° Fahr.; we must therefore provide a vat that will bear being heated up to this point. "Well," the tyro might say, "why not use an iron or a tin vessel, such as a saucepan?" Because the gilding solution will eat away iron or tin, and become spoiled with these metals, and because the gold will be deposited on the sides of the vat, and thus cause a loss of this precious metal. But the homely saucepan is not to be despised, for it is a useful article, and may be easily pressed into service. If we put the gold solution into a stoneware or porcelain jar, and place this in a saucepan, together with some hot water, we may heat the solution in the saucepan by placing it over a gas stove or over a fire, or any other source of heat. If the saucepan is lined with porcelain, or vitrified, or enamelled, we may heat the solution in the saucepan without using a porcelain or a stoneware jar, and the saucepan will then serve the purpose of a vat.

The silver solution will be worked cold, so we shall not require a vessel to stand the heat as a vat for this solution; but it must not be of metal, because the cyanide of potassium in a silver solution will dissolve a metal vat, and the silver is liable to be deposited on its sides. It does not act quickly on lead; and this is sometimes used to line vats employed to hold plating solutions, but a lead-lined wooden vat would be too cumbersome for our purpose. If only a quart or two of silver solution is employed, we may find a stoneware vessel large enough to hold the solution. A large stoneware battery jar will serve the purpose very well, but either the stoneware or the glass troughs used for the cells of accumulators will make the best of vats for silvering solutions. If these cannot be easily obtained, and a bell glass can be got—that is, a glass vessel shaped like a bell, and employed by gardeners to cover their plants, and by fish fanciers as aquariums for gold fish—this can be easily improvised as a plating vat. Carve out a wooden pedestal to hold the knob of the glass, and cement this into the wood base. Do not use a common earthenware vessel, whether glazed inside and out or not, as these are snares, ever liable to be destroyed by the cyanide and to break when least expected.

The coppering solution I shall recommend can be worked cold or hot, and may therefore be held in a vat similar to that employed for the silver solution. The vats may be stood on any bench or on a shelf. They will not need any other stand, but, for the sake of cleanliness, it is advisable to place each in a lead-lined tray, to catch any accidental drops of the solution, as this will penetrate wood and leave a disagreeable odour about the shop, even after all the plating things have been put away.

*The Gilding Solution.*—After several years' experience, I find the following the cheapest and best for the amateur gilder and the jeweller in a small way of business. Get one pint of distilled water from a druggist's shop, and also half a pound of best 95 per cent. cyanide of potassium. Please understand that this latter-named article is a deadly poison, and will injure health if handled with the naked hand. There will, therefore, be some difficulty in getting it, and when got, great care must be exercised in using it, and in keeping it in a safe place when not in use. It should be kept in a wide-mouthed glass-stoppered bottle, under lock and key. Dissolve two ounces of the potassium cyanide in one pint of hot distilled water, and place it in the vessel intended to serve for a vat. Get two strips or plates of pure gold, weighing from 7 to 10 dwts. each; punch a small hole in the upper edge of each, and hang each strip on a hook made of No. 20 platinum wire. Hang one strip in the vat connected to the wire leading from one pole of the battery (say, the zinc plate), and the other strip of gold to the wire leading from the other pole of the battery. See that the gold only

Fig. 1.—One-half of Wood Support for Battery Plates.

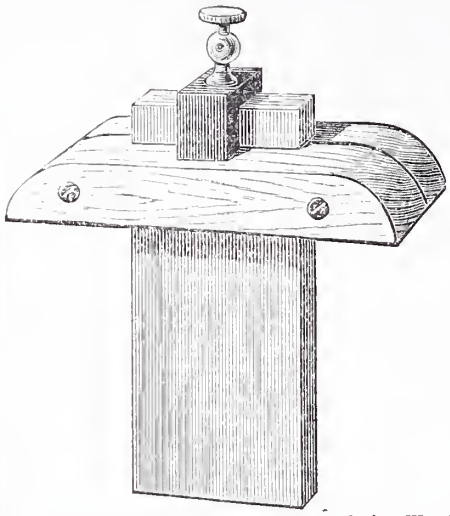


Fig. 2.—Zinc Plate of Battery held in Wood Support.

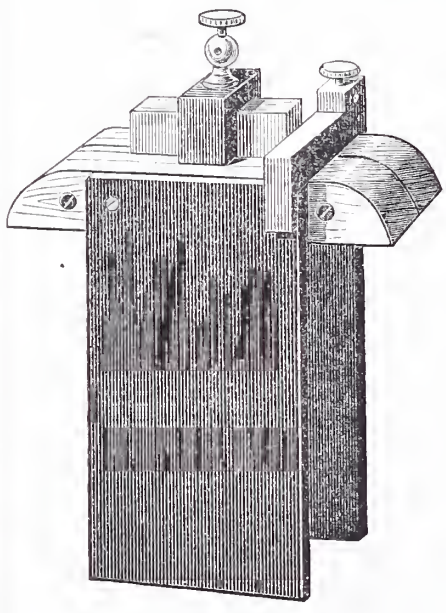


Fig. 3.—Battery Plates mounted on Wood Support and clamped together, ready for use in Cell.

dips deep enough in the cyanide solution to just touch the platinum hooks, but do not allow the copper wires to hang in the solution. Copper and gold will dissolve in cyanide solutions, but platinum will not dissolve in them. We want to dissolve the gold, and so make up a gilding solution, but we do not want any copper in the solution, as this will make the gold of a dark colour. If all has been done right, an electric current will pass from the zinc plates in the battery to the copper plates, and from these along the wire to the gold strip in the cyanide solution, through this, and back to the battery by way of the other gold strip and the wire leading to the zinc plate, thus completing the electrical circuit. Whilst current is passing in this way, gold will be dissolved off from the strip of gold hanging to the wire leading from the copper of the battery, and will be taken up by the cyanide of potassium to form the double cyanide of gold and potassium solution. Keep the solution heated up to 160° Fahr., and keep the battery connected to it for one or two hours. At the end of this time hang a German silver wire for a moment or two in the vat, connected to the wire leading from the zinc of the battery. If the wire takes on a coat of a satisfactory character, hang both strips of gold to the opposite wire, and call them gold anodes, and connect the work to be gilded to the cathode wire—that is, the wire from the zinc of the battery. The action of the battery may be carried on until 5 dwts. of gold have been dissolved into the solution, or we may commence gilding with only 1 dwt. of gold to the pint of solution. The quantity of gold in the solution can always be augmented if the surface of the things to be gilded is less than the surface of the anodes, and there is an excess of cyanide in the solution. The contrary condition will result, of course, in an impoverishment of the solution. A solution rich in gold deposits a rich-looking coat of gold in a short time, whilst one poor in gold works slowly, and deposits a poor-looking coat.

A full battery of at least three Wollaston, Smee, or Daniell cells, or two Bunsen cells, should be used in making the gilding solution, but it can be worked afterwards with a battery of one cell. The Gassner or the Leclanché are both unsuitable to use in making up the solution, but may be used in working it after it has been made up.

An inferior gilding solution may be made up by stirring into the cyanide solution enough chloride of gold to turn the solution green, then adding enough cyanide to take away the green tint. This will deposit a coat of gold of a fairly good colour, but the gold coat is apt to strip off whilst being polished or burnished. The best depositing solution is that of the double cyanide of gold and potassium made up by the chemical method, but the process for doing this requires more than an amateur's skill, and results in a great loss of gold when attempted by unskilled persons.

In another paper I hope to show how to prepare the articles for gilding, to work the gilding solution, and finish the goods after they have been gilded.

## AN EASILY-MADE RECEPTACLE FOR PARTS OR NUMBERS OF "WORK."

BY A. BEAN.

"Alas! things are not as they seem." This trite quotation has been so often used to express disappointment and disgust at expensive purchases which had been regarded as valuable in an equal degree, until suddenly discovered to be just the reverse, that it is quite a pleasure to be able to employ it (without its dispiriting prefix) in connection with a perfectly honest article.

As such we may fairly consider, I think, the book about to be described, and which is shown in the annexed illustration. This sketch, as the reader will no doubt observe, portrays apparently a neatly bound copy of

WORK; but the uninitiated searcher who may peer under its cover in natural expectation of help, in place of receiving any useful assistance from this volume, will find that the so-called book has resolved itself into a mere box; which, however, in its very singularity, may, let us hope, compensate somewhat for the absence of the anticipated assistance.

To its would-be maker, at any rate, this book-box will offer many inducements apart from that of novelty. For one thing, it is decidedly most useful for a variety of purposes. It is, moreover, easier by far to construct than the binding of a volume of printed sheets; which may, indeed, be so spoiled either by the sewing or the cutting of the edges as to be beyond the power of anyone, professional or amateur, to repair. Indeed, the greatest incentive of all, to one who has ever endeavoured to satisfactorily smooth the edges of books by the ordinary methods of the amateur, will be, I think, the fact that here, at all events, he will be spared that trial.

To those readers who do not possess the bookbinder's usually most used appliance, it will doubtless be an additional relief to learn that for our present purpose a press is quite unnecessary; the only tools required being a knife (known to dealers in cutlery as a French one), a folding stick or thick bone paper-knife, a glue-pot, and a brush.

Any ordinary binding material may be used in covering this box, but I should recommend, as being the most suitable, the leather denominated roan (which may be had of any colour) as protection for the back and the corners, bookbinder's cloth of a similar shade being placed on the sides. For lining the interior of the box, paper of a drab or grey shade is to be preferred, whilst the seeming edges should be covered with marble paper.

The boards needed will be one No. 3, and two No. 6 black ones, the former measuring 18 in. by 16 in., and the latter $12\frac{1}{2}$ in. by $9\frac{1}{4}$ in. each. About a quarter of a yard only of cloth will be necessary, whilst the piece of leather should measure $20\frac{1}{2}$ in. by 6 in. You will need no more than a sheet each of the lining and marbled papers.

Having obtained these essentials from any bookbinder, you may cover the thinner millboard on one side with the drab paper and cut it to the shape shown in Fig. 2. It should then be scored or cut half through its thickness with a sharp knife along the dotted lines on the uncovered side.

This will enable you to bend up the outstanding portions without cracking the board, after which, in order to secure them in place, you should glue strips of cloth along each angle on the outside of the box. About $\frac{1}{4}$ in. of each of these four pieces should be turned in over the upper edges, whilst their lower ends to the extent of half an inch should be attached to the foundation. One side of the board you will of course have arranged to fit the curve of the two end-pieces, so that a properly shaped back may be formed. The finishing touch to this portion of the volume is given by affixing a strip, 32 in. by $3\frac{1}{2}$ in., of marble paper around the three straight sides.

I may here perhaps be allowed to mention a difficulty with which you will doubtless have noticed I have to contend in describing this book as a box, and *vice versâ*. For you must not forget that the *sides* of the box form the edges of the book, whilst the two sides of the latter are spoken of as top and bottom respectively in the case of the former.

However, we may now leave the box proper for the present, and turn to the consideration of its surroundings. For these you must cut the piece of leather as shown by the lines in Fig. 3, the portion A being required for the back, and the offcuts B for the corners; the remaining small square may be regarded as useless save for the purposes of experiment.

Now make your knife as sharp as possible, and employ it in cutting or paring down the edges of the five pieces of roan, using a slab of glass or porcelain to support the leather against the pressure of the blade. The four similar portions should then be

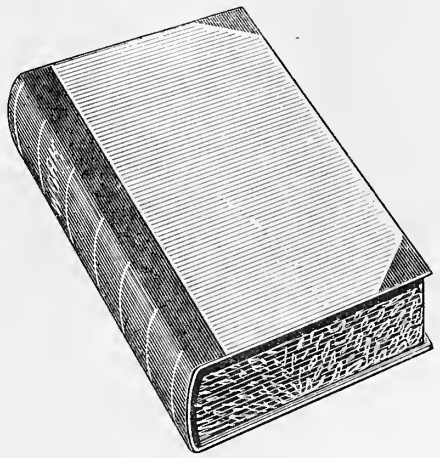


Fig. 1.—Book-Box as Receptacle for Parts or Numbers of "Work."

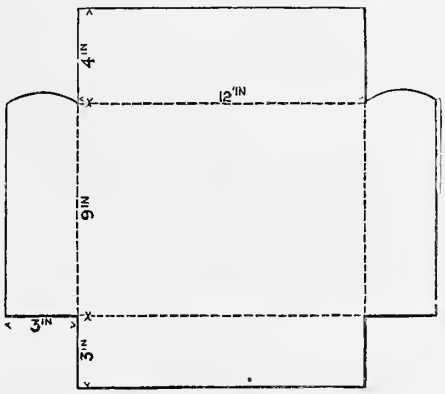



Fig. 2.—Plan of Pasteboard for Body of Box.

Fig. 3.—Mode of cutting Leather for Back and Corners of Case.

parted and placed on two corners of each board, their oblique edges being turned over their borders. After pasting the larger piece thoroughly over, lay at a distance of $1\frac{1}{2}$ in. from each of the longer edges the uncornered margin of one of the boards. A short piece of thick cord should then be placed across each end of the leather, reaching from corner to corner of the boards, in order to strengthen the roan somewhat; the overhanging portions being then turned tightly over in the same style as the smaller pieces.

Two pieces of cloth, each 14 in. by 9 in., should now be cut, and after just so much of their corners has been removed as will allow their leather substitutes to fully appear, affixed to the boards with thin glue, their extreme edges being turned in as before.

The inner and outer divisions of the volume will now be quite ready for amalgamation. This must be done by attaching the rounded *side* of the box to the leather back of the case with rather thick glue. After well rubbing these two together with the folding stick, you may then fasten the bottom of the box to the corresponding side of the cover.

To give finish to the upper portion of the receptacle, a strip of cloth 1 in. wide and 12 in. long should now be neatly glued along the inner joint of the board—or lid if you choose—where fastened to the curved side of the box, a piece of marble paper 12 in. by $8\frac{3}{4}$ in. being then evenly applied to the inside of that upper cover.

A box, however it may be enclosed, is scarcely a fit subject on which a 'prentice hand may successfully practice gold lettering; therefore, if you have not already had some experience in that branch, I should advise you to either employ the painter's method, or give instructions to the binder for its embellishment.

If the former plan is adopted, the back must first be divided into seven portions or panels, the five inner ones being made quite equal whilst the upper one should be about $\frac{1}{4}$ in. longer, and the lowermost one only half that length. A line of, say, $\frac{1}{16}$ in. should then be drawn between each of these divisions with a fine brush charged with gold size, additional ones being also placed parallel to the head and tail of the back, and also against the verge of the sides of cloth.

These lines must be left until they are very nearly dry, when you may lay over them the gold leaf or bronze powder in the same manner you have no doubt often observed painters adopt when using these materials.

If you succeed in doing this portion satisfactorily, you may then write the word WORK or other title with the same liquid on the second panel of the back, afterwards attaching the gold as before.

This plan, although perhaps somewhat of an innovation, will nevertheless give the book quite a legitimate appearance; and will look as well, if not better than many far more elaborate attempts with the ordinary tools of a book-finisher.

## PROMISCUOUS EXERCISES IN CHEMICAL ANALYSIS.

BY "CHEMICUS."

As examples, let us take "The detection and estimation of lead in potable waters," "The analysis of solder," "The determination of *added* water in milk," "The analysis of white lead," and "The estimation of moisture, ash, and sulphur in coal."

### DETECTION AND ESTIMATION OF LEAD IN POTABLE WATERS.

The presence of lead in potable waters may be readily detected by adding two cubic centimetres of a saturated, freshly prepared solution of sulphuretted hydrogen to fifty cubic centimetres of the water, acidified with ten drops of acetic acid, contained in a Nessler's cylinder. Should the water hold solid matter in suspension, or be turbid, it is filtered previous to applying the test. This applies also to the bichromate method of detection described hereunder. If the metal be present the

water upon standing some little time will acquire a brown colour, varying in depth of tint in proportion to the amount contained in the sample. For comparison, fifty cubic centimetres of lead free water, contained in a Nessler's cylinder, are treated in a precisely similar manner. Should the fifty cubic centimetres yield negative results, half a litre of the water is taken, the volume reduced by evaporation to fifty cubic centimetres, filtered if necessary, cooled, and the above test applied. If this portion also gives negative results, the water is free from lead.

It is claimed by the author, Mr. Sidney Harvey, that the presence of one-fiftieth of a grain of lead per gallon may be readily detected by the method described hereafter. And further, that no other metal likely to be contained in the water gives the same reaction with the reagent employed—viz., bichromate of potash. The principle of the method is, that lead salts form with bichromate of potash insoluble precipitates of chromate of lead.

In applying the test, 0·13 grammes of powdered bichromate of potash is added to half a litre of the water contained in a glass conical, the liquid well stirred and allowed to stand at rest, alongside, for comparison, of a similar conical containing half a litre of lead free water, to which the same quantity of bichromate of potash has been added. During the course of fifteen to twenty minutes a decided turbidity will be formed, should lead be present, while at the expiration of about twenty-four hours a precipitate will have settled at the bottom of the containing vessel, so that the supernatant liquid can be drained off almost to the last drop.

Lead being a very serious contamination of potable waters, since, when taken into the system, it accumulates and does not pass through, we give the following simple method for its detection, so that those of our readers who do not possess a knowledge of chemistry—and undoubtedly they are many—may determine for themselves whether this injurious and poisonous metal be present or not in their water supply. For the carrying out of the process, the apparatus required consists of an ordinary glass tumbler, and two bright and perfectly clean knitting needles; while the only chemical employed is acetic acid, or, if this is not at hand or procurable, vinegar. The *modus operandi* of the method is as follows: Fill the tumbler at least three parts full with the water to be examined, and add a dozen drops of acetic acid, or a teaspoonful of vinegar. Should the water be turbid, treble these quantities are added. Thoroughly mix the contents of the tumbler by carefully stirring with the needles, immerse the needles in the water, and allow them thus to remain in contact with the water, with occasional stirring, for some considerable time. From time to time withdraw one of the needles, always the same one, and examine its surface for dark or brown spots; or if the amount of lead is considerable, a grey coating, varying in depth of colour in proportion to the quantity present, which will be formed should lead be contained in the water. If, after immersion in the water for some eight to ten hours, the needles remain free from any spots or coating, even when examined with the aid of a magnifying glass, as will be the case when only small quantities of lead are present, withdraw the needles and allow to dry, precautions being taken to exclude dust, for twenty-four hours. If at the end of this time the needles have acquired no yellow, or reddish-yellow colour, the water is free from lead.

For the *quantitative determination* of the lead, fifty cubic centimetres of the water are carefully measured out into a Nessler's cylinder, four drops of acetic acid, together with two cubic centimetres of a saturated, freshly prepared solution of sulphuretted hydrogen, added, and the whole mixed. The colour of this solution is now compared with that of fifty cubic centimetres of pure distilled water, contained in a Nessler's cylinder, to which four drops of acetic acid, and two cubic centimetres of the sulphuretted hydrogen, as also one cubic centimetre of a standard solution of lead containing in every cubic centimetre ·0001 grammes of lead, have been added. To compare the colours of the two solutions, place the containing vessels side by side on a sheet of white unglazed paper, or a porcelain slab, and look down through them.

Should the colours of the two liquids differ, various quantities, larger or smaller as required, of the standard lead solution are added to fresh portions of fifty cubic centimetres of pure water, acetic acid and sulphuretted hydrogen added as before, until the quantity of the standard lead solution necessary to produce equality of tints in the two solutions is arrived at. Since each cubic centimetre of the standard lead solution contains ·0001 gramme of lead, the quantity of lead, in grammes, contained in fifty cubic centimetres of the water under examination will equal the number of cubic centimetres of the standard solution required to produce equality of tints multiplied by ·0001, and therefore a litre (1,000 cubic centimetres) will equal this quantity multiplied by 20. By multiplying grammes per litre by 70 we obtain *grains per gallon*.

Example:—50 cubic centimetres of the water taken for analysis. Number of cubic centimetres of standard lead solution required to produce equality of tints=6 cubic centimetres.

∴ 50 cubic centimetres of the water contains ·0001 × 6 = ·0006 grammes of lead.

∴ 1,000 cubic centimetres (a litre) of the water contains ·0006 × 20 = ·012 grammes of lead.

∴ *Grains* of lead *per gallon* of water = ·012 × 70 = ·84 *grains* of lead per gallon.

If the qualitative analysis has revealed the presence of only a small quantity of lead, a litre of the water is evaporated down to a volume measuring fifty cubic centimetres, filtered if necessary, cooled, and the lead determined as above.

The standard solution of lead is prepared by dissolving ·1831 grammes of crystallised acetate of lead in a litre of distilled water.

### SOLDER.

For the analysis the sample is cut up into small pieces, the smaller the better.

Weigh out into a conical one gramme of the solder, add fifty cubic centimetres of a mixture of equal parts strong nitric acid and water, and heat gently. When solution is effected, add 250 cubic centimetres of dilute nitric acid—one acid to six water—and carefully evaporate the solution down until it becomes pasty. When cool add 250 cubic centimetres of the dilute nitric acid, boil until the volume is considerably reduced, dilute the liquid with water, and allow to stand until the resulting metastannic acid has completely subsided to the bottom of the containing vessel. Collect the precipitate on a double Swedish filter, and wash until free from acid. Dry the filter paper with contents, remove the dry precipitate as completely as possible to a tared crucible, ignite the filter paper separately, add the ash to contents of crucible, ignite the whole at a strong red heat, and when cool re-weigh to determine the oxide of tin, $SnO_2$, which contains 78·67 per cent. of metallic tin.

Concentrate the filtrate remaining from the determination of the tin if the volume occupied is at all considerable, cool, add pure sulphuric acid in slight excess, and then twice the volume occupied by the solution of methylated spirits. Allow the solution to stand for some considerable time, collect the resulting precipitate of lead sulphate, $PbSO_4$, on a filter, wash with water acidulated with sulphuric acid, and subsequently with methylated spirits. Dry filter paper with contents, remove the dry precipitate to a tared crucible, and ignite the filter paper in the manner described in the article on "Brass: Its Analysis" (Vol. II., page [367). Add the filter paper, ash, etc., to the contents of the crucible, ignite the whole, and weigh the $PbSO_4$, which contains 68·32 per cent. of lead.

### DETERMINATION OF THE "ADDED" WATER IN MILK.

To arrive at the extent to which milk has been adulterated by the addition of water, it is necessary to make a determination of the "Solids not Fats," which is conducted as follows:—Carefully tare a perfectly clean platinum dish and in it place about ten cubic centimetres of the milk. Re-weigh the dish to determine the exact weight of the milk taken, and then submit to the action of the water-oven until evaporation to complete dryness has taken place. This beng effected, the dish and contents are allowed to cool, the dry residue covered with 100 cubic centimetres of benzoline, and heated in the water-oven until one-half of the benzoline has evaporated off, when the dish is withdrawn, allowed to stand until the solid particles have completely settled to the bottom, and the liquid then carefully decanted off. Repeat this treatment with benzoline some half dozen times, and after the final treatment, decant off as completely as possible the liquid, dry the residue in the water-oven for an hour, allow to cool, and weigh. Replace in the oven, heat for a further period of half an hour, and again weigh. If the second weight does not agree with the first, the dish and contents are again subjected to the action of the water-oven until a constant weight is obtained. The residue thus obtained is the *solids not fats* contained in the weight of the sample operated upon; it is calculated on100 parts by weight. In genuine milk the percentage of *solids not fats* is 9 per cent., and should it be under, the sample may be considered as watered.

The percentage of *added water* in milk is the difference between amount of pure milk in which percentage amount of *solids not fats* found are contained, and 100.

To determine the amount of *pure milk* in which the amount of *solids not fats found* is contained, it is assumed that 9 *parts of solids not fats* are contained in every 100 *parts* of *genuine milk*. Example:—

A sample of milk upon analysis is found to contain 8·00 per cent. of *solids not fats*. If, therefore, 9 per cent. of *solids not fats* are contained in 100 *parts of genuine milk*, 8 *per cent. of solids not fats* are contained in 8—100 ÷ 9 = 88·88 *parts of genuine milk*.

The amount of *added water* is, therefore, 100—88·88=11·12 per cent.

### White Lead.

The chief adulterations of the white lead of commerce are barium sulphate, calcium carbonate (chalk), and oxide of zinc. Barium sulphate, however, cannot be considered an adulteration unless it be present in quantities exceeding 5 per cent., since it serves to protect the lead from the blackening action of sulphuretted hydrogen.

The following is the method of analysis :—Weigh out one gramme of the sample, spread in a thin layer over the bottom of a small porcelain dish, and burn off the oil at a low temperature, continuing the ignition until no black carbonaceous matter remains. Cover the residue while hot with dilute nitric acid, digest at a gentle heat, dilute the solution and filter. Wash the insoluble residue on the filter free from acid, dry, ignite and weigh.

The residue thus obtained should be qualitatively tested for barium sulphate in the following manner:—Place a small portion of the residue on the end of a platinum wire, moisten with hydrochloric acid, and hold in the flame of the blowpipe, when if barium be present the flame will acquire a green colour. If no coloration be produced, the residue consists of silicates. It is not usual to separate the barium sulphate and silicates should both be present.

The filtrate remaining from the above determination is evaporated to near dryness to expel the excess of acid, diluted, heated to near boiling, and a current of sulphuretted hydrogen conducted through to saturation. (The solution must be distinctly acid, otherwise zinc sulphide will be precipitated.) The liquid is then allowed to stand at rest for some time, and the resulting precipitate of sulphide of lead collected on a filter and washed with sulphuretted hydrogen water. The filter paper with contents is then placed in a tared porcelain crucible, covered with strong nitric acid, gently heated until the acid is driven off, when the temperature is increased to redness, and the crucible, after cooling, re-weighed to determine the lead sulphate, $PbSO_4$. Every 100 parts of lead sulphate is equivalent to 88·118 parts of lead carbonate, $PbCO_3$.

To the filtrate from the sulphide of lead, add ammonia and ammonium sulphide in excess, close the mouth of the containing vessel, and allow to stand at rest in a warm place for some hours. Collect the resulting precipitate of sulphide of zinc on a Swedish filter, wash, dissolve in hot dilute hydrochloric acid, dilute the resulting solution, heat to boiling, and re-precipitate the zinc in the same, as carbonate, by the addition of sodium carbonate in excess. Heat to boiling, filter off the carbonate of zinc, $ZnCO_3$, wash thoroughly with hot water, ignite in a porcelain crucible, and weigh the resulting oxide of zinc, ZnO.

The ammonium sulphide filtrate remaining from the above determination, after the addition of hydrochloric acid, is evaporated to dryness, the residue brought into solution by digestion with dilute hydrochloric acid and filtered if necessary. The solution is then made strongly ammoniacal, ammonium oxalate—prepared by dissolving one part of the crystals in ten of water—added and heated to boiling for some time. The resulting precipitate of calcium oxalate collected on a Swedish filter, washed with water, converted into lime, CaO, by ignition at a strong heat, and weighed as such. Every 100 parts of CaO is equivalent to 242·857 of $CaSO_4$.

As regards the arrangements of the results, the residue insoluble in nitric acid is returned as *barium sulphate and silicates;* the lead as *lead carbonate;* the zinc as *zinc oxide;* and the lime as *calcium sulphate.*

### The Determination of Moisture, Ash, and Sulphur in Coal.

*Moisture.* — Carefully weigh out five grammes of the coal, which has been reduced to a fine powder, spread in a thin layer over the bottom of an iron dish or the surface of a clock glass, and submit to the action of the water-oven for an hour. At the expiration of this period, re-weigh the coal to determine the loss in weight which it has suffered, which loss represents the *moisture* on the quantity taken for analysis.

The portion thus deprived of moisture is preserved in a well-stoppered bottle, from which the various portions required for determination of ash and sulphur are taken.

*Ash.*—Weigh out into a large, shallow, tared platinum, or porcelain dish, one gramme of the moisture freed sample and gently ignite, with a free excess of air, over a Bunsen burner until the volatile matter is expelled and the coal is thoroughly coked. When this is effected, increase the heat to bright redness, and maintain at this temperature until the residual ash is free from black carbonaceous matter. This being attained, allow to cool, and re-weigh the crucible to determine the ash.

To ascertain whether combustion is complete, ignite the crucible with contents for a further period of ten minutes, allow to cool and re-weigh. The second weight should agree, within experimental error, with the first; if it does not the ignition is repeated until a constant weight is obtained.

*Sulphur.*—Intimately mix one gramme of the dry powdered coal with twice its weight of pure calcium oxide (lime), place the mixture in a platinum crucible and gently ignite over a *spirit lamp,* or, as is preferable, in the muffle, for half an hour. When this period has expired, increase the heat to bright redness and maintain at this temperature for about an hour, upon the expiration of which time remove the crucible from the source of heat and allow to cool. Cover the contents of the crucible with a small quantity of a saturated solution of ammonium nitrate, and apply a gentle heat until the liquid is driven off. By thus treating with ammonium nitrate, the calcium sulphide, formed by the combination of the sulphur of the coal with the calcium of the lime, is oxidised into calcium sulphate. Oxidation having been effected, place the crucible, when cool, in a beaker, cover with pure hydrochloric acid, and digest at a gentle heat until the mass has dissolved out. Withdraw the crucible after washing, dilute the solution, filter through a Swedish filter paper and wash. Dilute the filtrate, which now contains as sulphuric acid the whole of the sulphur present in the coal, to 250 cubic centimetres (the solution must be distinctly acid, but free from a large excess), add ten cubic centimetres of barium chloride solution, and allow to stand in a moderately warm place for twelve hours. Decant off as much as possible of the clear supernatant liquid, collect the resulting precipitate of barium sulphate on a Swedish filter, wash twice with dilute hydrochloric acid and thoroughly with water, ignite and weigh. Barium sulphate, $BaSO_4$, contains 13·37 per cent. of sulphur.

It is advisable to form a blank experiment with the re-agents employed, taking the actual quantities of each as employed in the analysis of the coal.

## DESIGN FOR GLOVE BOX IN FRETWORK.

BY ROBERT COXON.

### Subject of Design : "Music."

This design, if executed in a good hard wood, vulcanite, or brass, either as fretwork on another ground or in inlay, would make a very artistic article, either for gloves for a lady or any other articles for which it might be used.

The drawings are worked out full size, the top (Fig. 1) and end view (Fig. 2) complete, the side view (Fig. 3) repeating from centre, *c c.* The accompanying small sketch

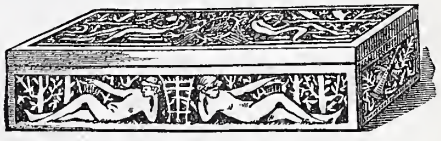


**Fig. 4.—Sketch of Glove Box complete.**

(Fig. 4) will serve to show the work complete, and could be either hinged or as a lid at the option of the workman. Figs. 1, 2, 3 will be found in page 41.

Having designed it to suit brass inlay work, for which it is more suited in the delicate portions, the workman must slightly thicken those parts if intended for wood execution.

It would also make a good subject for a music stand, either for a piano front, table stand, or upright, the top piece forming centre, with the side view repeated top and bottom, and mounted on coloured satin, silk, or velvet.

For the box, also, coloured material might be used as lining, or, if preferred, gilt cardboard mount or thin sheet brass would make a more suitable background to a dark wood like ebony or vulcanite, the inside being mounted in plush or velvet.

## FURNITURE AND ITS GLASS.

BY DAVID DENNING.

Glass as a Decorative Feature—Plate Glass — Silvering — Preparation of Frame — Measurement of Glass and Bevels—Purchasing Glass.

After wood, there is no material which forms such an important part in cabinet furniture as glass. Of course, the appearance is referred to more than the actual construction when it is said that glass is so important a feature; for glue, nails, and other odds and ends are, so far as joinery is concerned, of infinitely greater use than glass. They, however, are not supposed to be visible, and in good work are not more so than is absolutely unavoidable. Glass, on the contrary, is introduced into furniture almost entirely owing to the decorative effect which it gives when judiciously used. There are, of course, those who object to the use of glass in furniture except to the smallest extent, and from their point of view the reasons they give for doing so are not trivial. It is, however, not so much my intention to discuss the use of glass from an artistic basis as to offer a few hints of a practical kind to those who will have glass in their rooms. As one who has paid some attention to the subject, perhaps I may be allowed to make a few remarks about the general employment of glass. So far as I can understand the objections to its use, they are mainly because glass is seldom found in old furniture, and then only in

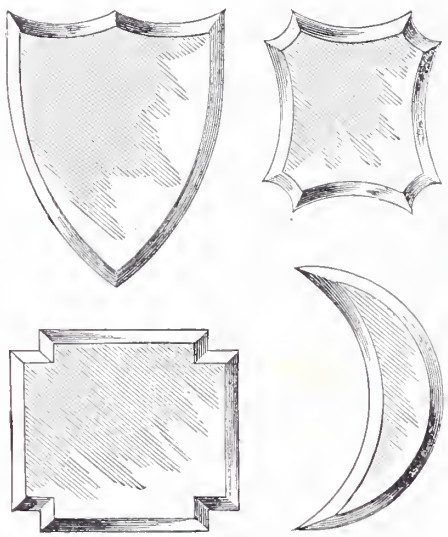
small pieces. It was never employed in large sheets; therefore, to do so now is an evidence of want of good taste, as the glitter is apt to destroy the repose which should characterise the interior of our dwellings. That is what has been said by the "utterly too too" artistic section of the community. Now, let us just look at the subject from a popular or common-sense point of view.

It is quite true that till a comparatively recent period glass was not used in large pieces in furniture, but its absence is not to be taken in any way as a proof of its use having been purposely avoided. Probably the real reason is to be found in the fact that glass has not always been obtainable in large sheets or plates. What is not made cannot be used, so that large mirrors never being found in old furniture merely shows that the old cabinet-makers had not got it to use. It is nothing but nonsense to urge that their superior artistic instinct induced them to use glass in great moderation, and only in small pieces. Whether or not glass is ornamental in furniture is to a great extent a matter of personal opinion on which everyone has the right to decide for himself—unless, indeed, he has a better half, for then he may possibly find his rights restricted. Those who do not like glass may have wood or some other material instead, while those who wish for plenty of it can have their wishes gratified to almost any extent without being thought peculiar or addicted to vulgar decoration. At the same time, it must not be understood that I am advising the excessive use of glass, for, personally, I am decidedly of opinion that it should be employed judiciously and in moderation—or, rather, I should say, with discretion.

The advantages of glass as a decorative material in furniture construction are so manifest that it may seem almost unnecessary to say anything about them. It must suffice just to remind decorators that they have a most useful material to deal with, and that they can combine utility with ornament. After all, if everything that might be said both for and against glass as a decorative part of furniture were to be urged, it merely resolves itself into this—glass is fashionable and popular. We find it largely used in overmantels, sideboards, cabinets, and all kinds of fancy furniture, principally in a silvered state—*i.e.*, as looking-glass or mirror. In furniture, transparent glass is comparatively little used, and when it is its object is principally to allow of the contents of the cupboard, or whatever it may be, to be seen. An ordinary bookcase with glazed doors will occur to most people as a familiar example.

Undoubtedly, a great stimulus to the use of glass as a purely decorative detail of furniture has been given by the greatly decreased cost of bevelling the edges. As is well known, the bevelled edges to all mirrors greatly improve their appearance, and when the small extra cost is taken into account it seems hardly worth while to economise by having plain edges. As so many amateurs wish to do everything for themselves—and doubtless it is a creditable wish—this may be an opportune place to say that neither glass bevelling nor glass silvering are suitable occupations for them. On a small scale they cannot be practised successfully. It will be found much more economical to get the glass ready silvered and bevelled from a dealer. With proper plant and appliances, both bevelling and silvering can be done at a very reasonable figure. I mention these matters, as several inquirers have desired to be informed in the "Shop" columns how they can do silvering. When they know, any efforts they may make are almost sure to end in disappointment. Of course, I do not wish to discourage any, but it is better for them to know that the "game is not worth the candle" in the opinion of those who are best able to judge.

No doubt most readers are aware that the kind of glass ordinarily used for mirror purposes is known as "plate." It is more suitable than the commoner and cheaper sheet glass, from the fact of its having a more even surface, and other good qualifications. It is also fairly thick, so that the edges can be suitably bevelled. Another kind of glass, the thin or "patent plate," is only used when the ordinary kind is too thick for the purpose. For bookcase doors and transparent panels both plate and sheet glass are used. For ordinary furniture the latter is quite suitable, and is much cheaper than the former, which is, however, preferable when first-class quality is necessary. The silvering is now generally done by what is known as the "patent process," to distinguish it from the older one, in which mercury and tinfoil were used. In the patent process pure silver is chemically deposited on the glass.



Fancy Shapes for Glass Bevelling.

Having said enough about the actual material, it will be well after this preliminary chat to say something about the work of fitting and fixing the glass into the furniture—taking up the subject, in fact, from a practical or workshop point of view, so far as it concerns the cabinet-maker. Of course, it goes without saying that the more he knows about the material the better for himself, but this knowledge is not so necessary to him as an acquaintance with the ordinary workshop methods of actually using the glass, and combining it with wood in constructing furniture.

It may seem almost unnecessary to say that the edges of glass used in furniture are laid within a rabbet, but a few remarks about the rabbet itself are not uncalled for. Perhaps the chief point that the maker of any frame which it is intended to fit glass to should attend to is the absolute necessity of having it "out of winding." If it is "in winding," it stands to reason that a perfectly flat, even sheet of glass cannot be close to the wood which should support it. The consequence is, that as a space between the wood and the surface is unsightly, the workman may be tempted to try and force the glass into its proper position—*i.e.*, so far as appearance is concerned—for the proper position is naturally that in which the glass lies close, without any coaxing or straining. It may, when speaking of glass, seem strange to those who are not accustomed to working it to refer to its being forced to lie against a frame in which it does not bed naturally.

Glass is usually regarded as so absolutely rigid that any attempt to cause it to bend would be useless. Now, although for ordinary purposes glass may be considered inflexible, it is not perfectly unyielding, but any curve that may be imparted to it in order to get it to lie close against an imperfect frame is got at the risk of fracture, not only at the time, but even afterwards, especially if it is moved. It will easily be understood that the larger the glass the more readily it can be forced to fit a faulty frame; but the fact that the larger the glass the greater will be the cost of replacing it in the event of a fracture should not be overlooked. It will be found better not to try and adapt glass to a frame, but to make the frame as it should be for the reception of the glass.

From what has been said, it does not require great perceptive faculties to understand that the flat, or portion of the rabbet on which the glass lies, must be on the same level all round. In other words, the rabbet on each of the sides of the framing must be cut to exactly the same depth. To make the matter perfectly clear, let us suppose that on three sides of a rectangular frame the rabbet has been cut to a depth of $\frac{3}{4}$ in., while on the remaining one it is $\frac{1}{4}$ in. deeper. It is evident that a piece of glass of proper size being let into the frame will lie on the wood of the sides first mentioned without touching the fourth, as it would have done had all four been properly prepared to the same depth. But it may be said that such a discrepancy as that just named could not occur in practice; and this I am ready to admit, for the measurements have been purposely exaggerated in order that there may be no possibility of a mistake in even the greatest novice understanding what is meant. Although a difference of $\frac{1}{4}$ in. has been mentioned, one of even half that might be equally prejudicial. As a further exemplification of the same principle of faulty work, let us assume that instead of the whole of the rabbet of one side of the frame having been cut wrongly, it is only irregular in depth at one part—for example, that at the angle one of the pieces is not quite on the same level as the other—and it will be evident that in this case also the glass cannot bed properly. This defect is in practice much more likely to occur than the other. The remedy, of course, is to pare away with the chisel the superfluous wood, but it will be much better to avoid the necessity for doing this by taking proper precautions to have the work right in the first place. It only needs a reasonable amount of care and skill to do so. In the event of one or more sides of the frame having rabbets too deeply cut, it may be better to level them up by gluing veneer instead of cutting down the side or sides which are too high. The necessity of cleaning away any glue which may have exuded at the mitres, and become hard, must also be insisted on, for nothing is more apt to cause the glass to be fractured, perhaps because a careless worker might not notice its presence till the mischief has been done. Hardened drops of glue which have accidentally got within the rabbet must also be carefully removed. Their presence can

(*Continued on page* 42.)

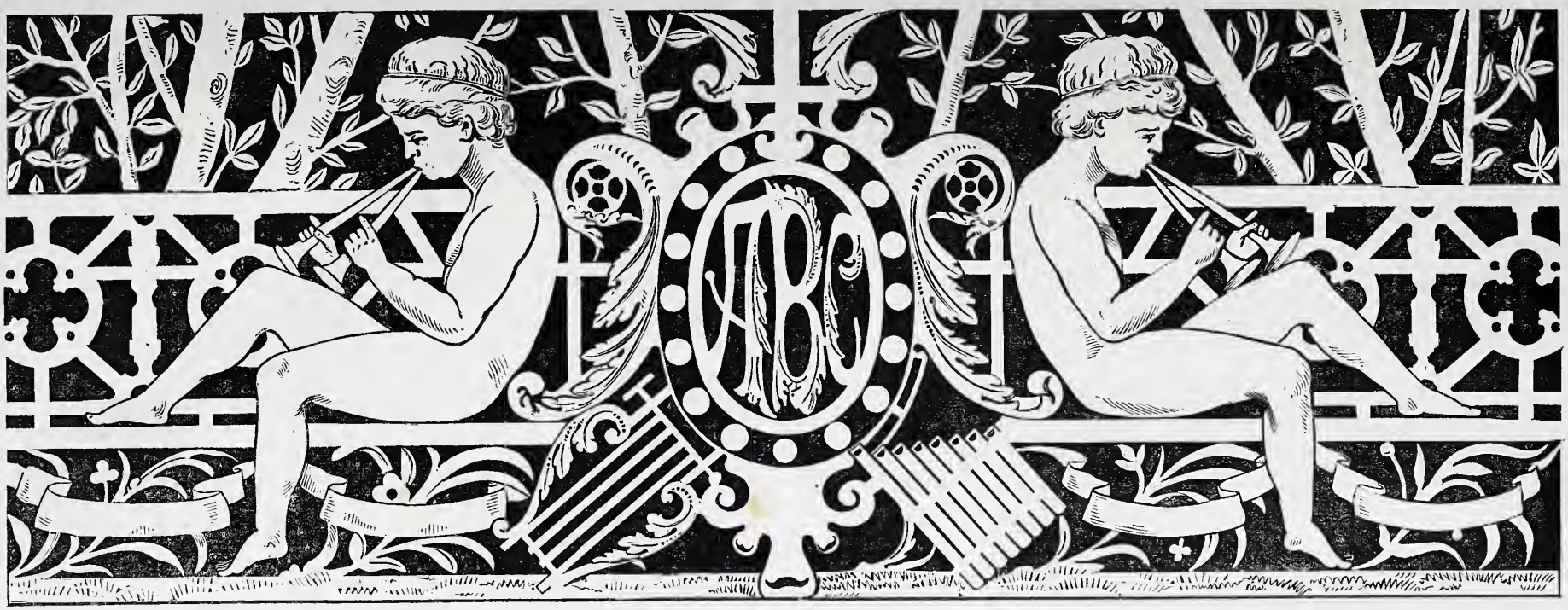


Fig. 1.—Top of Glove Box in Fretwork. Designed by Robert Coxon.

Subject of Design: "Music."

Fig. 2.—Half of Front of Glove Box: reverse at line *c c* to complete.

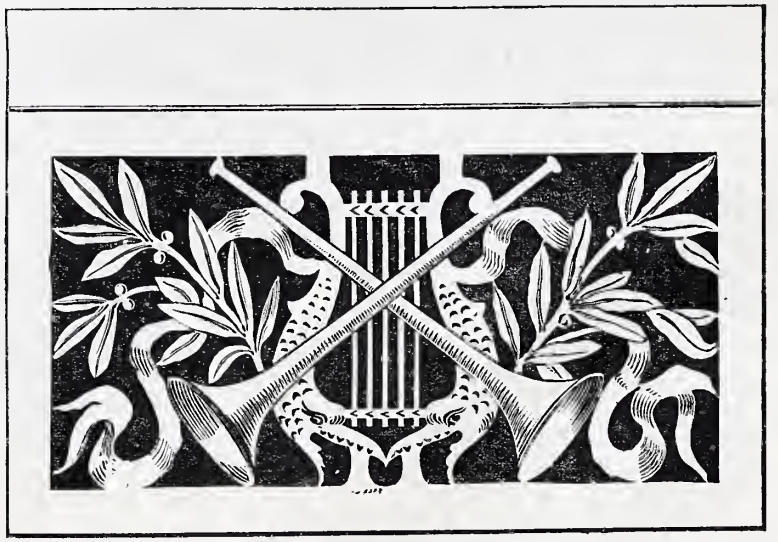


Fig. 3.—End or Side of Glove Box.

easily be ascertained by running the edge of an old chisel or similar tool along the inside of the rabbet.

Nothing further need be said about the rabbet, unless that its width is not important, provided it be sufficient to give an adequate margin to the glass. This, in the case of plain edges, may be taken as not less than ¼ in. Less would hardly do, though it may be, and often is, chanced, while more may be regarded as a waste of material, though, as will be seen later on, when treating of measuring glass, this does not necessarily follow. Plain-edged glass may or may not fill the entire space within the rabbet, as it is of little consequence whether it does or not. The same, however, can hardly be said of bevelled-edged plates, for in such cases the width of the rabbet most suitable may be stated as about ½ in. The reason will be given later on; and in the meantime it may be well to state that as it is, from various causes, not always practicable or convenient to get a rabbet of this width, the difficulty of a wider one may easily be overcome. Whenever practicable, the depth of the rabbet should be such that the back of the glass is below the surface of the surrounding woodwork. Sometimes this cannot be managed, but with a little forethought it generally can be—except, perhaps, in very small thin fancy frames, when the thin patent glass comes in handy.

The measurement of glass for furniture is by no means an unimportant item for the cabinet-maker to observe, not only in getting the actual measurement for the glass-cutter, but in setting out the work. A very short space will show the reasons for this. As is well known, glass is sold by the foot superficial. It is not, however, sold at one uniform rate per foot, irrespective of size, as the rate increases very considerably per foot as the plate increases in size. Thus the price might be, let us say, 2s. per foot super. for plates not over 2 ft., while a plate measuring 15 ft. might be charged for at the rate of 3s. 6d. per foot. It is, further, the custom to reckon a fraction of an inch as a full inch. Thus, a plate measuring 1 ft. on each edge would of course be charged at its actual superficial measurement of 1 ft., but if the dimensions of the plate are, say, 12¼ in. by 12⅜ in., it would be reckoned as a 13 in. by 13 in. plate, containing 1 ft. 2 in. super. Now, supposing that there is a rise of a few pence between the rate for under one foot and that for under two feet, it will be seen that for the sake of the two small fractions of an inch (which it is quite conceivable to suppose might have been dispensed with had a little ingenuity been exercised when setting out the working drawing) a considerably greater cost has been incurred, with only a very slight advantage in the size of the glass. In such a small size as has been named for the sake of illustration, the actual difference is neither here nor there, but it must not be forgotten that the same rule holds good whatever the size of the plate; and if this is a large one the difference in cost may be considerable. The cost of plate glass, whether transparent or silvered, is always by the foot superficial, but when it has bevelled edges an additional calculation must be taken into account. The cost of the bevelling depends on the width of the bevel, reckoned by ⅛ths of an inch; thus, when ordering or asking for quotations, it is necessary to specify ½ in., ⅝ in., or ¾ in., or whatever the desired width of bevel may be. This is reckoned at so much per foot-run, taking the edges of the plate all round, so that on a plate measuring 1 ft. on each edge there are 4 ft. of bevelling, which must be reckoned separately, and added to the cost of the glass otherwise. The custom of charging for fractions of an inch in the bevelling varies, but perhaps the usual plan is not to reckon anything under half an inch, and to charge anything above that as a full inch. Some dealers, however, charge all parts as a complete inch. The difference, in any case, is very trifling. For ordinary articles of furniture, and for moderate-sized plates of, say, anything under 2 ft. square, a ¾ in. bevel is suitable, though, if the extra cost be not objected to, it may be very well a ⅞ in. or 1 in. bevel. A great deal depends on circumstances, for there is absolutely no rule to go by, unless it be that the cheaper class of furnishing houses always, for very obvious reasons, have very narrow bevels on their glasses. When the rates for bevelling are quoted by a beveller or dealer, it must always be understood that the figures apply only to rectangular or round shapes, for fancy shapes, with inward curves or corners, are always charged considerably higher. Thus, it must not be expected that the ordinary rate would apply to such shapes as those shown in the diagrams that are given in page 40. The reason of this is on account of the increased risk of breakage during the process of bevelling. It not unfrequently happens that the beveller objects to give any quotation for such work, but charges for it correspondingly to the amount of breakage which has happened. In other words, the bevelling of irregular shapes must be done at the customer's risk. When a quotation is given, the customer may be pretty well sure that it is sufficiently high to cover the beveller's risks. Circular or oval plates are generally calculated for as if they were square-cornered, the longest measurements in each direction being taken.

In case the word "rate," which has been several times mentioned, might mislead any readers by inducing them to believe that a uniform tariff is adopted by all bevellers, silverers, and glass-dealers or merchants, let it be said that there is no uniform standard of prices, especially for bevelling and silvering. For the glass itself, there is a kind of standard or agreement among some, if not all, of the leading plate glass houses; it is, however, not rigidly adhered to, and the occasional or amateur buyer can hardly expect to be put on the same terms as the constant buyer for trade purposes. Occasionally a wholesale house may be found who will execute a retail or amateur's order, but the prices will naturally be more than for extensive or regular trade orders. It will therefore seldom or ever be to the advantage of the amateur to take much trouble to get in communication with the firm who actually supplies the glass and does the bevelling and silvering, for he will probably save nothing by so doing. Glass bevellers and silverers do not exist in every town of even a large size, but there are few without a good cabinet-making shop to which glass is supplied wholesale, either from London or elsewhere. Mind, when I say cabinet-makers, I do not mean mere house-furnishing dealers, because there are plenty of so-called cabinet-makers who manufacture little or nothing of what they sell, and they can seldom supply the amateur with glass at a reasonable price. Let him, however, go to an actual manufacturing firm of cabinet-makers who are in direct connection with a glass house, and he will probably find that he can do better than by buying direct himself. This applies especially to those who may be living in a place to which the prepared plates have to be conveyed by rail or other carrier: for the simple reason that perhaps the retailer gets several plates sent down at once, and by that means considerably reduces the cost of carriage on each. A single plate sent in a case by itself would cost nearly as much for carriage as if several more were packed in the same case. As plates are generally silvered and bevelled after they have been ordered—*i.e*, they are not kept in stock—it is necessary to give the order several days before the plates are required for use. From a week to a fortnight may be considered a fair time to allow. I have purposely refrained from giving any scale of prices, because these, on account of difference in quality and the various rates of carriage between the nearest wholesale dealer and wherever the purchaser may reside, could only tend to mislead. Any would-be buyer can easily ascertain the price at which he can be supplied in his own neighbourhood. It will be sufficient for him to name the size of the plates he requires, with the width of bevel, without troubling himself to know the rate per foot.

Having now given a few hints about glass as applied to furniture, the next thing will be to describe the actual fixing within the frames of the various kinds which are likely to find their way into the workshop. This, however, must be deferred to a future occasion.

## SOME RULES FOR CONTRIBUTORS AND CORRESPONDENTS.

To save trouble all round, Contributors and Correspondents, present and future, are earnestly requested to note and observe the following Rules, laid down for their guidance, and to adhere to them strictly. Compliance in every particular will save much unnecessary loss of time and waste of material and money in sending back through the post letters, articles, and drawings, to have such things done to them as have been left undone by the writers.

And first let me address Contributors who from time to time have been sending, or intend to send, papers for publication in Work; pointing out to them that the first paper on "The Violin: How to Make It," which appeared in No. 105, is, in every way, as far as arrangement goes, a *model paper*, showing throughout the proper way in which to write articles for Work. To this paper contributors are, and will be, referred, should occasion require me to do.

1. **Syllabus of Contents.**—The title of each and every paper must be followed, *first* by the name or *nom de plume* of the writer, as preferred by him or her; and *secondly*, by a brief synopsis or syllabus of the contents of the paper, comprising the sectional divisions of the subject matter of the article, and the subdivisions into which each sectional division is further divided. The title of the sectional division should form a side heading to the first paragraph of the section, to be set in a black letter as the side heading to this paragraph. Each subsequent paragraph of the section commencing a new subdivision should have its title, as a sub-heading, to be set in *italics*. It is desirable that sections should be broken up into paragraphs as much as possible. This mode of treatment will be found to facilitate reference, and, in a great measure, to cause each article to carry its index with it. Articles for printers should be written on *one side only* of the paper.

2. **Illustrations.**—Illustrations in every case must be drawn on separate paper, and not mixed up with the text in the manuscript, for the manuscript, if accepted, is sent to the printer, and the illustrations to the engraver. Every illustration must have its *inscription* written clearly beneath it, setting forth its number, as Fig. 1, Fig. 2, etc., and showing what it is intended to represent.

3. **Length of Articles.**—For the sake of variety of subjects and to interest as many readers as possible in each number, *ceteris paribus*, preference will always be given to short articles. Papers should range from one column as a *minimum*, to five or six columns as a *maximum*; and illustrations from one-eighth of a column as a *minimum*, to one page as a *maximum*, where the cuts are numerous or necessarily large. Contributors, however, should seek to attain a happy medium, and, whenever possible, to avoid reaching the maximum, either in subject matter or illustrations.

*** *In future, all Papers and Drawings in which these Rules have not been complied with will be returned to the senders for the insertion of omitted matter. The writers of accepted articles now in the Editor's hands must do what is requisite in the slip proofs of such articles, when sent to them for revision.*

A few words may now be addressed to Correspondents who write letters to appear in "Shop," or put questions therein, and to those who write answers to such questions.

1. **Letters.**—Let all letters be brief, and kept as closely to the point as possible. No personalities of any kind can be admitted.

2. **Questions.**—These should be put in as few words as possible, and every question should be written on a separate piece of paper, because questions on different subjects are, as a rule, sent to different persons for reply.

3. **Replies to Questions.**—In answering questions, the replies must be made as brief as possible. In replies running to considerable length, all redundant matter will be struck out, or the answer will be returned to the writer for reduction in length. When an answer cannot conveniently be compressed into a small compass, it is better to obtain permission from the Editor to treat it in the form of a short paper.

4. **Illustrations.**—These must be avoided in "Shop" as much as possible. In future, only such illustrations as may be positively necessary will be accepted.

*** *It must be understood that the preceding Regulations for Correspondence in "Shop" are necessary in order to lighten the pressure on that department of* WORK, *and to enable Replies to Questions to be given far more quickly than at present.* THE EDITOR.

## SHOP:

### A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

### I.—LETTERS FROM CORRESPONDENTS.

**A Useful Candlestick.**—W. J. F. (*Cork*) writes:—"The artiele here described does not claim to be ornamental, but I think there are few tradesmen or amateurs who would not at one time or other find it *useful*. We often hear the request from a worker for 'somebody to hold the candle.' This article, without altogether doing away with the necessity for 'somebody,' will do so in some cases, and that is an advantage. Its construetion is simplicity itself. It consists of a base and two sides. Tbe base may be any piece of waste wood, say, 10 in. by 4½ in. by 1½ in.; and the sides, say, 3 in. by 2 in. by ½ in. Of course, the sides may be as long as desired, and of any proportions; a higher eandlestick would require a larger base. The long edges of the base will be bevelled slightly towards the top; a ¼ in. of bevel will be enough for the measurements given. The sides are then nailed on to the base, and left loose at the top. It will then be found that they have a spring at the top strong enough to hold a candle. The inner parts that grasp the candle should be hollowed slightly with a gouge. The candle can be pushed up or down easily, and will remain in position. Thus you can make a candlestick of any height—8 in. or 9 feet if you wish. A smaller size, about 1¼ in. high, is very handy for bench use, and a great improvement on the 'piece of wood and four nails,' an arrangement which does duty in so many places."

Useful Candlestick.

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Relief Stamping.** — JOINT. — The specimens which you send are all very good. In the larger ones, where the line and a few of the letters are broken, the fault is but trifling; it may arise from several causes. First, the die may not have been properly filled up with colour. Use a good stiff brush, and daub well into the die. Secondly, your method of "wiping" or cleaning may be at fault. Try the old-fashioned style of "wiping" on paper, and, if possible, use hard paper—waste of cream-laid paper. Avoid thin "printing." Be sure that your "matrix" is sharp. The die itself might want "picking out" or touching up. I am inclined to think that your matrix has not been sharp enough. You will find this out by looking at the reverse side of the stamped sheet. The impression will appear lighter at the faulty parts.—G. C.

**Venetian Blinds.**—BENEDICT.—The rollers for the action may be obtained of any ironmonger, or at an upholsterer's warehouse. The article promised will soon appear.—B. A. B.

**WORK Index and "Shop."** — There is published a complete Index to Vols. I. and II. The "Shop" supplements are already paged.

**Speaking Machine.**—H. M. W. (*Blackpool*).—You want to know how to make a "speaking machine" in the simplest manner. Perhaps the article on the "Phonograph," which is to appear shortly, will take your fancy.—W. D.

**Glass Writing.**—A. H. (*Stratford, E.*).—The following matter on writing on glass is to be found in "The Art and Craft of Sign Writing," by Mr. Wm. Sutherland:—Chap. VII., Decorating on Glass; Chap. VIII., Gilding on Glass; Chap. IX., Gilding on Glass (*continued*); Chap. X., Gilding on Ground Glass, etc.; Chap. XI., Gilding and Ornamenting on Glass (the application of printing processes); Chap. XII., Embossed and Figured Glass; Chap. XIII., Embossing and Etching on Glass with Acids; Chap. XIV., Embossing Flusbed Glass; Cbap. XV., White Acid Method; Chap. XVI., Another Method of Embossing on Glass. If you require a copy of this work, you must hurry up, as there are only about forty copies left, and the book will not be reprinted. Queries cannot be answered by post.—H. L. B.

**Lacquering.**—C. B. (*Huddersfield*).—There must be something radically wrong somewhere if, as you say, you *invariably* get your lacquering streaky. This is often due to the separation of the brush—that is, the hair of the brush, etc., instead of keeping in one broad surfacc, spreads out in two or three portions pointed at the ends; the parts between the points thus do not get their share of lacquer. You can easily see if this is the cause in your case; if so, get better brushes, with a good body of hair in. The best "wrinkle" I can give you is to go in for the new American substitute for lacquer, which is now used by most of our leading brass manufacturers. It is called "Zapon," and is sold by the Fredk. Crane Chemical Co., 22, Newhall Hill, Birmingham; and Short Hills, New Jersey, U.S.A. I find it far superior to ordinary lacquer, both in ease of application and also in appearance, which is the chief thing after all; for, as you say, it is annoying after getting an article up to perfection, to spoil it in the lacquering, but with zapon there is very little fear of this, and the article looks just as handsome after lacquering (or zaponning, as it is termed) as it did before. For figured work especially it is suitable, as it preserves the finest hair-lines in all their metallic sharpness. It does not "set" so quickly as lacquer, which is an advantage on plain, highly polished surfaces, such as you speak about. I have no doubt that, from the reading of this, many will try a sample, as lacquering seems a "crux" for many; and, therefore, I append a few instructions for its use, trusting they will prove of service to you and others who may read them. In the first place, it is very important that as much care should be taken in cleaning the work, and freeing it from all grease, polishing material, etc., as in ordinary lacquering; and the zaponning should be done in a room which is free from dust and draughts, and the articles should not be handled, as the fingers leave marks on the polished surface, and grease as well. Articles to be zaponned do *not* require to be heated, another great advantage, but it is best applied in a warm room, and the articles should not be quite chilly. There are two ways of applying zapon—viz., by "dipping" and by "brushing." It is recommended to dip all articles that will admit of so doing, but in cases where, from consideration of expense or from the size of the article this is not practicable, brushing may be resorted to. In this case, the zapon should be flowed on with a full brush, care being taken not to brush over any part a second time until it has become dry, when any part that has been missed may be touched up again. Wave marks or brush marks will entirely disappear when dry. Should the articles peel after coating, the cause is grease. The foregoing remarks apply to "Dip Zapon." "Brush Zapon" should be applied as thin as possible; therefore, wipe the brush free from all excess, the same as in ordinary lacquering. Brush once only over the surfacc to be covered, and allow it to dry; a second coat may then be given if desirable, but it is not necessary if the work is covered. It can be had colourless, and in various eolours, gold, green, etc., etc.—R. A.

**Bird Cages and Wire Baskets.**—KENT COAST. —Consult the Index to WORK, Vol. II., for Bird Cages. Wire-working in all its branches is treated in this volume, and commenced in No. 105 of WORK.

**Speaking Tube.** — J. McD. (*Glasgow*). — You need have little fear of your speaking tube not acting, provided you take care to fit it up properly. Use good tubing, about ¾ in. internal diameter. Be sure that the joints are quite sound and air-tight, and that the interior surface is quite smooth. You could, of course, use telephones, but they would be much more costly. A complete installation, including bells, switches, etc., would cost £5 or £6. Messrs. Cox & Co., 11, Fetter Lane, would supply you with all requirements for the above sum; you could easily fit them from their instructions.—W. D.

**Paper Cap.** — CARADOC. — It is extremely easy to make these caps, but extremely difficult to explain clearly how it is to be done. However, with the help of diagrams, I hope to be fully understood. First, make the paper exactly square, three times the size of the crown—thus for 7 in. square cap, the paper must be 21 in. by 21 in.; for 6½ in. cap, 19½ in. by 19½ in.; for 6 in. cap, 18 in. by 18 in. Now spread your paper flat out before you as in Fig. 1, and on the diagonal line A B fold the point C on D, crease it, and again spread out the paper flat; and in like manner on C D fold the point B over A, crease it, and flatten out again. Secondly, fold the square into thirds, first on the line E E, and next on F F (see Fig. 2); then fold the strip again into thirds on G G, H H (see Fig. 3). Now spread the paper out flat. It will then be seen that the square G G, H H will form the future

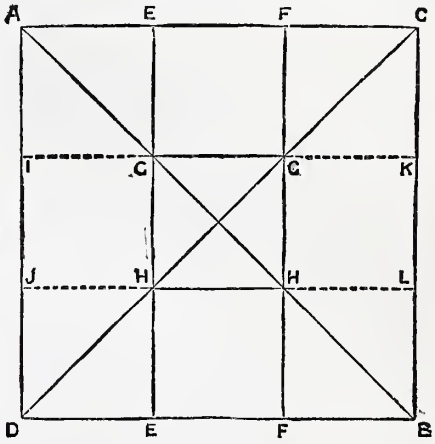



Fig. 1.

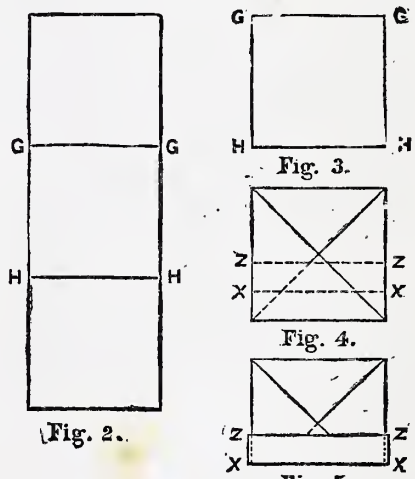



Fig. 3.




Fig. 2.




Fig. 4.




Fig. 5.

Paper Cap.

crown, whilst E F, G G, and H H, E F will form two plain sides when the said sides are folded at right angles to the crown. In Fig. 1 all the outward creases are drawn in full line, whilst the inward ereases are only dotted. Now to form the other two sides of the cap, and at the same time to maintain the plain sides in their proper position. Fold down and pinch together on tbe respective lines A G, H D, H B, and G C, tbe small squares A E I G, J H D E, H L F B, F C G K into triangles, and fold them against the two sides I G J H, G K H L, with D upon I and A upon J on one side, and B upon K and C upon L on the other side (see Fig. 4). Now fold up all round about 1 in. of your four sides (see Fig. 5), and proceed then to turn up a second time all round at X X and Z Z, thus forming a band which will firmly hold the cap together.—J. W. H.

**Scene Painting.**—FRETWORKER.—Articles upon this subject have already appeared in Vol. II. The other subject you refer to will be treated in due course.

**Poles of Magnetic Needle.**—AMATEUR.—You are quite right. The north pole end of the compass needle is, strictly speaking, the north-seeking end of the needle, and is therefore the south pole of the magnetic needle employed in the compass. But this end, by common consent, is regarded as the north pole of the needle, and the relation of other magnets to this is determined accordingly. In converting a steel bar into a bar magnet by enclosing it in an electrical solenoid, we regard the end to the left of the course of the electric current as the north pole end of the magnet.—G. E. B.

**Charge for a Voltaic Battery.**—R. L. (*No Address*).—If the battery is intended to be a Bunsen, charge the cell containing the zinc with one part sulphuric acid in from eight to twelve parts of water. Allow the mixture to cool before placing it in the cell. Charge the cell containing the carbon with strong nitric acid—no water in this. The acids must not be mixed together. The carbon plates should go in the porous pots with the nitric acid, leaving the outer and larger pots for the zinc cylinders and the mixture of sulphuric acid and water.—G. E. B.

**Rendering Parchment Transparent and Waterproof.**—BANNERMAN.—So far as I understand his requirements, I imagine that BANNERMAN might get what he wants by following the process sometimes resorted to for making imitation oil paintings from old mezzo-tinto engravings. To do this, the back of the print is covered with repeated coats of *mastic* varnish till it becomes transparent; oil colours, chiefly in flat tints, are then laid on the back. The best advice I can give to BANNERMAN is to try the mastic varnish in this way. As I do not know his purpose, I cannot say positively that this will give as much transparency as he requires, but I presume that it will; and it will certainly make the parchment waterproof, without impairing its strength, which are points upon which he insists. Of course he must take care that his parchment is of uniform thickness, or it will not appear equally transparent in all parts.—S. W.

**Alarum Clock.**—C. K. (*Mildmay Park, N.*).—Take out the movement, and on the arbor that carries the alarm hand (that is, if a lever; you do not say if a lever or pendulum) between the plates is generally a spring to hold the arbor tight. This spring may have got loose by the pins coming out; if so, pin it up tight. Or perhaps the wheel that rides loose on the arbor, and has a notch cut in the edge of the collet or sleeve, and is pressed against a pin going through the arbor, gets fixed in rising up the slope. Smooth the slope up nicely, also the pin, and put a little oil, then try. Or perhaps the arm on the hammer is bent down out of the way of the hook or up too hard against it. I think you will find one of above faults with it.—A. B. C.

**Enamelling Metal.**—J. P. (*Bethnal Green*).—The so-called enamel, such as is applied to bicycles and tricycles, is simply a fine japan, but enamel has somehow a better sound, or is considered a more taking name, so I suppose that is why the vendors of such articles so term it. Such being the case, we naturally arrive at the conclusion that it is applied in the same way. And as to the question whether it is too difficult for an amateur, that depends upon whether the amateur is prepared to go to the expense of erecting an oven large enough to stove the parts in, for this is the secret of good enamelling, or japanning, whichever you like to call it. If, as is most likely the case, you are not prepared to do this, there are for your choice the various articles advertised for this purpose, such as Foochow, Guest's, Aspinall's, etc.: you will find their prices and addresses in any issue of the cycling papers. They answer their purpose fairly well, but are not to be compared with stoved work. I am a bit of a cyclist myself, and when my "steed" requires a fresh "coat," I purchase a little best black japan (*not* Brunswick black) and a little of the best carriage varnish that I can get for money. Two coats of the black and one of varnish, and I have a nice-looking machine again, and the renovation costs not more than 1s. 6d., and lasts a whole season, which is as long as I care for. Moral—Go and do likewise.—R. A.

**Lamp for Box Battery.**—A SUBSCRIBER.—I infer your lamp to be a 10-volt 8 c.p. incandescent electric lamp. As you cannot light such a lamp with current from a small 4-celled box battery, the fault lies more in the selection of lamp than in the construction of the battery. The lamp should only require from 6 to 8 volts—six, rather than eight—but not higher than the latter figure, or you will get no light at all. Mix the bichromate of potash solution with the sulphuric acid in a stoneware jar, and allow the liquid to cool before placing it in the cells. The brass tang may be soldered to the zinc if the joint is well made, and the lead heads for the carbons may be square instead of round, without in any way interfering with the working of the battery. Add another cell or two to your battery if you are going to use the same lamp, and you will then get a light from it.—G. E. B.

**Drilling China.**—H. P. (*Brighton*).—The best and easiest way is to drill with a chip of diamond set in a tube, and used with a special drill, such as is illustrated in the article upon "China and Glass Riveting" in No. 53 of WORK. Read this article, and if it is such work you wish to undertake, you will, I think, gather some useful hints from it.—W. E. D.

**Stuffed Bird-Case.**—F. M. (*No Address*).—I send a sketch of bird-case. To make it, proceed as follows:—Procure a piece of pine 3 ft. 4 in. long, 2 in. wide, and 1¼ in. thick, and plane it up, then run a rabbet ½ in. wide and ¾ in. deep (as per sketch A, Fig. 3) for the bottom board to rest in; then run the rabbets and mould as Fig. 3, B, then procure a piece of pine 1¼ in. square, 7 ft. 6 in. long; cut off a piece 3 ft. 7 in. long, and after planing up square, run a rabbet ¼ in. by ⅜ in. down each side as per sketch (Fig. 4), then take the other piece and rabbet it ¼ in. by ⅜ in. down one side only, and down the other a rabbet ½ in. each way; this is for the back to rest in (Fig. 5). Get another piece 3 ft. long, and plane up as Fig. 6; this is for the top frame. We will now make the framework. Take the piece of base framing and cut a piece off 1 ft. 7½ in. long with a mitre at each end, then cut two more pieces 7⅞ in. long with a mitre at one end only, and proceed to glue and nail them together like Fig. 7, with the large rabbet inside. Now take two pieces like Fig. 4, 1 ft. 9¼ in. long, and cut a bit out at one end from corner to corner of each rabbet as per dotted line, and ½ in. deep; this will allow the front pillars to rest on the base frame at the points C, C. Now, if you place the front pillars on the base frame, you will find that the rabbets are exactly in

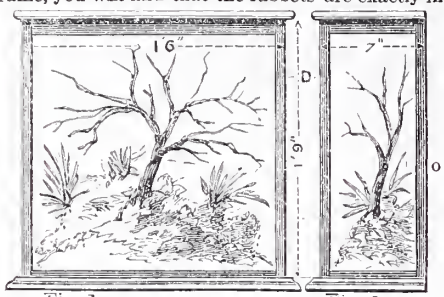



Fig. 1. Fig. 2.

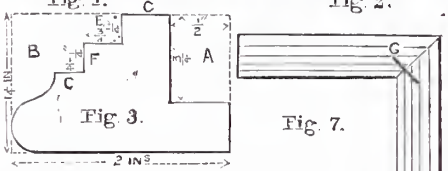



Fig. 3.

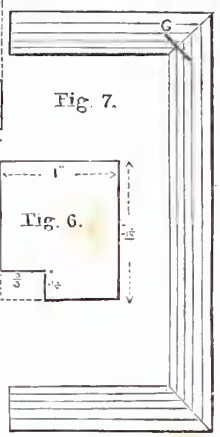



Fig. 7.

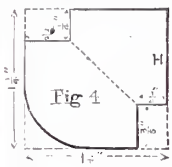



Fig. 4




Fig. 6.

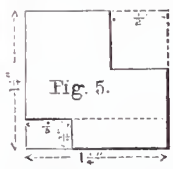


Fig. 5.

**Stuffed Bird-Case. Fig. 1.—Front. Fig. 2.—End. Fig. 3.—Base Frame. Fig. 4.—Plan of Front Pillars. Fig. 5.—Plan of Back Pillars. Fig. 6.—Top Frame. Fig. 7.—Mitred End.**

one place, and by cutting the corner of the base frame down to C (Fig. 3) as per line G (Fig. 7), until the front pillars are on a line with F (Fig. 3), you will be able to glue and nail them in position as shown in Figs. 1 and 2 (D, D). Now take the piece that you have rabbeted (Fig. 5) and cut two pieces off 1 ft. 9½ in. long each, and then cut them as per dotted line (Fig. 5), and ½ in. deep, care being taken that you do not cut the wrong end, as all the rabbets that are ¼ in. by ⅜ in. must come together for the glass to fit in. Now, if you put the piece on Fig. 7 with the rabbets in place, you will see that you can cut a piece out of the end of the base frame end 1 in. long and ½ in. deep, which will let the ends of the back pillars rest on C, C (Fig. 3), the same as the front pillars. Now take the piece of top frame and cut a piece 1 ft. 4 in. long, and cut a piece out of each end ¼ in. long and ⅜ in. wide from the back; this will allow it to fit into the rabbet of the front pillars and also the back of the same at H (Fig. 4). Now cut two more 5 in. long for the ends; cut them the same as the front, and glue and nail all firmly together. Now take a piece of ⅛ in. pine, 1 ft. 7½ in. long and 7⅛ in. wide, plane it up, and round the edge off on three sides, leaving the back square. Now proceed to glue and nail it on the top, letting it project ⅛ in. on the front and sides only, and you will have frame like Figs. 1 and 2. Now take a piece of board and fit it in the rabbets of the base frame in the inside for the bottom of the case, then procure sufficient board to make the back, and let it just drop inside the rabbets of the back pillars, so that it will come flush with them at O (Fig. 2). You can now use your own taste in blacking or gilding the frame, but if the front pillars are stop-chamfered and picked out in gold, with the other parts ebonised, you will be quite satisfied with the looks of the case. Now put in the glass, or you can fasten in the back, covering it with calico stretched tight to paste the paper on, and after pasting the paper on and distempering the back and top and the inside of the front pillars, you may make your rockwork or tree on a separate board and slip it inside the case, fastening it down with screws. You can now head in your glass and black the back of the case with glue and lamp-black. Of course, you can use your own taste for the front pillars, but I do not like turned ones; they are not as neat as one that is stop-chamfered and beaded like the moulding you buy in black and gold.—J. A. W.

**Stain.**—S. S. (*Salford*).—To stain birch a mahogany colour is not difficult. As good a stain as any for the purpose is a decoction of logwood chips in water. Test the strength on a piece of waste wood before using it on anything of value. Your question about matching up teak is one that cannot be answered satisfactorily, for in this class of work no definite directions can be given. One might just as well ask how an artist gets effects in a picture, and then expect to do the same when one gets to know the paints he uses, without having any knowledge of the art of painting. Matching-up is an art which may to a certain extent be learned under a good teacher, but hardly at all from verbal instruction. I should experiment with those pigments which seem most likely to give the tints you want, and carefully note the results. The various shades of brown are most likely to be useful to you.—D. D.

**Ebonite.** W. A. N. (*Forest Hill*).—I do not know of any material by this name, but from your description it is probably the same as vulcanite. If so, it can be got from any shop where indiarubber goods are sold. It can be cut with a saw and other tools. I presume you want it for fret-cutting. It is not very pleasant to work with—at least, not so much so as xylonite, with which there is not the slightest tendency to chip. However, your best plan will be to get a small piece of each, and, by trial, ascertain which of them suits you best.—D. A.

**Varnishing and Polishing.**—T. B. (*Dodworth*).—What you ask for are apparently full directions for both polishing and varnishing, as well as staining—in fact, a complete guide to the work. To give this is, of course, out of the question in "Shop." As you say you are quite unacquainted with the art of polishing, I am afraid I must ask you to wait a bit before your wishes can be gratified; but in the meantime, you will do well to read over the numerous hints on the subject which have already appeared in these columns. Perhaps it may be of assistance to you to recommend you to buy stains ready made, and to varnish with a brush instead of polishing with a rubber. Copal or any hard clear varnish will do for the purpose. I hope these hints will be of service to you. If you find any difficulty, let us know, and we will do what we can to help you, but it is impossible to give a novice full instructions for the practice of a difficult art in all its phases in "Shop," or even in any one number of WORK.—D. D.

**Safety Cycles.**—J. W. H. S. (*Sharow*).—A series of articles on this subject will appear in this volume of WORK.

**Silvering by Nitrate.**—G. O. M. (*London*).—There are several recipes given for this, but perhaps the two following will be as easy for you as any:—(*a*) Dissolve ten grains of pure nitrate of silver in 1 oz. of water; stir with a glass rod, and drop strong ammonia in until the brown precipitate is redissolved. Make separately a solution of ten grains of Rochelle salt in 1 oz. of water. Clean the glass well, and warm by the fire or in the sun; make a wall of putty, beeswax, or other suitable substance round the edges to prevent the liquid flowing off. When ready, pour on sufficient of the two solutions to cover the glass to a depth of about ¼ in., using two parts of the nitrate to one part of Rochelle salt. Let it stand, if possible, in the sunshine for an hour or two, until the silver is deposited; then pour off what remains, and wash four or five times with soft water; let it dry, and finish by varnishing either with equal parts of beeswax and tallow, or one composed of gum dammar, twenty parts; asphalte, five parts; gutta-percha, five parts; and benzine, seventy-five parts. This latter sets very hard. (*b*) Dissolve 1 oz. of nitrate of silver, ½ oz. of spirits of hartshorn, and 2 oz. of water; filter; then add 3 oz. of spirits of wine or naphtha, and about twenty-five drops of oil of cassia; let it remain a few hours, when it will be ready for use. Prepare the glass in the same way, and pour on the solution; then drop into it, in different places, a few drops of oil of cloves and spirits of wine (one part of oil of cloves to three parts of spirits of wine). The more oil of cloves the quicker the deposit, but too much should not be used. Finish off in the same way as in the first recipe.—W. E. D.

**Mould for Lead Heads.**—H. F. F. (*Hackney*).—The mould for the lead castings on the heads of carbon plates used in Leclanché cells may be made of any moulding material, such as sand, loam, or plaster of Paris. Get an old carbon, and use the head of this for a pattern. The carbon plates have the heads cast on them head end downward, resting on the tang of the binding screw thrust into the bottom of the mould. An iron mould, cast to the shape of the lead head, will turn out the sharpest and best finished castings, and can also be worked at a faster rate than moulds made in sand or in plaster of Paris.—G. E. B.

**Carbon Plates.**—F. W. (*Addlestone*).—If the gas retort carbon is dense, close-grained, and hard, the plates cut from it will do equally well with those bought elsewhere. Use an old saw or one improvised from hoop iron, plenty of wet sand, and elbow grease without stint. It is a dirty and a laborious job.—G. E. B.

**Slides of Brass Wind Instruments.**—YORKIO.—Heat the outside of the slides over a gas jet, taking care not to fuse the solder. Pour a little *oil* (not paraffin, which is not a good lubricant) on the junction of interior and exterior slides. When the oil has been drawn in through the action of the heat, pass a narrow slip of stout linen or canvas through the bow of slide, and fix the ends in a vice, or tie them round some fixed object; then pull the instrument steady and firmly. If the slide cannot be now drawn, the bow must be unsoldered, and each side be attacked separately. For this purpose a small mandrel (which can be made in wood), to fit tightly the bore of slide, is required. When inserted in the slide, it should project sufficiently to give you good purchase. Then, after again heating and oiling, try and turn the slide, drawing it at the same time firmly toward you. Should this fail, there is probably a bruise in the slides, and it is a case beyond amateur curing. Send the instrument to the maker. If the bruise cannot be taken out by acting upon the suggestions given on page 780 in No. 100, you had better send it to a maker. Any attempt to straighten the bow of hell would almost certainly result in cracking the tubes; and even if you succeeded in escaping this danger, you could not bend it back to its original shape again.—G.

**Tobacco.**—N. M. (*Norwich*).—Tobacco plants are raised from seed, which, in this country, is commonly sown in heat (in a frame, pit, etc.) in the month of March, the seedlings being pricked out into small pots, and not placed in the open air till the mild weather of June has set in. Or, in the open air, the seed is sown in sunny borders early in May. The tobacco plant loves a warm, sheltered spot, with a southern aspect. It is very susceptible to cold east winds. It requires a rich soil—to plant it in any other is indeed seed and trouble thrown away. It should have a deep, free loam, or ground deeply trenched with well-rotted manure. In dry weather it needs an abundance of water. For the purposes of commerce, the plants are cut when the leaves begin to change to a yellowish-green. They are first laid upon the ground to dry, the thicker stems being slit through to facilitate drying. Afterwards they are hung on poles, so that the air may have free access to them. If, as is often the case in this country, artificial heat is needed to assist, it must be of a very gentle kind. When just sufficiently dry (not so dry as to break), the tobacco is heaped together on wooden platforms to ferment or "sweat." The drying and sweating are very delicate operations, and much care and skill in them are required to produce a high-class article.—A. Y.

**Silvering Mirrors.**—E. T. (*Blackburn*).—Several replies have been published upon this subject during the last few months in WORK. The process is as follows:—A piece of tinfoil is covered with mercury (quicksilver); a sheet of paper is laid upon it, and the glass upon the paper, which is then withdrawn, leaving the glass resting upon the foil and quicksilver; it is then weighted down until dry. Although this sounds rather easy, in practice it is the reverse, and the larger the glass the more difficult it becomes for an amateur.—W. E. D.

**Hydrofluoric Acid.**—ETCHER writes:—"Can you tell me how the white acid used in glass-etching is made?"—By white acid, I suppose you mean hydrofluoric acid ($H_2F_2$), or fluoric acid, as it is sometimes called. It is made as follows:—Powdered fluoride of calcium is placed in a leaden retort, and twice its weight of sulphuric acid (oil of vitriol) poured upon it, and by means of a stick is made into a paste; it is now gently heated, when gas is freely given off; this must be collected in another leaden vessel containing water. The water absorbs the gas, and it is continued until it will take up no more. The water is thus highly charged with acid, and is the liquid hydrofluoric acid used in etching glass. Great care must be used in making it: the operation ought to be conducted in the open air, as it acts injuriously upon the organs of respiration. The vapours produce pain at the finger-ends, and drops on the skin act like a red-hot iron, producing painful sores; it must also be stored in indiarubber bottles, as it corrodes and dissolves glass. Should you only need a small quantity, it is far better to buy it than to make it, on account of the difficulty and danger. You ask "how the designs are put on." The glass is coated with Brunswick black, beeswax, or some other substance that will resist the acid, and the design is cut through that down to the wax. Designs are cut with wheels of different diameters, mounted in a lathe, and wetted with emery and oil.—W. E. D.

**Coloured Views.**—A. E. S. (*Glasgow*).—I cannot decide to what class of articles you refer when you ask for the process of producing "coloured view articles," such as are sold at "coast fancy goods stores." Now there are several kinds—some being coloured photographs, and mounted in optical contact with glass. Some small articles are simply coloured prints in optical contact with glass; others again may be printed in inks, such as common earthenware is done with. Perhaps this is what you mean as you mention ink. How did you make your ink? Did you use metallic colours? None other are of any use with glass or pottery. This probably was the cause of your failing.—W. E. D.

**Engine Power.**—G. D. (*Sheffield*).—If there is no expansive working—that is, if the initial pressure of 60 lb. is continued to the end of the stroke—you would get, allowing for friction, about a ½ h.p. from your engine, rather under than over perhaps. By calculation, it would come out ¾ h.p.: thus,

$$\frac{\text{pressure} \times \text{area of piston} \times \text{velocity in feet per second}}{33000}$$

$$= \frac{60 \text{ lb.} \times 3{\cdot}1416 \times 133 \text{ feet}}{33000} = {\cdot}75 \text{ h.p.}—\text{J.}$$

**Camera.**—H. W. (*Gateshead*).—The shutter most generally approved for studio work is Cadett's Patent Shutter, which is simply a flap shutter attached to the back of the lens mount and worked by the expansion of a small bellows working between the sides of a case with a movable lid, to which the shutter is connected. The pneumatic principle of action is, of course, the same in all shutters, being the expansion in a small air-tight bag at one end of a tube by the compression of a larger one at the other. A variety is made by the propulsion of a small sealed tube from another open one, in which it slides, the sealed tube pressing upon a lever or trigger as the case may be, as in Fig. 1. The dotted lines show the indiarubber tube connected with a ball, from which the air is forced by pressure with the hand; A represents the short sliding tube with stops. The advantage of having the shutter work at the back of the lens inside the camera is that it can be used without attracting the attention of the sitter, an important matter where children are concerned. The shutter itself is made of a frame of bent wire, over which black velvet or cloth is stretched, and of a size sufficiently large to cover, and a little to spare, the lens to be used. The attachment consists of a ring of wood covered with cloth, with a loose piece that can be pressed against the lens mount by means of a thumbscrew, as in Fig. 2. The manner in which the flap is raised and lowered is that the wire framework, which

Fig. 1.

Fig. 2.
Camera Parts.

works on a bar above the lens, is brought down on one side in the form of a short lever, against which the pneumatic arrangement presses, thus raising the flap. A piece of elastic is stretched across the flap a little below its point of suspension, that immediately on the removal of the pressure brings it (the flap) back to its original position over the lens. There is a great variety of methods of utilising the air pressure and forms of shutters, but up to the present time for studio work the simple flap is preferred. With regard to the other questions, the use of hinges in sliding frame is that a longer extension of the camera may be had than if it were only the size of the solid unhinged part of the baseboard. In the diagram shown, it will be seen that without hinges the frame would prevent the closing of the baseboard, which, although not perhaps clearly shown, does fold up, the shorter piece being of the width of the front woodwork of the camera. The bent wire acts as a spring when either one or both of the shutters are in place, and the use of it is to stop out the light by pressing one of the strips of wood to cover the opening on the withdrawal of the shutter, and the spring is got by the pressure of the wire against the shutter that remains in place. If the division between the plates is too thick for the plates used, there is no objection to making it of thin zinc or other metal blackened. The buttons that keep the plates in position are sunk level with the framing. The less play between the division and plates the better, so long as there is room, making allowance for the varying thickness of the glass in general use. If metal is used, a weak spring fixed on each side is an advantage. Some prefer a piece of blackened eardboard, slightly buckled. The idea is to keep the plates in proper register by pressing them gently against the buttons in front, whatever may be the plan used to effect it.—D.

**Engine, etc.**—C. S. W. (*Settle*).—It will be quite sufficient to add the names of the towns only in which the firms you name carry on business, provided you put on the envelopes the nature of the business. If you want a model, you cannot do better than advertise in WORK. There will probably be an horizontal engine described in WORK shortly.—J.

**Paper-Making Machinery.**—H. W. C. (*Lee, S.E.*).—We do not see why the idea should not succeed, and it appears to be novel. If it does the work proposed, it would probably be worth patenting.—C. E.

**Electrotyping.**—ELECTRO.—(1) The wires leading from the dynamo to the vat get hot, because they are not large enough to carry the current required in the vat. The sulphate coating has nothing whatever to do with the heating. (2) If the wire from the negative pole of the machine is connected to a stout metal bar on which the slinging wires or clips of the moulds rest, and the wire from the positive pole of the machine is connected to a similar stout metal bar supporting the anodes, there should be no necessity to connect the wires at both ends. The resistance is not at these points, but in the leading wires themselves. (3) Electrotypes for the press are mounted on wood blocks, the whole being made "type-high." Electros on metal are employed for ornamental purposes. The prices charged for these are variable.—G. E. B.

**Nickel Bath.**—B. J. (*Dorking*).—To make up twenty-five gallons of nickel solution for plating, procure ½ cwt. of double sulphate of nickel and ammonia. This will cost about 23s. from such firms as Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham. Dissolve the nickel salt in hot rain-water, and filter it through calico into the vat; then fill up with filtered rain-water. The solution should be neutral to blue litmus paper, and have a specific gravity of 1·520, as tested by a direct reading specific gravity hydrometer. If it is acid, the acidity must be corrected by adding sufficient liquid ammonia. If the solution is too dense, withdraw some of the liquid into another vessel, and fill up the vat with rain-water. As a rule, use 1 lb. of nickel salts to each gallon of water. Work with a large surface of pure nickel anode, obtainable where the salts are to be obtained.—G. E. B.

**Pencil-Holder.**—PEN.—We have examined the description and sketch sent us, and it appears to be a useful and practical idea, but whether it is a novelty we could not say without a search to ascertain if prior rights have been established by anyone. There is not the least doubt but that many less promising inventions are patented daily; but before taking any steps in regard to patenting, you should make, or have made by a competent person, such a search as would decide this important point, and then you will be in the proper position to consider what you had better do in the matter.—C. E.

**WORK Volumes.**—FAIERO.—You should address the publishers—Messrs. Cassell & Company, Limited, London, E.C.—but the price of a WORK volume (7s. 6d.) is so small that it will be hardly worth your while to write about the cost of exchanging numbers for a volume.

**Model Electric Lights.**—F. E. O. (*No Address*).—Articles on the above subject appeared in WORK, Nos. 76, 82, 89, 92, 94, 97, 99, 100, and 104. They can be had through your bookseller, or from the publishers, Messrs. Cassell & Company, Limited, London, E.C.

**Harmonium Reeds.**—It is useless to place harmonium reeds on pipe organs, as the reeds will not keep in tune with the pipes. Change of temperature, which will lower the pitch of the pipes, will heighten that of the reeds, so that the resulting difference is considerable. The only thing practicable is to add a set of reed pipes, a small trumpet for loud stops, and an oboe or clarionet for softer tones. You do not say what stops your organ is to contain, so I am unable to advise as regards any additional flue pipes. As regards a black stain for wood, I do not think you can get anything to sink deep into the wood unless it is put on boiling hot; but perhaps some other contributor may be able to assist you in this matter.—M. W.

**Marbling Colours.**—W. J. J. (*Southwick*).—Marbling colours ready ground, in air-tight tubes, which I mentioned in my articles on "Bookbinding," may be obtained in large or small quantities from Messrs. Berry & Roberts, St. Bride Street, London, E.C. They vary greatly in price.—G. C.

**Stitching in Binding.**—NIL DESPERANDUM.—I have not the slightest idea of what you want. Here is your query: "Is there no other way of stitching other than stitching through the cardboard and buckram in bookbinding; and if so, will you kindly let me know?" Write again, and try and explain your difficulty a little more definitely.—G. C.

**Stamping.**—J. S. (*Amsterdam*).—You have used Dutch metal instead of gold-leaf, which is really the cause of your failure. But if you follow carefully the instructions given on the page you quote, use real gold, and use the powder supplied by Mr. W. Valters, 1, Pembroke Terrace, The Park, Salisbury, Wiltshire, you will have the best stamped silk, satin, or velvet in Europe. Do not use bronze powder or Dutch metal, which, although cheaper in the first cost, turns out the most expensive in the end. When you have tried the powder, you might report, as I would like to know if you succeed to your own satisfaction.—G. C.

**Index to Vol. I.**—L. K. (*London, S.E.*).—An Index to Vol. I. of WORK has been ready since the volume ended, and has been advertised many times in WORK. The price is 1d., or post free for 1½d., from the publishers, Messrs. Cassell & Company, Limited, London, E.C. The Index to Vol. II. is now ready, price 1d.; post free, 1½d.

**Gutta-Percha Soles.**—WEEKLY READER.—An article on the above subject appeared in WORK, No. 102. It was entitled "An Easy Method of Resoling Boots." This will suit you, probably.

**"Patent."**—D. K. (*Dumfries*).—Provisional protection gives no *legal* right to the use of the word "Patent." The legal right to do so is only acquired when the patent has actually been granted.—C. C. C.

**Violin Papers.**—J. B. (*Broomhead*).—These will be given in Vol. III. of WORK, now commencing.

**Book on Practical Blacksmithing.**—WASSE.—The name and address of the publishers of the above work, noticed in "Our Guide to Good Things," No. 89 of WORK, is given at the end of the notice. Write to the publishers for the price of the book.

### III.—Questions Submitted to Correspondents.

**Pendulum.**—HORA writes:—"Will anyone give me the dimensions for a half-seconds compensated zinc and iron pendulum—viz., length of suspension spring, length of steel or iron centre rod, length of zinc tube, and length of external iron tube, the bob to be centrally supported? What thickness of the above tubes is required for a bob weighing, say, seven pounds?"

**Enamelling Slates.**—J. D. (*Holyhead*) writes:—"I should feel obliged if any reader would give me information of any book or treatise upon enamelling, especially slates; or, possibly someone can give me information as to how to do this work."

**Coppering.**—A. K. (*Edinburgh*) writes:—"Can anyone give me a recipe for a solution for coppering lead or tin?"

**Hair-Sieve Bottoms.**—HOOPBENDER writes:—"Can any reader oblige with the addresses of two or three makers or dealers of hair-sieve bottoms?"

**Doll's House.**—W. L. (*Penge, S.E.*) would feel obliged if any reader could tell him where he could buy such fittings as small door-handles, knockers, and fire stoves.

**Coopering and Chairmaking.**—J. S. (*Longsight*) writes:—"I should be glad to know the opinion of an expert as to what advantage there is to coopers and chairmakers in the wooden brace, etc., over the iron one used by joiners and others."

### IV.—Questions Answered by Correspondents.

**Scrap Leather.**—J. M. (*Manchester*) writes, in reply to A. F. W. (*Oldham*) (see page 829, Vol. II.):—"You ought to experience no difficulty in disposing of any reasonable quantity of scrap leather. Try Platt's or Asa Lee's in your town, who use it for case-hardening purposes. Another market for it, or any other animal membranous refuse, is the manufacturing chemist, who makes ferricyanide of potassium, or 'prussiate,' as it is often called."

**Iron Lasts.**—F. M. (*Ebbw Vale*) writes, in answer to W. S. (*Highbury*) (see page 830, Vol. II.), *re* Iron Lasts:—"He could get them from J. & H. Cooper, 35 and 37, Caledonian Road, and 1A and 2A, Albion Street, King's Cross, London, N.; or from W. Beaney, London. I forget the latter's full address, but he could get it from the *Shoe and Leather Record*, price 2d. They are sold both by the pair and by weight, according to the kind he wants. The former range from 11d. per pair for children to 3s. for men; and the latter, from 9s. 6d. to 15s. per cwt. Full information can be got by applying to either of the above for price list."

**Hair Cloth.**—H. E. (*London, N.W.*) replies to G. J. W. (*Ballymena*) (see page 830, Vol. II.):—"You can get hair cloth of Tubbs', upholsterer's warehouseman, Goodge Street, London, W. Price about 1s. 6d. per yard for 18 in. wide, to about 4s. 6d. for 36 in."

**Circular-Saw Bench.**—E. H. H. (*Chatham*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"Let him get some 4 in. by 3 in. fir, and set out four rails in pairs, for three uprights—one in middle, and others about 9 in. from ends; then brace from top of middle stile to bottom of end stiles; then mortice and tenon a piece across top and bottom of ends, and your framing is complete, although for heavy work the ends should be braced. Use 4 by 2 for braces; for top, get some 1½ by 9 fir, and screw down to framing, and then cover with stout sheet iron, screwed down. If S. P. gets a list from Reynolds & Co., Britannia Co., or any of the leading machine makers, he will get all the information he desires, and get better ideas from their illustrations than can be given in writing."

**Draw-Knife.**—LONDON STAIR BUILDER writes, in reply to W. W. M. (*Glasgow*) (see page 830, Vol. II.):—"You should write to Melhuish, tool dealer, Fetter Lane, London, E.C. I think they could supply you with the draw-knife and chamfer gauge. I fancy the latter is a Yankee invention, and costs 60 cents in the United States of America."

**Plate Rack Rods.**—J. B. F. (*Eastbourne*) writes:—"*Re* your answer to J. N. (*Erith*) (see page 812, Vol. II.), what he wants is supplied by the Cheap Wood Co., 72, Bishopsgate Street Within, E.C., under 'Sash-Bars and Rounds,' No. 289, and costs 2s. 1d. per 100 feet."

**Impressions.**—DUBLINIENSIS writes, in reply to H. M. (*Leeds*) (see page 781, Vol. II.):—"Some years ago I wanted to do a similar job, to send the impression abroad for purpose of recognition by a supposed owner of the book. I managed it very fairly thus (I must first say the impression was in *intaglio*):—I placed the book in a box, the edges of which were about an inch higher than the book, first covering the gilt edges with brown paper, lapping the edges inside the covers; then I got some nice tissue-paper, and damped it on both sides with hot olive oil with a flat camel-hair brush, laid it evenly on cover, and covering this with hot very fine silver sand to about ½ in. thick, smoothed it, and then laid over that an even-surfaced board, which was weighted down with two half-hundred weights, and let it remain a couple of days, when I removed all, and found I had an excellent cameo impression."

**Band-Saw Machine.**—TEAK writes, in reply to J. H. (*Sheffield*) (see page 765, Vol. II.):—"He will find suitable machine by sending 6½d. for catalogue (of six hundred engravings) to M. Tiersot, 16, Rue des Gravilliers, Paris."

**Castings.**—PARTICK writes (see page 782, Vol. II.):—"If J. D. (*Glasgow*) will communicate with . Munro, 1, Ewing Place, Partick, he will get the desired information."

**Screen to Fold Both Ways.**—W. S. (*Rugby*) writes, in reply to F. C. (*Swanley*) (see page 780, Vol. II.):—"Perhaps this may suit you. The edges of side-rails are rounded, and must be 4 in. longer than screen—2 in. at top and 2 in. at bottom. These ends are reduced to form a nice dowel, the use of which will be presently seen. Now take a round rod same thickness as frame, and the same length, on opposite sides; make a nice hollow all its length, so that the rounded edges of frame will fit in nicely. You now want four round pieces each 2 in. long, and same thickness, with a hole bored right through to fit nicely on the dowels of frame. Fix two of these at bottom of centre rod in the hollows, one on each side; take the leaves of your screen, and drop the dowels into the holes; now take the other pieces with holes in them, and drop them over dowels at top; glue, and fix in hollows; and there you are with a hinge that will fold both ways, and show no opening. I may say that it is not necessary to have the sides of frame round, provided the edges are made so, and a piece of bamboo will do well for the tubes."

**Window-Cleaning Chemicals.**—H. B. S. writes, in reply to C. T. (*Ashton-under-Lyne*) (see page 634, Vol. II.):—"The composition of window-cleaning liquid is dilute hydrofluoric acid. The cleaner mixes a little of the strong acid with water in a pail, rubs it on the windows, and quickly washes it off again; if left on the windows, it quickly etches them—*i.e.*, renders them dull and opaque. It cannot be kept in a glass bottle, as it dissolves glass, but is sold in gutta-percha bottles. It must be carefully used, as it causes very bad sores if spilt on the hands; it rapidly clears away grease and dirt from factory windows, and that is what it is used for. I believe there is a Window Cleaning Co. in Leeds who hold a patent for the use of it for that purpose, but I may be mistaken."

**Rods for Plate Rack.**—F. S. (*Highbury*) writes, in reply to J. N. (*Erith*) (see page 812, Vol. II.):—"Rods from ½ in. up to 1½ in. may be bought at any timber yard that stock Swedish mouldings. Stuarts', Drayton Park, Holloway, supply them at 2s. 6d. per 100 feet, ½ in. thick."

**Violin Book and Tools.**—J. H. W. (*Leeds*) writes, in reply to J. E. (*Chatham*) (see page 814, Vol. II.):—"I can, as the result of practical experience, recommend 'The Violin as it was and is,' published by Ward & Lock. With regard to tools, I shall in a few weeks be in a position to supply the same at a reasonable rate, and shall then advertise them in WORK."

**Window Steaming.**—J. (*Portsmouth*) writes, in reply to the inquiry by J. B. (*Colchester*) (see page 670, Vol. II.):—"Nothing will cure this like ventilation, and I would suggest J. B.'s carrying a flue, if possible, directly from over gas jets, as in the improved sun-burners, into a chimney flue—not directly outside, as in this latter case it is almost certain to produce an in-draught. There is generally a spare chimney flue over most shops, the precaution being first taken that there is an up-draught in the chimney. If this does not quite cure it, a few holes in addition may be cut in bottom of window, and covered with fine gauze to keep out dust, thus forming a current of cool air across inside of glass. Will H. Hinge allow me to thank him for his very clear description of Ottoman couch? so plain, that I think the most of us amateurs can understand it. My better-half intends me to have a good try at it, as soon as I have time to spare. Can he suggest any style of hinge, to enable it to be opened from either side? A strong pin firmly screwed on to each corner, and dropping into a metal V bearing, or something of that sort."

**Rods for Plate Rack.**—F. H. (*Streatham*) writes, in reply to J. N. (*Erith*) (see page 812, Vol. II.):—"Joseph Sandell & Co., 101, Waterloo Bridge Road, or any moulding merchant will supply J. N. with ¾ in., ½ in., ⅜ in., and ¾ in. round moulding for plate racks. They are made in lengths from 6 feet to 20 feet. J. N. will find, by getting the rods from a moulding merchant, that he will save himself a lot of trouble."

### V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. C. P. (*Lambeth*); T. S. (*Kendal*); G. S.; L. K.; ENGRAVER; W. S. (*Cambridge*); H. W. (*Rochester*); E. C. (*Bristol*); W. G. (*London, W.*); W. F. M. (*Paddington, W.*); ELECTRICAL; G. G. (*Abergavenny*); W. H. B. (*Birmingham*); J. O.; INQUIRER; L. S. L. (*Kirkcaldy*); ALADDIN; S. D. (*Wigan*); W. J. T. (*Aston*); H. L. (*London*); PERCY; B. F. E. (*Carlisle*); J. M. (*Midhurst*); AMATEUR; DEWDROP; ST. CRISPIN; T. R. (*Belford*); T. J. (*Handsworth*); C. S. (*Nottingham*); W. H.; J. H. (*Manchester*); OLD CLOCK; H. P. (*London, W.*); DARKEY; T. H. (*Staffs.*); J. B. (*Derby*); AUCKLAND; BARRA; LENSES; F. H. (*Newington*); J. A. (*Gristhorpe*); BERTIE; W. W. (*Eastbourne*); E. M. J. (*Wrexham*); B. A. B. (*Hampstead, N.W.*); J. S. (*London, N.*); R. J. S. (*Wolverhampton*); LOTO; W. H. C. (*London, N.E.*); W. T. H. (*Somerset*); CHEMICUS; E. A. and W. G. (*Bristol*); R. C. M. (*Bristol*); A. L. (*London, S.E.*); A PLUMBER; F. S. (*Kidderminster*); M. A. H. (*Richmond*); J. M. (*Sunderland*); A. N. F. C. (*Christchurch*); R. W. (*Radnor*); F. A. (*Portsmouth*); TOPPER; SILICATO; J. K. (*Birmingham*); CARPENTER; J. T. (*London, S.W.*); E. L. M. (*Finsbury, E.C.*); W. R. S. (*Nottingham*); E. R. D.; PAINTER; A CONSTANT READER OF "WORK"; V. S. (*Kensington*); A. D. (*Newcastle-on-Tyne*); A READER FROM NO. 1 OF "WORK"; G. J. R. (*Walthamstow*); SNOB; L. A. (*Hampstead, N.W.*); A SUBSCRIBER; JOBBER; J. Z. (*Somerset*); PEN AND INK; SNIP.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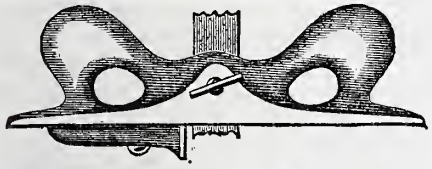

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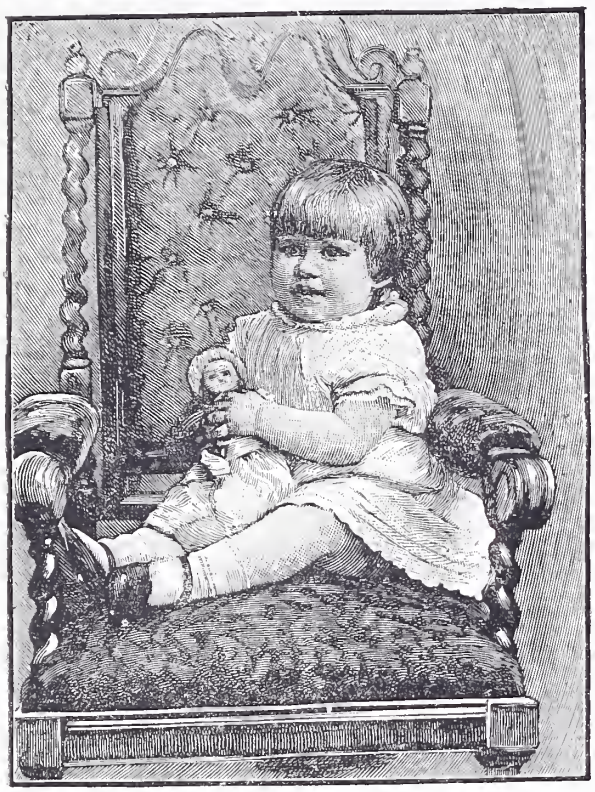

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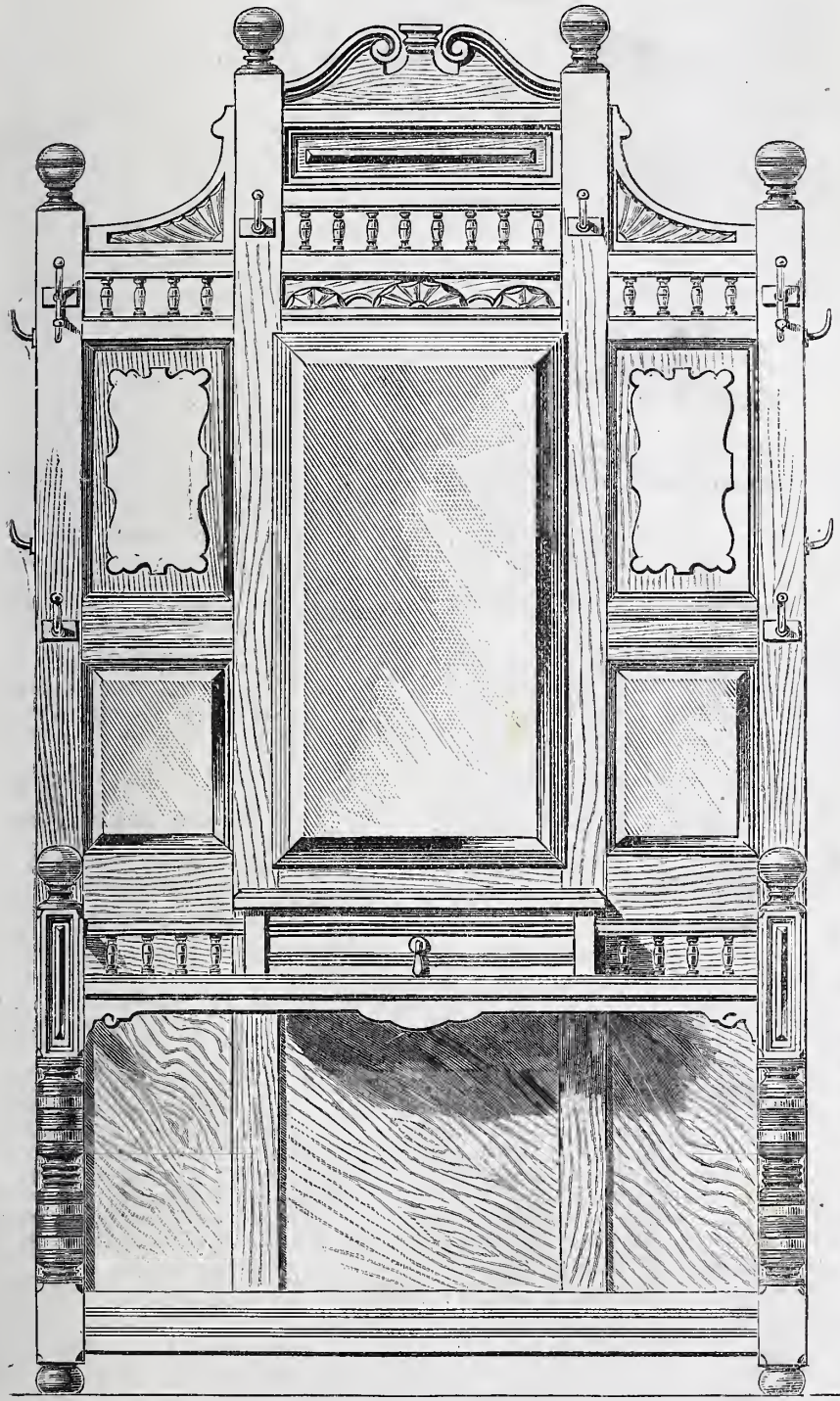


Fig. 1.—Hall Stand: Front Elevation.

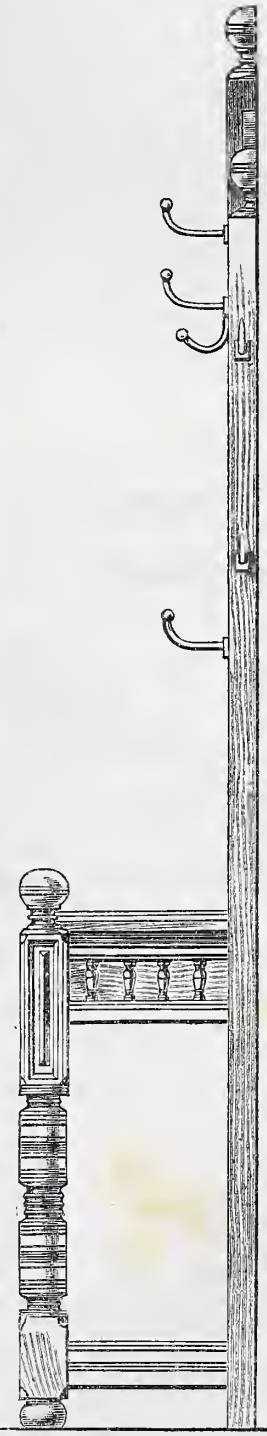
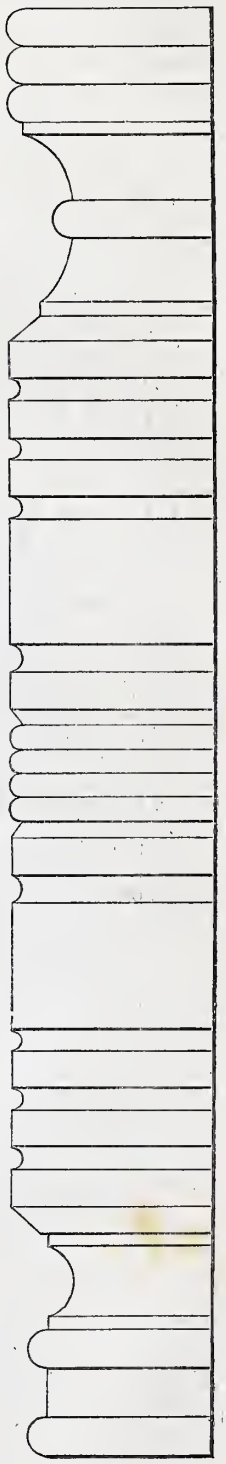


Fig. 2.—Side Elevation.

Fig. 5.—Turned Column, Half Length (full size).



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BY DAVID DENNING.

INTRODUCTION—MEASUREMENTS—CONSTRUCTION—WORKING DRAWING—MATERIALS—UPRIGHTS—CROSS RAILS—BEADINGS—TURNING AND MOULDING ON COLUMNS—MOULDING UNDER DRAWER—DRAWER BOX—BASE—PANS FOR UMBRELLAS—PANELS—BRASS WORK.

As the entrance hall of a house is the first part of the interior which is seen on opening the door, it is only natural that anyone who takes a pride in his surroundings should wish for a favourable impression to be created in the mind of the visitor by its contents. Unless the hall is of unusually large dimensions, the amount of furniture which can be placed in it is naturally very limited, and for all practical purposes may be said to be confined to the hat and umbrella stand, or, as it is often called, the hall stand. The hat stand may be separate from the umbrella stand, but when space allows, a much more important-looking piece of furniture results if the two are combined. It cannot be said that the stand which I have called "mine" presents any very novel features, either in its construction or its design. It is nothing but a good, substantial thing, not ugly, nor yet devoid of some pretensions to decorative effect. Probably it will be none the less welcome to readers because it, to some extent, follows the traditionary shape and arrangement of an ordinary hall stand, instead of consisting of various ingenious combinations or extraordinary lines. The construction is not difficult, nor need the cost be great, as there is no elaborate carving nor anything which an ordinarily skilful cabinet-maker cannot manage with his usual tools.

As the beginner would hardly attempt to make such a piece of furniture, it will be unnecessary to enter into a minute description of the details of construction so far as the manipulation of the wood and tools are concerned; while the accompanying illustrations almost supply the practised cabinet-maker with all the information he can require. To leave him without any description—or perhaps I should rather say without any hints—to guide him would not be altogether satisfactory to the majority, and the following remarks will, no doubt, be an assistance.

Fig. 1 gives the front and Fig. 2 the end elevation. As both of them are drawn to inch scale as nearly as possible, it will be seen that the outside measurements are as follows: height, 7 ft. 6 in.; width across front, 4 ft.; and depth from back to front, 1 ft. 2 in. It will thus be noticed that the stand is not a small one, although it is not unwieldy or cumbersome. Those who, for any reason, wish to make a smaller stand of similar design will have no difficulty in doing so, as it will only be necessary to take the design as it stands, and reduce the distances between the upright pieces. At the same time, it should be remembered that a very light small hall stand is not generally satisfactory, from its liability to fall forward when heavy coats are hung on it.

Leaving generalities, let us now examine the construction more in detail. We find all the essentials of a hall stand. There is a good-sized looking-glass, so arranged that a person of ordinary height can make use of it without stooping or standing on tiptoe. There is also a convenient table with drawer, and the spaces for umbrellas, sticks, etc., are large and get-at-able. The whole is sufficiently heavy to prevent the slightest risk of a mishap in the shape of an upset from any number of coats or other things which can reasonably be hung on it.

Although general measurements are given, the maker must on no account omit to prepare a full-sized working drawing from which to set out his stuff—as wood is generally spoken of among cabinet-makers.

American walnut is the wood of which the stand from which this description is taken is made, and it looks very well; there is, however, no reason why those who prefer oak or mahogany should not use them. In case oak be chosen, it may be well to say that it should not be fumigated and wax-polished, as the polish is easily injured by damp; and it is unreasonable to suppose that such a piece of furniture as a hall stand can always be kept clear of wet coats and umbrellas.

The uprights are of 1½ in. stuff, so that "down"—which, for the information of novices, may be explained as meaning finished after planing—they are about 1¼ in. thick. This may strike some who are accustomed to see that many London-made, and possibly other hall stands, are made much thicker, as being very thin when compared with these. It must be remembered that the wood to which reference is being made is solid, whereas in the unusually massive-looking stands the parts are generally found to be simply faced on the fronts and veneered on the edges. Of course, if the maker wishes he may go to the expense of thicker wood in the solid, or use facing with pine backing.

The cross-rails are, of course, the same thickness as the uprights. Those at the top, both in the centre and sides, are about 1½ in. wide, while those lower down are about 4 in. The bottom rail, to which the bottom of the stand is fastened, may be of any convenient width, and it is a matter of opinion whether it should project above the bottom board, and so form a small backguard, as in the illustration, or be below the bottom board. In the latter case it may as well be made of pine, as it is not seen.

It will be noted that the two longer uprights are fitted to the bottom rail, the ends of which are fitted to the end pieces. All the other rails are stopped by the uprights, for it would not be good construction for the rails to go right across and the uprights to be fitted into them. Whether the joints be dowelled or mortised and tenoned, is a matter of little consequence. The professional cabinet-maker will probably prefer the former, leaving the other and more tedious one to the amateur. It should be remembered that the centre rail below the glass must be considerably wider than any of the others, as it forms a back to the drawer box.

It will be noted that the edges of the narrower rails are beaded, and that the intermediate wider ones have beads run across them. These, of course, must be prepared before the rails are fastened in. The beadings are shown by Figs. 3 and 4, the latter of which, it may be stated here, is the same as on the drawer front, and the former as on the rails above the spindles in front and at the ends. These rails are of 1½ in. stuff, and about 2 in. wide.

The turning on the front columns, which are of 2½ in. square stuff, is shown full size, so far as the members are concerned, in Fig. 5. As the pattern is repeated for the lower part, only half the length is given. The squares of the columns are ornamented on the front and end, as represented in transverse section by Fig. 6, which gives the parts full-sized.

The moulding on the edge of the rail under the drawer is given in Fig. 7, but this—and, indeed, any of the others—may be altered to suit the fancy of the maker, who, very likely, may have preferences of his own.

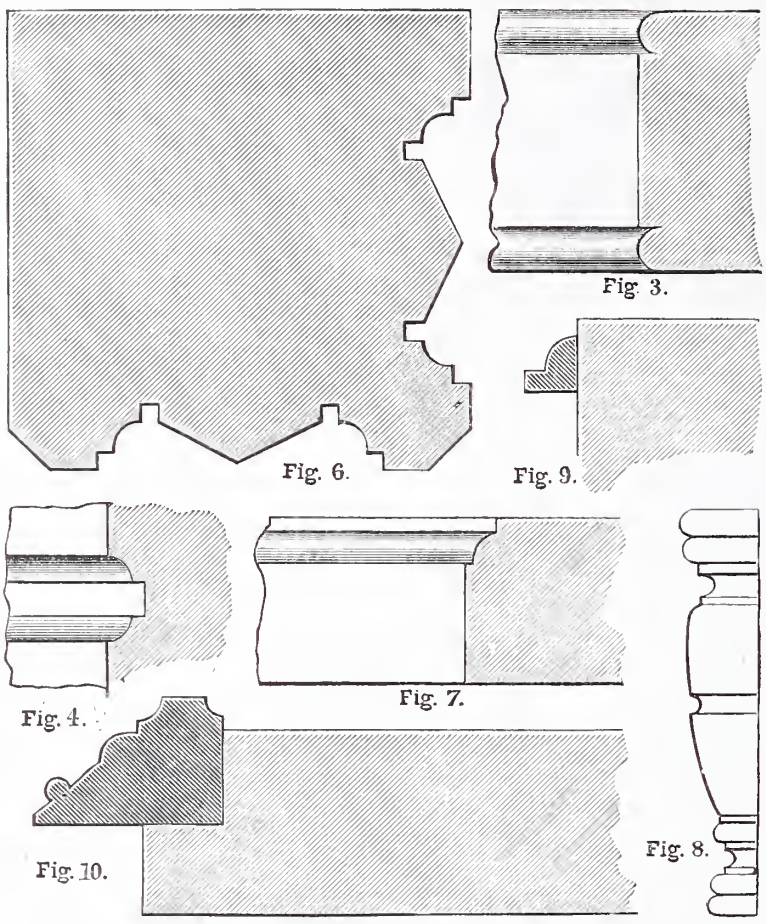



Fig. 3.—Beading on Rails. Fig. 4.—Beading on Drawer Front. Fig. 6.—Section of Square of Column. Fig. 7.—Moulding on Rail below Drawer. Fig. 8.—Turned Spindle. Fig. 9.—Panel Moulding. Fig. 10.—Moulding for Glass. All Figs. full size.

The same pattern of moulding is on the edge of the table top, which is screwed through from the back.

The ends of the drawer box are solid 1 in. stuff, and are fastened in the same manner to the back. Their bottom edges are on a level with the lower surface of the rail, under the drawer front. As the drawer and its fittings present no unusual feature, it may be presumed that it is unnecessary to say anything more about them. The fitting of the ornamental rail beneath presents no difficulty, and its shape is sufficiently shown in Fig. 1 to enable anyone to set it out.

The base will require some thought to be given it by those who are not familiar with similar constructions, though it is very simple. The front rail—viz., that which is visible in Fig. 1—is about 4 in. wide, of 1 in. stuff. The back one has already been referred to, so need not be mentioned further. As is well known, pans or tins are usually let into the bottom of umbrella stands, and this one is no exception to the general rule. They are, of course, where they will be most convenient, and that is under the open spaces on each side of the drawer. The whole of the bottom may be covered in, and holes subsequently be cut for the reception of the pans, but it is more convenient to have these of a good size than to have them so small as they sometimes are in stands otherwise well got up. The pans in this stand are, therefore, as big as they could be without being unsightly. They fill the space from back to front, and are practically square. Their edges rest on the front rail, on a ledge fastened to the back one, on the end rails, and on the board which encloses the remainder of the bottom. Now, the only part which is likely to trouble anyone is the end rail, for unless made as thick as the front columns, there will be a hitch somewhere, as the maker will soon find out for himself unless he is careful. To use such a piece as supposed would be only a waste of good material, so the way to do without it is to make the end rails say 1 in. less in depth than the front one, and then to make them equal to this by planting a piece of the necessary width on the top of them. The same object might be attained by making front and ends of the same width, and setting them back as far as possible. This method, however, would not look so well. In case anyone may want a pattern of the small spindles to turn to, Fig. 8 gives in full size all that is necessary.

The construction has now been sufficiently described, and all the rest to be done may be looked on as ornamentation, if we except the hooks, which, of course, are a necessity on any hall stand.

The lower panels above the umbrella spaces are plain, with sunk bevels. They are fastened in by mouldings of the pattern shown by Fig. 9, which gives the full-sized section. The same is used to the panels above, which are simply pieces of $\frac{1}{2}$ in. stuff, shaped as shown by the bow or fret saw. The carving on the panel above the glass and elsewhere is of the simplest kind. The moulding round the glass, as befits the most conspicuous part of the stand, is of a more elaborate character than the others. It is shown, also in full size, by Fig. 10. The fitting of the silvered plate calls for no special mention. Those who do not mind the trifling extra cost should have its edges bevelled.

The brass work consists of four coat hooks, two hat and coat hooks combined, and four single hat pegs, as well as a handle for the drawer.

We now come to an end of the hints for the construction of a combined hat, coat, and umbrella stand, with hall table, and if any beginner does not find them ample enough, let him remember that the job is not a suitable one for a novice, and that by the time he has acquired the manual skill necessary to make it, he will find that difficulties in the way of understanding the construction have vanished.

## A USEFUL MICROSCOPE LAMP.

BY H. B. S.

Advantages of Lamp — Method of Making Lamp Chimney of Tin Plate—Method of Making Shade—Cost of Lamp, Chimney, and Shade.

For the benefit of readers of Work who have a microscope, I will here describe a lamp and method of making which will, if followed, for a very small sum supply them with a useful article which would cost at least 15s. if bought of a dealer.

The fully-made article is seen in Fig. 1. The advantages of the lamp are: (1) That instead of the ordinary lamp chimney, a chimney of tin plate is substituted, in which is an ordinary 3 in. by 1 in. glass slip, or a slip of tinted glass of the same size; (2) the glass slip can easily be replaced, costing 4d. per dozen; (3) the glass slips do not break so easily with the heat as the glass chimneys; (4) the lamp is so low that, by tilting the microscope a little, direct light may be got from the lamp without reflecting the light by mirror.

Buy the lamp body—they cost 6½d. in Liverpool. The wick stands about 3 in. from table. Then get a piece of tin plate, 6 in. by 5½ in. (Fig. 2), and mark out an oblong by means of rule and steel point, commencing $\frac{3}{8}$ in. from side, of 2½ in. by 1¼ in., then, by means of a cutting chisel, cut the piece out. Next prepare a strip of tin, $7\frac{3}{8}$ in. by 1 in. (Fig. 3). Rule right across it four lines, at 1⅝ in., then at 2½ in. from last, then at 1⅛ in., and again at 2½ in. Then rule right along one edge ¼ in. from side, and on the other side ⅛ in. and at ¼ in., as shown. Bend the box into shape, after snipping at each of marks ¼ in. on each side. This will leave ⅛ in. over at end, which requires soldering. Snip the box at top and bottom as shown (Fig. 3), so that the box will accommodate itself to the round shade. When this is done, push the box through hole in large sheet, bend up the ¼ in. as a flange, bore two holes on each side of the box through both sheet and flange, and rivet with copper rivets. Now bend the sheet on a round article, allowing about ¼ in. to wrap over, bore holes and rivet. The chimney will now be 1¾ in. in diameter, which will suit most lamps.

It will be found that the box will be thrown a little out of shape by bending the chimney into the round form, but this can easily be remedied by a few touches of the pliers. Now bend the top piece outwards ¼ in. as marked, the bottom piece outwards ¼ in., then inwards again for ⅛ in., and the side pieces ⅛ in. inwards, as shown in Fig 4. The box will then appear as in Fig. 4, and will allow of the glass slipping in from above, being held there by the side flanges.

All that remains is the making of the shade. This shade prevents the light of the lamp coming to the unoccupied eye. Cut out a piece of tin plate, 4⅛ in. by 1¼ in., cut as in Fig. 5; this will allow 1⅛ in. for top and 1½ in. for each side. Snip at each mark to ¼ in., then bend into shape, and bend inwards each of the pieces snipped ¼ in.; this will then allow the shade to rest on glass slip, as shown in Fig. 1. The tin shade, being bright, is a good reflector, and a great deal of the light lost in every direction with glass chimney is now reflected and sent out in one direction; besides this, by using direct light from the lamp, a good light is got for high powers or for rather opaque objects.

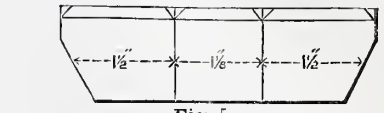


Fig. 5.

Fig. 3.

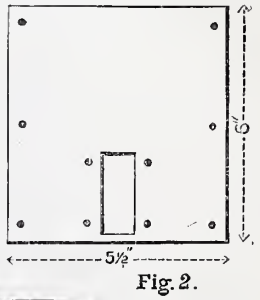


Fig. 2.


Fig. 4.

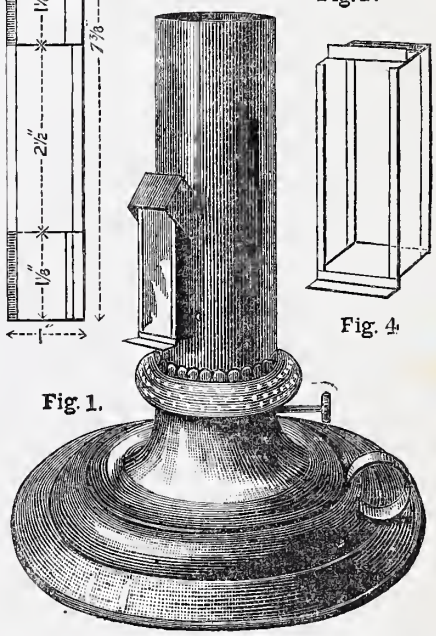


Fig. 1.

Fig. 1.—Microscope Lamp complete. Fig. 2.—Tin Plate to fit over Lamp Glass. Fig. 3.—Pattern of Template for Box. Fig. 4.—Box when bent into Shape. Fig. 5.—Hood or Shade for Box.

My lamp cost me (without tools): For lamp body, 6½d.; for one sheet double-crown tin plate, 5d.; copper rivets, 2d. (per oz.); one glass slip, ⅓d. Total, 1s. 1½d. and ⅓d. The glass slip has lasted quite a year, and is now as good as new. There are two friends of mine who have also made them, and they are as well pleased with their lamps as I am with mine. Finding this to be the case, it has occurred to me that others may find the lamp thus fitted and adapted for the purpose equally useful, and I have therefore placed on record in Work the result of the experiences of myself and my friends, and the way in which we went to work; trusting that it may encourage and enable others to follow in the same path.

# CONSTRUCTIVE STRENGTH IN METAL WORK.

BY J. WHITFIELD HARLAND.

MODES OF UNITING METALS—TENSILE AND COHESIVE STRENGTH—MANIPULATION OF IRON—PREPARATION OF STEEL—EXPANSION AND CONTRACTION OF METALS—ROLLING AND HAMMERING IRON PLATES—CONDUCTION OF ELECTRICITY IN WOOD AND METAL—ELASTICITY.

IN my hints in No. 76, Vol. II. of WORK, on "Constructive Strength in Woodwork," I pointed out that the very nature of wood itself demanded that the way of the grain, and the splitting tendency of it, should be taken into account.

In Metal Work there is no grain such as exists in wood, and metal does not split, but it cannot be held together by cement as wood is by glue; and whilst wood cannot be melted or heated, metals can be, and this gives rise to a totally different mode of construction.

Uniting metals may be done, firstly, by welding: *i.e.*, by heating almost to fusion two parts, and hammering them until they form one piece; secondly, by riveting; thirdly, by screwing or bolting; fourthly, by brazing or soldering; whilst the shape or form of pieces of metal may be altered, firstly, by forging; secondly, by stamping; thirdly, by melting and casting; fourthly, by rolling or bending.

In all construction, then, we must consider the reason for preferring one of these modes in any given case—that is, we must find out which of them is the strongest in relation to the purpose in view, and a few hints (for I only consider these papers as hints, and anything but an exhaustive treatise) in this direction may help WORK readers to think out for themselves, in their own way, and apply to their own work, such hints as may seem to them to have some bearing on the particular job.

Metals, like woods, have each their own tensile and cohesive strengths, as well as resistance to compression, from which their breaking strain can be ascertained. Tables are published of these strengths, and in construction, such as buildings, bridges, ships, etc., it is no longer safe to work merely as is done in carpenters', joiners', and cabinet work, with a knowledge of *where* strength is required; we must measure and estimate not only where strength is wanted, but how much strength is necessary. Human life is at stake in such work, and an error of judgment or a false calculation might produce a catastrophe causing agony and death to scores of people, besides making their relatives and survivors wretched, and often pauperising them. Such heavy responsibility as this should not be lightly undertaken, and demands the most conscientious care in design, in calculation and watchfulness, during its gradual completion, that no bad workmanship or faulty material creeps in to become a menacing danger.

By far the most useful and most used metal is iron, and it is of three distinct varieties—cast-iron, wrought-iron, and steel—which are none of them chemically pure, but are pure iron differently impregnated with carbon and other bodies. Thus cast iron contains the most carbon, steel less, and wrought-iron less still. By various processes cast-iron may be deprived of nearly all its carbon, and then becomes malleable or wrought-iron, or wrought-iron can be changed into steel by processes which add carbon to it: if too much carbon be not added, its malleability is not only not impaired, but improved, whilst if more than sufficient carbon be added its malleability is quite destroyed, and it becomes brittle, is much weakened in both tensile and cohesive strength, although its resistance to compression is not vitiated to the same proportionate extent. There is also a comparative degree of hardness in these three forms of the metal iron, owing to the presence, no doubt, of carbon. Cast-iron, whilst homogeneous, is granular in texture—I was about to say crystalline. Steel also is so to a less extent, partaking more of the fibrous structure of wrought-iron, though in an inferior degree; but it also possesses the property of being capable of excessive hardening, or tempering, as it is called: a property without which no tools for work could ever be made, and which all workers ought to regard as one of God's best gifts to man. Curiously, cast-iron with more carbon, and wrought-iron with far less, do not possess this property, except so far as their outer surfaces are concerned, which is termed, therefore, case-hardening. An instance of case-hardening is afforded by the Bower-Barff process, as it is termed, which consists in exposing cast-iron, wrought-iron, and even steel heated to redness to the action of steam (*i.e.*, the vapour of water). The effect of this is to convert to a slight depth the surface exposed into an oxide of iron, viz., the black or magnetic oxide (or peroxide of iron $Fe_3O_4$) which occurs also in a natural state, and is almost as hard as the diamond, and crystallises in cubes. It is useful, also, inasmuch as, being a higher oxide than the protoxide (*i.e.*, iron rust), iron so treated becomes rustless, resists the weaker acids and weak solutions of the stronger acids; thus it requires no painting, and is practically indestructible. It is called magnetic oxide, from the fact that natural loadstones consist of it. Cast-iron, if quickly cooled, especially in damp sand, where the heat of the metal when poured converts the moisture into steam, is almost converted in parts of its surface into this oxide (or perhaps, also, a silicate or aluminate combined with it), and the "skin," as it is termed, is extremely hard and brittle; but if the castings be annealed—that is, cooled very gradually—they are termed "malleable castings"—are fibrous rather than crystalline, and will bend rather than break.

Further, steel prepared by adding carbon to wrought-iron—especially when it has been subjected to a great deal of hammering, and more so still if made of wire, nails, or other small pieces welded into one mass—is far superior to steel made by partially burning, or otherwise getting rid of the excess of carbon in cast-iron. In other words, adding carbon to wrought-iron is better than taking carbon away from cast metal or "pig-iron." Bessemer steel partakes of the character of the latter process; Swedish steel of the former. Its tempering property is still further developed and improved by hammering—hence the best tools are those upon which the most labour has been expended, and therefore they are cheaper in the long run than low-priced ones. In a less degree, rolling adds to the value of both steel and wrought-iron—its action making both more fibrous, and therefore tougher.

In generalising thus, as I am doing, I must not omit to mention the fact that heated iron, steel, and cast-iron contract in cooling, although not to the same degree, probably, because the heat employed is much greater in the case of cast-iron than in forging—its contraction is greater. Steel also may be melted and cast, and then its contraction is also greater than forged or hammered steel. In order to obviate this contraction, which is unequal and by no means uniform, since it depends upon the rapidity of cooling in one direction being hastened or retarded by surrounding influences, Sir Joseph Whitworth successfully introduced the process of casting under compression, whereby the melted metal was compressed whilst heated to the extent required to prevent any further contraction as it cooled. Patterns, therefore, were made the exact size, instead of any allowance for contraction being made. That compression castings are immensely stronger than ordinary castings almost goes without saying, but if proof be needed, take a strap pulley or drum. The boss scarcely contracts at all—the arms, in proportion to their length, only about $\frac{3}{16}$ths of an inch to the foot; whilst the thin flat rim, six times the length of the arm, still contracts $\frac{3}{16}$ths of an inch to the foot. It stands to reason that there will always be a compressive strain upon the arms, due to the rim having contracted six times as much as the arm has done. But under compression the contraction is not in cooling, but whilst the metal is in a molten state, when its component particles are mobile, and can seek their own positions. How often, in turning drums or pulleys true on the face, do they break and fly to pieces—directly the "skin" is turned off, the rebound, so to speak, of the compressive strain on the arms overcomes the cohesion of the rim, and it gives way. Here let me remark that from its form the rim of a pulley will stand a far greater force from without than from within; a pipe, therefore, will burst from within far more easily than be crushed by pressure from without; nay, more, it is almost, not quite, as capable of resisting crushing from without as if it were solid throughout; and the crushing strain, if applied endwise, therefore, is practically the same as if it were solid, thus a hollow column will, if of correct proportions, bear as much weight as a solid column would—more, in fact, than the same weight of metal could sustain if made solid instead of tubular. This is due to the distribution of contending forces, whereby they neutralise each other's action. Hence we may safely deduce that form or shape contributes to the strength (as it also does to beauty, if thoughtfully used) of construction in metal. Take as a case in point a plate of iron $\frac{1}{4}$ in. thick, 3 in. wide, and 7 feet long. Support the extreme ends, and put on in the middle weight enough to break it. But if you dish such a plate—that is, form a corrugation lengthwise, say $\frac{1}{4}$ of an inch in depth—although the plate will be narrower, twice the previous breaking weight will be supported without danger. To consider the torsal or twisting strain: if the plate be flat, a very slight force applied in a contrary direction at each end will twist it easily; but if it be dished as described, such slight amount of force will have but little effect; it would remain practically rigid. In like manner, angle iron is almost as strong as a solid bar of the same breadth and depth, and far stronger than the same weight of iron rolled into a square or round bar; whilst T iron is for some positions, and under certain strains, stronger still. There is a still further gain: the weight of superincumbent iron is so much less for the same equivalent of resistance to strains—as in a roof, for instance—that the supporting walls or columns having less to carry may be so much, proportionally, weaker—hence an economy of material—without loss of

strength, whilst the labour in hoisting a less weight to the same height is also lessened. Further, if instead of *rolling* iron to such sections as I have alluded to, it were *hammered*, its strength would again be increased. The true explanation of these phenomenal facts lies in the great truth that all metals resist compressive strains much more easily than they do tensile, torsile, or side strains—just as I said there was a first principle in considering constructive strength in woodwork, but under different conditions. To illustrate this familiarly, a man can carry on his back or shoulders a far greater weight, when once it is raised for him, than he can lift from the ground.

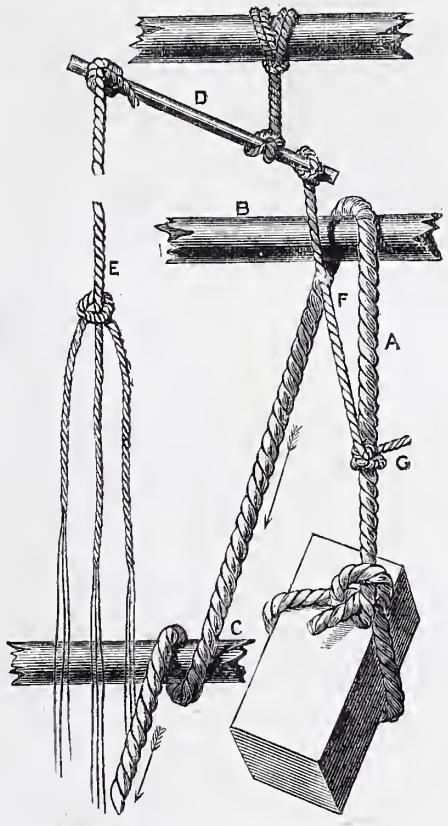
I ought not to omit another point of difference between wood and metal, and it is a very important difference—viz., that whilst wood never contracts in length, all metals do under the variations of temperature. Wood is affected not by mere temperature, but by moisture and light. Metal is, so far as is at present known, affected by heat alone. Light and damp apparently, though this is not proved, have no influence on its expansion or contraction, which probably is due to its greater density, or its homogeneous, instead of cellular, structure, which leaves no interstices for moisture to lodge in or light to permeate.

Another point of difference, which I fear has not been at all sufficiently investigated, but which offers a wide field for speculative scientists, is the different degrees of comparative conduction of electricity in wood and metal. We do know that cast or wrought-iron girders on railways when laid horizontally to carry traffic become less and less fibrous, and ultimately crystallise. Is this due to electricity, as I more than suspect, or to vibration, as some engineers maintain? Does vibration act direct, or does it, in some unknown and incomprehensible manner, generate or attract electricity? I cannot say, but I trust some day it may be elucidated. As in girder bridges, without such knowledge we cannot find any means of negativing its effect, because we do not know the cause. Take girders in subways, etc., for instance: if girders give way from this cause—*i.e.*, crystallisation—or from the constant action of rust, enhanced by sulphurous fumes emitted by locomotive engines and bad ventilation, "What price for shares?" Were I at the elbows of railway engineers, I would suggest that in replacing any girders the new ones should be previously made *rustless* by the Bower-Barff process, and that experiments be made, at no matter what cost, to determine what is the cause of crystallisation, and what is its remedy; and that a thorough inspection of all girders should at once be made on all the underground routes in the country. Unless this be done, no one will be less surprised than I to see an "extra special" newspaper detailing some catastrophe directly attributable to this cause.

There is one point of similarity between wood and metal that ought not to be lost sight of—viz., elasticity, a quality or attribute of both, differing only in degree. In some woods it is, as in some metals, nearly absent, as in lead and in cocoanut, where the elasticity is that of ivory, mere resilience, when struck. Steel, as a metal, possesses this attribute in the highest degree, as do lancewood, and yew, and hickory among woods. In metals, the greater the ductility the less the elasticity; and the reverse also holds good. Gold, the most ductile of metals next to lead, is absolutely inelastic. Now, elasticity is a force!

The subject of constructive strength in metal work after this introduction will divide itself into two distinct classifications—the one involving strength obtained by form only, and the other involving strength obtained by, in addition, utilising separate parts which, in the aggregate, being constructed on the lines of the first classification, and united in some one of the foregoing methods, shall, as a whole, constitute good construction.

It will be impossible in this connection to refer to such minor considerations as the way to put together jewellery, for instance, where appearance is the main consideration. I shall devote my limited space, in the two papers to follow, to illustrating "good form" and good combination for strength, rather than beauty.




Chinese Method of raising a Heavy Weight.

## A CHINESE METHOD OF RAISING A HEAVY WEIGHT.

BY P. B. H.

The annexed sketch illustrates the method at present in use in China for raising heavy weights in the construction of buildings, etc. Whether any readers of Work will ever be brought into such a predicament as to have recourse to a similar method, time alone will show. It will, no doubt, be interesting, however, as an illustration of the antipathy this people has to anything new. Their method of procedure is as follows:—A good stout rope A is fastened round the object to be raised (in this case a stone is shown), and carried over a horizontal beam B, placed at some convenient height above the permanent resting place of the stone; it is then given a complete turn round a lower one C, and the end is dropped to the ground or some convenient platform, where it is held fast by one or more men, as required. This rope is principally for holding the weight after each rise, while the knot G is being readjusted. At a convenient height a lever D, about 25 ft. long, is hung suspended from a beam by a rope, which acts as a fulcrum about 4 ft. from the end. From the shorter end of the lever a rope is dropped and fastened by a running knot as low as possible on the main rope A. Another rope E at the longer end of lever falls to some convenient stage, where the end being unwound, as shown, each separate strand is grasped by one or several men, according to the power to be exerted. The ends of the rope E are now pulled, and the rope A is then raised, together with the weight, by the lever D, the men at the bottom end of A taking up any slack during the raising. This process is continually repeated, the running knot G being lowered, and the whole raised until the weight is at its destined height.

The above is a very good example of the use of the lever and friction, as very little force will be required at the lower end of the rope A to keep a heavy weight suspended, on account of the friction between the encircling rope and the beam C. This same frictional action is often seen when bringing up steamers at the landing-stage, and also on the rotating capstans used for shunting in railway sheds.

When we consider that such primitive means are still in use among the Chinese, who can be surprised that it is extremely hard to induce them to adopt railways?

There is thus, it will be seen, plenty of latitude for the persuasive powers of engineers and commercial travellers to induce them to use steam and machinery; but labour being no doubt so cheap, and the saying that "Time is money" not having yet been transplanted to the Chinese brain, there will be still some obstacles to overcome their prejudice. They are much worse than the natives of India in having anything instilled into them. These latter, when first the barrow was introduced, filled it about a quarter full, and then carried the whole on their heads. It was some considerable time before its proper use could be driven into them: so that it may still fall to some of our readers with strong persuasive qualities to make them abandon such methods, though I have no doubt the above arrangement would be useful in some parts of the world inaccessible to machinery.

## THE RUBBER IN FRENCH POLISHING: HOW TO USE IT.

BY DAVID DENNING.

How to Make the Rubber—The Outer Covering—The Wadding—Prevention of Creases in Covering—Charging with Polish—Motion of Rubber over Work—Re-charging—Touching with Oil—Preservation of Rubbers.

As is no doubt very well known, the pad by means of which French polish is applied is technically called the rubber. Without it the French polisher can do little or nothing in actual polishing, although he may not require it in the preliminary operations of oiling, staining, etc. However simple in itself the rubber may be, it is necessary that it should be properly and carefully made of suitable materials, for if it is not, really good work cannot be done with it. Possibly some readers who have seen polishers at work may be inclined to think that no great care is necessary, for all they saw was a dirty-looking rag covering a similarly uninviting-looking lump of wadding, or, as it is sometimes called, cotton wool.

Notwithstanding appearances being against it, the rubber, if in competent hands, will, on inquiry, be found to have been more carefully made than might have been expected, and the polisher would, in all probability, prefer it to any nice clean-looking rubber such as a novice would choose. Mind, it is not said that a dirty rubber is what is wanted, for dirt is fatal to really first-class work, and the polisher should keep his rubbers as clean as he possibly can. They naturally will get stained and discoloured with the polish, but that is a very different matter from being dirty. It may be news to some readers that old rubbers are preferable to new ones, provided that they have been properly taken care of and not allowed to get hard. The care of rubbers will be dealt with later on, and, in the meantime, their construction and general manipulation may be attended to.

For the outer covering or casing of the pad, soft rags are necessary. They may be either cotton or linen, the great point to be observed as essential to success being that they are perfectly soft. It should, perhaps, also be said that they must be tolerably fine, or, at any rate, free from knots or lumps. From this it will be seen that though rags have been mentioned as suitable, some care in their selection is necessary, and that it would never do to have a piece with a seam across it for a rubber, as anything which would tend to scratch the film of polish as it is being laid or worked on in the final operation of spiriting off must be carefully avoided. Some polishers advise the exclusive use of linen, but to confine oneself to this is a needless restriction. It must not be supposed, because rags have been mentioned, that new material may not be used. To render it suitable, however, it must be thoroughly washed to remove all traces of the sizing and stiffening with which it may have been finished. Of course, before it can be used for polishing it must be thoroughly well dried. This may seem a small point to urge, but it must be remembered that success in polishing depends to a great extent on the observance of details, and judging by the answers in the "Shop" columns, difficulties which would not occur to the experienced polisher are constantly cropping up. The necessity of avoiding damp (aqueous) cannot be too much insisted on. In addition to rags—of which not a very large quantity need be laid in, as in an ordinary household there is generally plenty of material available—some wadding will be required. This really is the rubber, as the rag is principally of use as a covering and to keep the wadding within proper bounds. White wadding is the best to use, and it is readily obtainable from any upholsterer or chemist; possibly it may be purer if got from the latter, and it is most certainly very much dearer than any reasonable upholsterer would charge for something equally suitable. Enough ought to be obtainable for a few pence to last a considerable time. If got from an upholsterer the wadding is sure to have a thin film or skin on one or both sides, according to whether it has been split or not. Anyhow, this skin must be removed, leaving nothing but the soft cotton. In cotton manufacturing districts, it may be useful to know that the raw material, if it is clean, will do equally as well as the finest wadding. The material known as cotton flock, and used by upholsterers as a stuffing for mattresses, chairs, etc., is not suitable, unless perhaps for the coarsest work. Even then it should not be used if anything better is available. For some special kinds of work rubbers composed entirely of flannel are occasionally recommended. It is, however, a matter of personal preference, and it is, to say the least, very doubtful if there is any advantage in using flannel, except sometimes, perhaps, for large flat surfaces, which can be got over more quickly with a large rubber than with a small one. All things considered, the novice cannot be advised to use any but the wadding rubber, and to become a competent polisher with it before experimenting with anything else.

To form a rubber it is only necessary to take a piece of the wadding and a piece of rag of sufficient size to enclose it. It is not enough, however, merely to wrap the wadding up anyhow, for it is absolutely necessary that on the bottom or sole of the rubber—*viz.*, that part of it which comes in contact with the work—there shall be no creases or folds. If there are any, then the delicate shellac film will be scratched. Perhaps the best way to convey the idea of what is wanted in a good rubber will be to imagine the wadding and rag ready to hand. Let a piece of the wadding be taken—say sufficient to form a ball, when moderately compressed, of double the size of a walnut. Put it in the centre of a piece of rag and gather up the edges of this so that the wadding is enclosed, as it were, in a bag. Keep the bag from opening by holding it with the thumb and finger tips, then press it down on any flat surface to flatten it, when, provided there are no creases, the rubber may be regarded as perfect. The whole thing is really very simple, and with a little care it will be almost impossible to make a mistake. The size of the rubber will, to some extent, naturally depend on the nature of the work, but that just given may be regarded as generally suitable. It is, however, impossible to lay down hard-and-fast rules in this respect, and the polisher, as he gains experience, must be guided by circumstances. Too large a rubber is not advisable at first. It has been mentioned incidentally above that the rubber is to be held by the tips of the thumb and fingers, but it must be understood that though this is the usual, because the most convenient, way with a rubber of moderate dimensions, the polisher may adopt any other method which suits him better. He will probably find, for example, that when using a large rubber it can be more conveniently used by holding it in the palm of the hand.

To use the rubber it must, of course, be charged with polish. Some care will have to be exercised in doing this, and to prevent mistakes it is well to say here that actual directions for completely preparing and polishing any article are not now being given. We are at present only concerned with the rubber, so that many points which it would otherwise be necessary to refer to may be disregarded with the assurance that they will be considered in due course. Some polish being handy, the covering of the rubber is to be opened so that a little polish can be dropped on the wadding. A convenient way of doing this is to have the polish in a bottle, the cork of which has a channel or notch cut in it to allow only a few drops at a time to escape. Some polishers dip the rubber, or rather a portion of it, into the polish, but then the novice must remember that an expert may venture on methods which a beginner should not attempt. The method recommended is the one generally adopted, so the learner will be under no disadvantage in following it. The wadding must by no means be saturated with polish, of which only enough should be used to moisten it and come through the rag covering when pressure is applied. The rubber having been charged, gather up the rag as already directed. Then, to equalise the polish, press the rubber moderately firmly into the palm of the other hand. The sole of the rubber ought now to be ready for application to the wood, which, for explanatory purposes, may be assumed to have been properly prepared to receive its first coating of polish. The principal thing at this stage, it must be recollected, is to get a good even body of polish on the wood, not thick in one place and thin in another, but distributed all over alike, and not too thickly anywhere. How this may best be done depends, to a certain extent, on circumstances, and on the custom to which the polisher has become habituated. One example must suffice, as, after all, if the desired result is got, the precise method is of secondary consequence. Let it be assumed that the work to be done is a small table top or other flat surface. With moderate pressure on the rubber, wipe quickly over the entire surface, first with, then across, the grain of the wood. Then proceed without delay to go over it more minutely, the motion generally adopted being shown in the accompanying illustration. The pressure should be gentle at first, but as the polish gets worked in and the

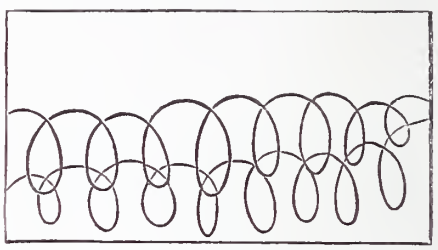


Diagram showing Movement of Rubber in French Polishing.

rubber drier, it is to be increased, though at no time must the pressure degenerate to mere scrubbing.

A very important point which it may be necessary to caution the novice about is the necessity of not allowing the rubber to remain stationary on any part of the work, and on no account ever to leave the rubber lying on it during temporary absence or at the end of the day's work. While the rubber is in contact with the wood it must be kept constantly in motion. As often as the rubber gets dry it must be recharged with polish, but let the novice beware of using this in excess.

When the rubber seems to stick, instead of moving pleasantly and sweetly over the wood, just touch the face of it with a little raw linseed oil. If the oil could be dispensed with altogether it would be better, but as it cannot be, the next best thing is to use it as sparingly as possible. The merest touch will suffice.

When any job is finished do not throw the rubber away, as amateurs have been known to do, under the impression that a rubber, when once laid aside, becomes useless. It does if left exposed to the air, because the spirit evaporates, leaving the shellac to harden. As old rubbers are better than new, when done with they should be kept in an air-tight receptacle; a tin canister or a biscuit box will do as well as anything. If they are laid aside for any length of time, they will even then become hard unless the box be perfectly air tight, which it probably will not be. A few drops of spirit put into the box now and then will, however, keep the contents in proper condition for use.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### The Wire Gauge and its Variations.

The gauge is an instrument for determining the numerical size of any particular piece of wire. There are many different kinds of gauges, and, upon good authority, it is said that great variance exists amongst them. Fig. 4 is a drawing of the one I have seen mostly used. The decision, when ascertaining the size, is arrived at by placing the wire in the *notches* (the holes are merely for the sake of convenience), and the number of the notch into which it will exactly fit distinguishes the size by which the wire is recognised.

There is a little book, published by Messrs. Spon & Co., Charing Cross, London, written by Mr. Thomas Hughes, entitled, "The English Wire Gauge"—a book of which my opinion is that it would prove usefully acceptable to wire-drawers and wire-workers alike—in which are given over two dozen diagrams of distinctly different wire gauges, the originals of which, the author tells us, he has been collecting, and are of this and also last century's manufacture. Through the whole of his book he clamours for a standard gauge, on the grounds that at present the same sized notch on two or more different gauges is known by different numbers, thus frequently creating confusion.

I will take the liberty of making a few quotations from his handy little publication. In one part he says: "An order was received by cable from New York for . . . No. 36 W.G. (wire gauge). The receivers gave out the order No. 36 B.W.G. (Birmingham wire gauge), not aware of any other wire gauge. The manufacturers, incidentally learning what the . . . was for, instituted inquiries, and discovering it was for America, rightly concluded the gauge intended was Stub's, or Warrington wire gauge, that being the 'Birmingham wire gauge' commonly used in the United States. Had this order been executed in No. 36 B.W.G., the . . . would have been useless for the purpose intended. No. 36 on Stub's gauge is No. 44 on the 'Birmingham wire gauge,' and the difference in the price of . . . this order £28. . . ."

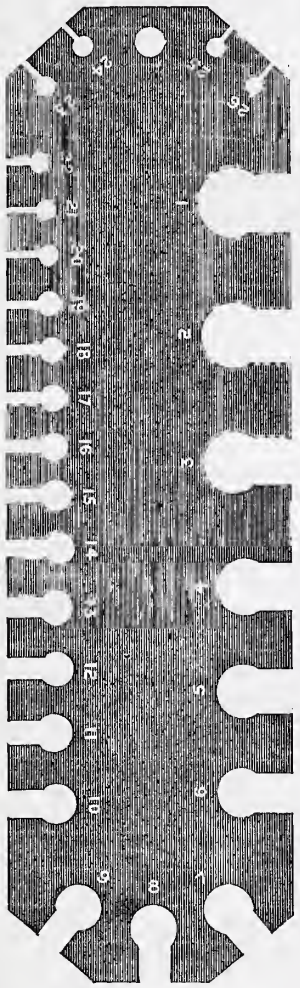


Fig. 4.—The Birmingham Wire Gauge (B.W.G.).

Mr. Hughes gives a drawing of what he proposes should be accepted and used as a "standard English wire gauge."

Although I have recommended his book to wire-drawers, I must tell them that in one portion he says: "Wire-drawers, as a body, are not the most intelligent of workmen; withal, they are too well aware of the fact that wire gauges vary, and are consequently content to draw their wire carelessly, irregular in size and form, knowing disputes cannot be settled by gauges." Whether this is fair or unfair to this section of workmen I will not venture an opinion. I trust it is not, for I have always been inclined to believe that the average British workman, whatsoever he laboureth at, is a painstaking individual. But Mr. Hughes gives his reasons for arriving at the above conclusions; and he also gives a brief but interesting history of wire-drawing.

He elsewhere says: — "Accurately drawn wire is daily becoming more and more incumbent upon manufacturers. Formerly good drawing was wire which would enter one notch, but not the next notch on the gauge to it, the limit of variation—say No. 1 wire—being the two-hundredth part of an inch. It mattered not whether the wire was round or oval." This is, undoubtedly, a fact, but I shall not endeavour to alter such circumstances, and therefore shall adopt the use of the gauge shown in Fig. 4, one which has been extensively used. Whenever I may mention certain sized wire in connection with any of the articles which I shall do my best to describe in following papers, it must be understood that I am using the numbers indicated upon the gauge just spoken of.

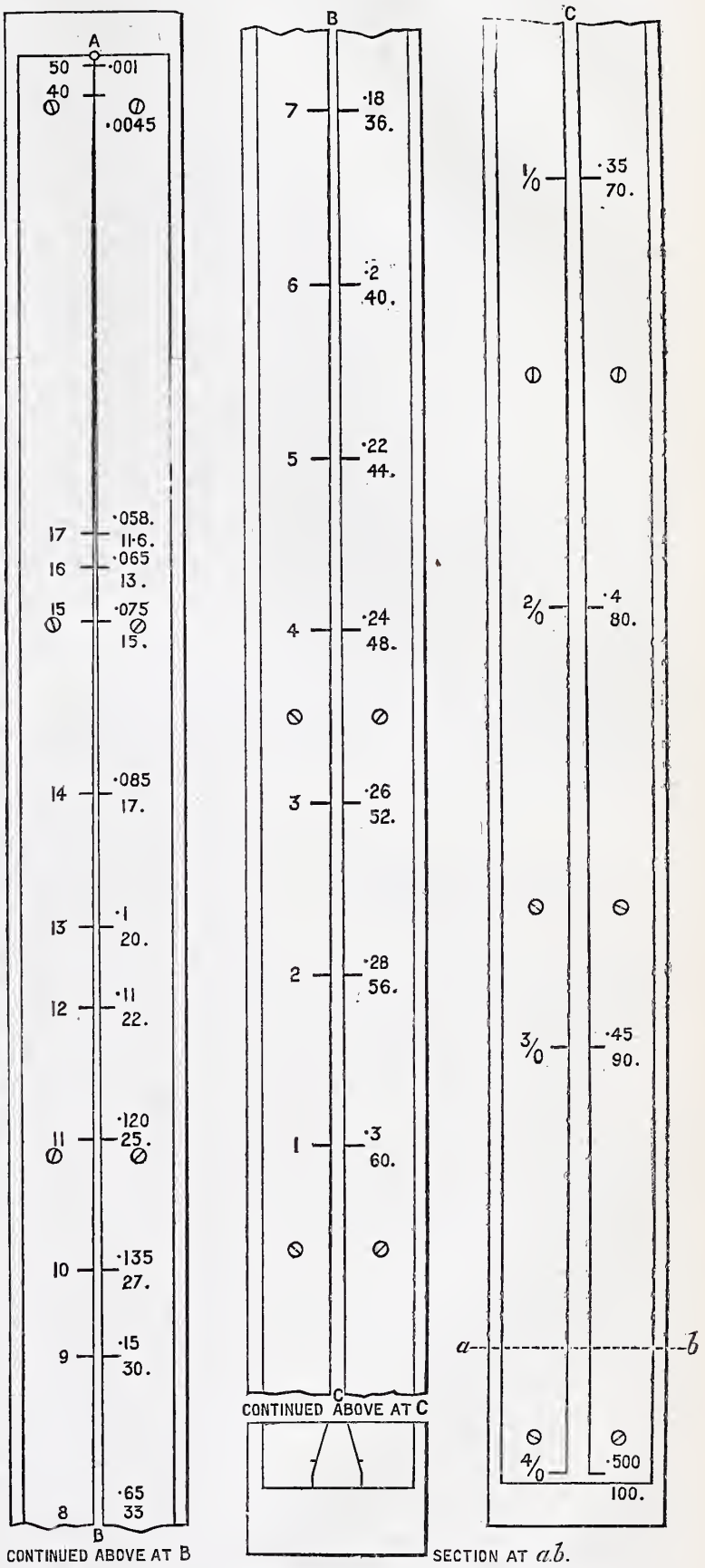



Fig. 4a.—Hughes' "English Standard Wire Gauge," slightly modified.

As wire increases in thickness, it is very often distinguished as *rods;* but it must not be assumed that I have taken any particular thickness as a starting point, for what in one workshop would be merely called wire would in another be termed rods. In reference to this Mr. Hughes says :—

"I have not found a wire gauge made anterior to 1846 to contain a larger size than No. 1, demonstrating that down to 1846 the largest size *wire* was No. 1. Anything larger was called *rods.*"

I have alluded to wire-drawers, but it is not my intention—indeed, it is not within my power—to describe the process of wire-drawing. In fact, such really has no more to do with *wire-work* than the operations carried on in saw-mills have to do with what is generally known as *wood-work.* I give in Fig. 4A a diagram of "the English standard wire gauge," the invention of Mr. T. Hughes, reproduced, with slight alterations in the position of the figures, from his publication, "The English Wire Gauge." I cannot ascertain whether or not it has been adopted by many wire-drawers or workers, and would thank anyone acquainted with any firm using this gauge to announce the fact to me. I shall say nothing further upon the merits or demerits of the article than to remark that its length is a prominent impediment. I might suggest that, if made similarly, with graduated groove, but round—that is to say, its two ends almost meeting—it, perchance, would be an improvement. I am aware that there would then be an inner and an outer diameter formed by the groove, but I fail to see that this would materially affect its utility or accuracy. I reproduce the design here, knowing full well that it will be brought before numerous readers who may not have heard of Mr. Hughes's interesting book.

## A TANGENT GALVANOMETER FOR WOOD-TURNERS.

BY H. A. MILES.

DESCRIPTION OF POST OFFICE TANGENT GALVANOMETER—HOW TO MAKE A SIMPLER, THOUGH EQUALLY EFFECTIVE, FORM—DESCRIPTION OF PARTS—HOW VARIOUS PORTIONS ARE CONNECTED—MATERIALS REQUIRED—METHOD OF PREPARING TURNED PARTS—LINING INSIDE OF INDEX BOX WITH TINFOIL—GLASS REQUIRED—USE OF MIRROR—DRILLING NECESSARY—DIVISION OF INDEX—PREFERABLE ALTERNATIVE — PIVOTING OF MAGNET — SUSPENDING SAME BY SILK THREAD — NEEDLE — BEST LENGTH — INDICATOR — WINDING OF COILS—GAUGES OF WIRE TO BE USED—CONNECTIONS OF COILS ON BASE—USE OF SHORT CIRCUITING KEY—LEVELLING SCREWS—HOW MADE—USE OF THE INSTRUMENT — EXAMPLE — SHUNTING PART OF CURRENT—CONCLUSION.

THERE is always a demand amongst amateur wood-turners for designs of simple articles which are effective in appearance, and yet do not require an extraordinary degree of manipulative skill in their construction. I therefore propose to show how a turner of average, or even limited, ability may make a handsome article at a very small cost.

Those who have studied electricity will not require to be told the use of a tangent galvanometer, which is a costly though beautiful instrument. Those used in the post office, for instance, which are of the best design, are all of brass, with adjustable controlling magnet, micrometer levelling screws, etc., and are so arranged that the upper portion may move through an arc of a circle independently of the stand.

The instrument I shall describe was designed for the use of electrical engineering students who wished to construct their own apparatus, and was made of mahogany.

Fig. 1 is a front elevation of the completed instrument. A is the ring which contains the coils of wire ; B is the box in which the index plate and magnet are placed ; C is its support ; D the support for the ring and box ; and E the base.

Fig. 2 is a section of Fig. 1, and shows the manner in which the various portions are fixed together.

The mahogany required will be a piece 1 in. in thickness, sawn roughly to a circle $9\frac{1}{2}$ in. in diameter. A circle 2 in. in thickness and 6 in. in diameter, another $1\frac{1}{2}$ in. in thickness and $9\frac{1}{2}$ in. in diameter, about 6 in. of 3 in. square, and a few odd pieces of small size.

To commence, fasten the piece of 1 in. stuff on the taper screw chuck, and face up one side. Reverse it, and then true up the other side for a couple of inches from the outside, and cut the groove for the wires—$\frac{1}{2}$ in. wide by $\frac{3}{8}$ in. deep—on its periphery. The edges of the flanges should now be neatly rounded and papered up on both sides, after which the ring may be cut off with a parting tool, the inside dimensions being 7 in. The inner edges will probably be slightly rough, and may be papered off by hand, or a piece of stuff may be chucked, and a recess turned on its face, into which the ring fits, friction tight, a little chalk being used to prevent any slight slipping. All being now finished, it should be put away till wanted for polishing.

The piece left on the chuck must also be put aside, as it will be utilised in making the cap for the index box.

This may now be commenced. The 2 in. stuff should be chucked and faced up, leaving it of the shape shown in the section. The projecting portion being 2 in. in diameter by $\frac{1}{4}$ in. in depth, this side must now be chucked and the stuff turned down to a diameter of $5\frac{1}{2}$ in. The inside may now be removed to a depth of $1\frac{1}{2}$ in., leaving the bottom $\frac{1}{4}$ in. thick. The bottom may have a small bead run round, and the edge of the box must be rebated to take the cap, as shown in Fig. 2.

Now remove the box from the chuck, and replace the disc from which the ring was cut. This must be turned down so that the box will fit easily and yet not loosely, the rebate being of sufficient depth to allow for the thickness of the glass. The outside may be roughed into shape and the cap cut off, when the box must be rechucked, the cap fitted on with a little chalk, and neatly finished off with glass-paper.

The projection on the bottom should now be partly cut away, as to leave a tapering dovetail, which fits into a corresponding mortice in its support.

Before proceeding with the box support, etc., it would, perhaps, be advisable to turn up the base, and then work upwards. The base, which is of $1\frac{1}{2}$ in. stuff in the rough, should be faced up true on one side, reversed, and the edge of the other side trued up, and the middle recessed $\frac{1}{4}$ in. deep to within 1 in. of the edges. A bold moulding should now be turned on its circumference. A parting tool cutting a hole in the centre about 1 in. diameter will now remove it from the chuck.

The ring support, D, should next be done up, being made from 3 in. stuff. The bottom should be turned to fit the centre hole in the base, and a $\frac{1}{4}$ in. hole bored right through for the passage of the wires connecting the coils with the terminals in the base. A slot must now be carefully cut with a fine saw, into which the ring must tightly fit. The ring should now be marked, so as to be able to replace it in its exact position again ; care being taken that the grain of the wood is either horizontal or vertical, the former, to my mind, having the best appearance. A $\frac{1}{4}$ in. hole must now be cut in the portion of the ring which fits in the slot, and the base of the box support turned so as to "cap" the other one, and fit into the hole in the ring by means of a projecting pin—the top being fitted with a dovetailed recess as shown in perspective in Fig. 3, corresponding to the dovetail left on the under surface of the index box.

The woodwork is now complete, and should be nicely polished ; the interior of the index box should, however, be left plain, its sides subsequently being covered with tinfoil neatly glued all round to reflect the light on to the index plate.

If the galvanometer is to be fitted with levelling screws, three will be required, and I shall refer to this at a future stage ; but if not, three small knobs should be turned up, all exactly the same thickness, and glued in their places underneath, as shown in Fig. 2, the pins fitting into the holes bored for their reception.

The wood-turner's portion is now finished, and he may survey with pardonable pride the neat appearance his work will present if it has been conscientiously done, and the directions given have been properly followed.

The next stage will be to get a piece of looking-glass to fit inside the index box, and a piece of plain glass to fit *on* its edge inside the cap, the latter maintaining it in position. A small hole should be drilled in the centre of each.

The division of the scales on the index is a matter requiring great accuracy, and a deal of trouble would be saved by taking a walk yourself, or sending that convenient acquisition, a young brother, to the nearest newsvendor's, there purchasing a duplicate of this number of WORK, and cutting out the index, which may then be fastened to the looking-glass, using paste and glue. When dry, the two portions marked × may be cut round with a sharp knife, and carefully removed. For those who would prefer to make the scales themselves, I have shown the means of obtaining the tangent divisions (Fig. 4). The use of the mirror is to prevent errors due to parallax, as if the eye is exactly over the needle its reflection on the glass will not be visible.

The important question has now to be decided as to whether the magnet and pointer shall be balanced on a pivot, or suspended by a cocoon thread. I need hardly say that the former is vastly superior to the latter, though proportionately more difficult. If it is decided to suspend the needle, the silk thread is secured in the hole in the glass cover by a little shellac, and the needle fastened to its other extremity as near as possible to the index.

I shall, however, take it for granted that the larger proportion of my readers will prefer to pivot it properly, and make a good job of it.

A sewing needle driven upwards through the bottom of the box so as to project about $\frac{1}{4}$ in. through the centre hole in the mirror will make a splendid pivot. The surplus part underneath may be broken off out of the way.

The needle now claims attention. It may with safety be made $\frac{3}{4}$ in. long without introducing any perceptible source of error considering the diameter of the coil, and should be about $\frac{3}{16}$ in. wide and $\frac{3}{32}$ in. thick.

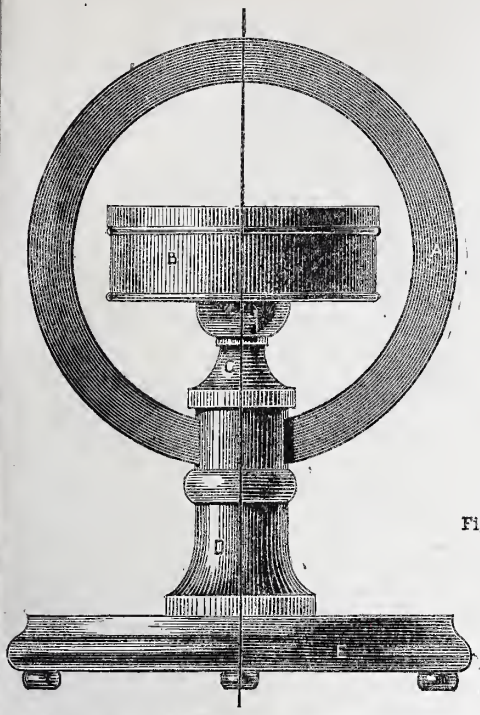
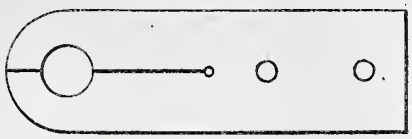



Fig. 1.—Front Elevation of completed Instrument.



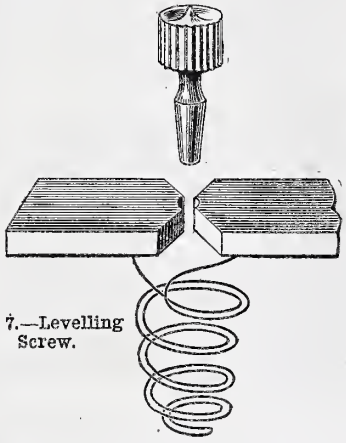


Fig. 7.—Levelling Screw.

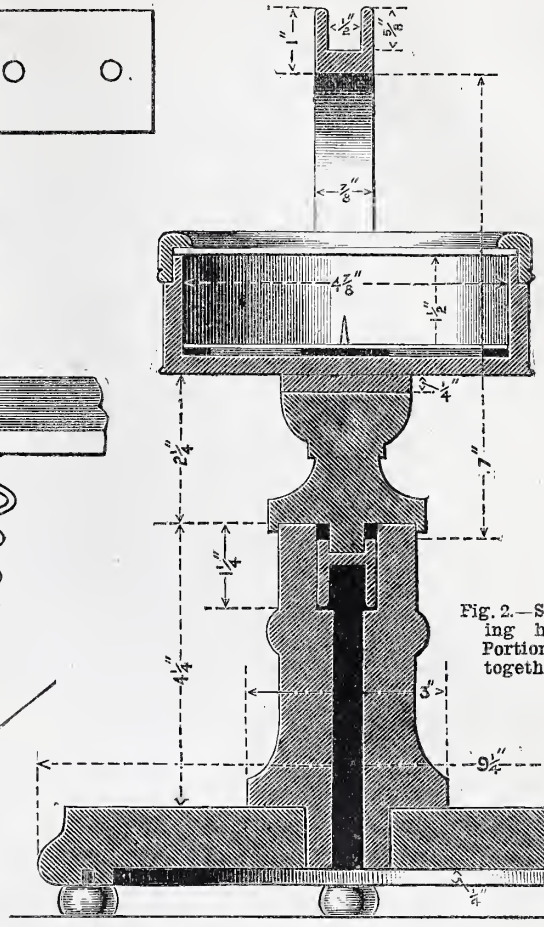



Fig. 2.—Section showing how various Portions are fixed together.

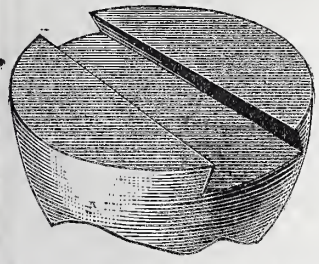


Fig. 3.—Dovetailed Recess in Top.

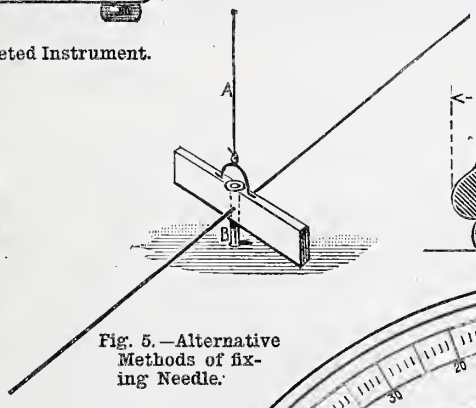



Fig. 5.—Alternative Methods of fixing Needle.

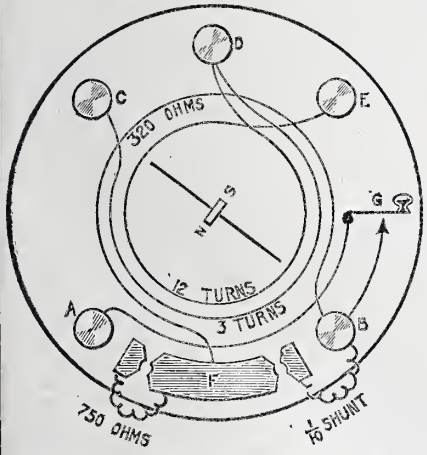



Fig. 6.—Resistance Blocks, Terminals, Wires, etc.

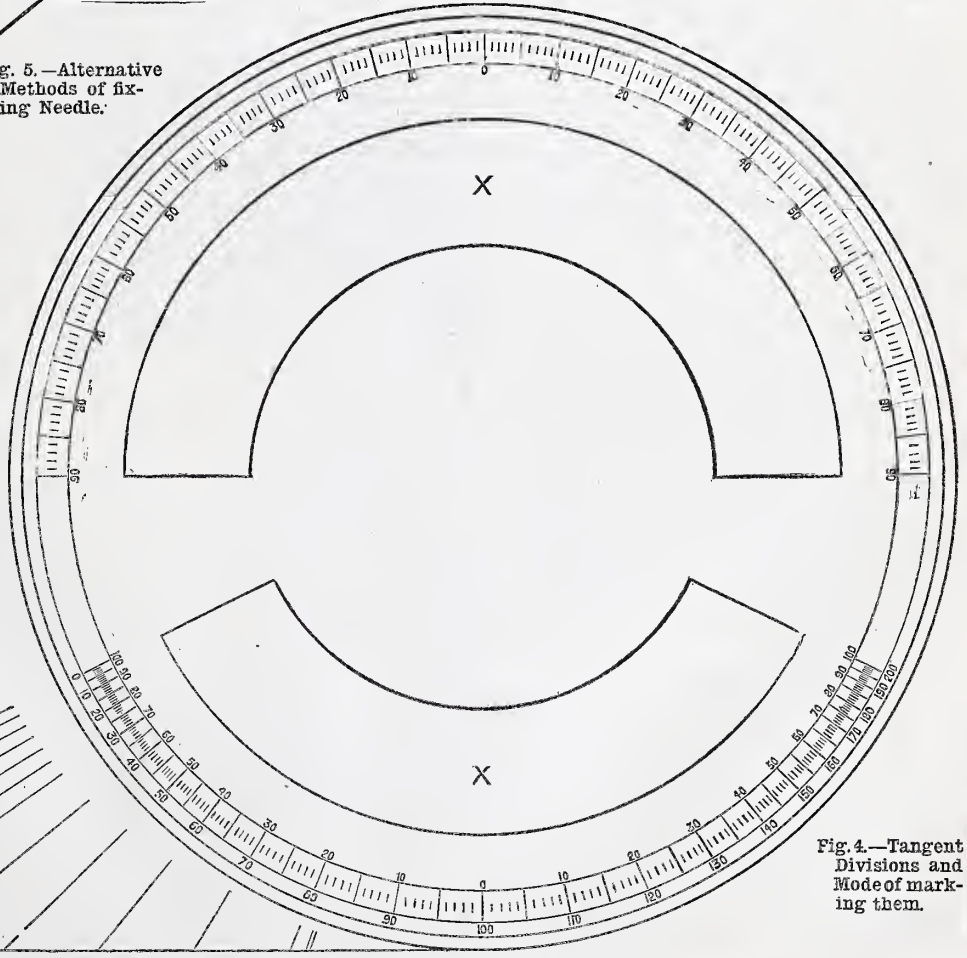



Fig. 4.—Tangent Divisions and Mode of marking them.

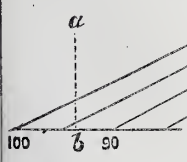
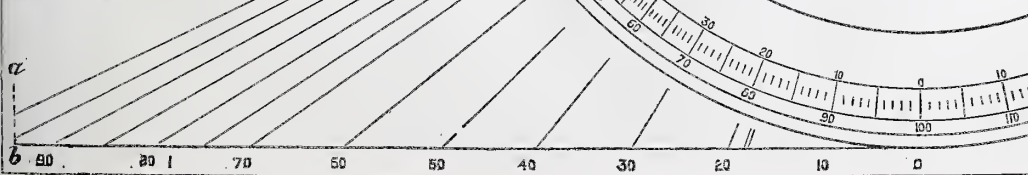



Fig. 4a.—Continuation of Fig. 4 to Left Hand.



A hole should be drilled through the centre across the $\frac{3}{16}$ in. width, sufficiently large to allow the sewing needle to pass freely through. The needle should pivot on a jewel, as it is absolutely necessary to eliminate all possible friction. A jewel set in a small plate can be obtained at the watchmaker's, and fastened immediately over the hole by a little solder or shellac. A piece of very fine but hardened copper wire must now be fastened to the piece of steel, so as to form a straight line at right angles to it, and of sufficient length to reach the width of the index card. This pointer is the means employed to read the deflections shown on the scale. The accuracy of the pointer may be tested by observing whether its two points correspond to the zero on each side of the scale.

Fig. 5 shows the alternative methods of fitting the needle: A showing the silk thread means of suspension, and B the sewing needle pivot.

The winding of the coils may now be proceeded with, and wire of the following gauges, best quality, should be used.

Between the centre of the resistance blocks and the terminal B, No. 36 silk-covered copper wire of sufficent length to offer a resistance of 320$^w$ should be used; something over $\frac{1}{2}$ lb. will be required.

Between C and D, three turns, and between D and E, twelve turns, of No. 18 silk-covered copper wire, the three turns being wound in the opposite direction to the twelve turns.

The resistances inserted between the brass blocks are made up of No. 38 German silver wire, wound on a shallow reel under the base, the wire being doubled in half before being wound, as shown in Fig. 7.

The wires are neatly wound in the ring and passed through the hollow pillar and out below the base, where they are connected to the various terminals, as shown in Fig. 6.

When this has been done, a strip of patent leather may be fastened over them, so as to give a neat finish to the coil.

The small key shown at G, in Fig. 6, is for the purpose of checking the oscillations of the needle, and bringing it quickly to rest, the coils being short-circuited when the key is depressed.

Levelling screws, if required, may be made in the following manner—

Three pieces of rolled brass, $\frac{1}{4}$ in. by $\frac{5}{8}$ in., and 2 in. in length, may be neatly filed up, one end of each being rounded to a semicircle, as shown in Fig. 7, where also is seen the positions of the holes to be drilled. The hole at the rounded end should be tapped to take a convenient-sized thread, say $\frac{1}{4}$ in. Whitworth, though a fine instrument thread is far preferable. The end may now be sawn down for a short distance, and the ends slightly closed by a light tap with a mallet (to save denting the metal), so as to give a spring grip upon the screw. The two small holes at the other end are for the purpose of screwing it to the under side of the wooden base.

The levelling screws may be of any form. The heads should preferably be milled, and the ends rounded, so as to avoid scratching the surface of any polished table, etc., on which the instrument may be placed.

The galvanometer being completed, perhaps a few words as to the manner in which it is used will not be amiss.

Referring to Fig. 6, a current sent from C to E would give nine turns, acting on the needle, three of the twelve being neutralised by the three in the opposite direction between C and D.

The resistance of these coils is almost negligible, so that by using the various terminals effects can be obtained from three, nine, or twelve turns, without appreciably varying the resistance of the circuit.

The 320$^w$ coil is joined to the middle brass block and to B. If a plug is inserted in the left-hand hole, the end of the coil joined to the middle block is connected to terminal A direct. Without the insertion of this plug, however, an additional resistance of 750$^w$ is left in the circuit, and the resistance between A and B is 1,070$^w$.

The resistances are arranged for use with a Daniell cell of a comparatively low resistance, and if such a cell be joined to A and B, the current would be equal to $\frac{1{\cdot}07 \text{ volts}}{1070 \text{ ohms}}$, or ·001 ampere, viz., 1 milliampere.

If a current to be measured is very strong, a very high deflection will be the result, and to obviate the difficulties which would arise, the current is "shunted," or provided with a second path, so that only a portion passes through the galvanometer, the remainder passing through the shunt.

If the shunt was equal to the resistance of the coil, half the current would pass through each; but if the resistance of the shunt is $\frac{320}{9}$ ohms, then $\frac{9}{10}$ of the current will pass through the shunt, and only $\frac{1}{10}$ through the galvanometer.

This is the case in the instrument in question, the resistance being wound in the same way as previously described, and also placed beneath the base. The shunt is brought into play by inserting the right-hand plug.

Suppose a current of 1 milliampere gives a deflection of twenty-seven tangent divisions. If the tenth shunt is then inserted, and a deflection of eighty-one divisions obtained with a current of uncomputed strength, the current flowing round the galvanometer is evidently three milliamperes, but as this is only $\frac{1}{10}$ of the real strength, it follows that the total current is thirty milliamperes.

I do not profess to have explained the theory of, or more than touched upon the method of, using the tangent galvanometer, and have no wish to trespass upon the domains of our electrical contributors; but persons unacquainted with its use will not require to make it, and those who do understand it are not in want of any explanation. The coils requiring to be of a specified resistance should be tested carefully by means of a Wheatstone bridge.

In a future paper I hope to show how a simple bridge may be constructed.

## OUR GUIDE TO GOOD THINGS.

### 4.—The Britannia Company's No. 8 Fret-Saw Machine.

From the time of its introduction the Britannia Company's "No. 8" machine has been a favourite one with fret-cutters who could appreciate its numerous good features. The makers have, however, not been content to rest on their oars, but have, from time to time, introduced improvements as they have been suggested, till the "Improved No. 8," as the newest form of the machine is called, is as nearly perfect as possible. All the chief points of the original, the heavy driving wheel, large table, equal tension of the saw with perpendicular action, etc., have all been preserved, so that in general the machine remains much as it was. Closer examination, however, shows that there are several well-thought-out improvements, which cannot fail to be appreciated alike by the novice and the experienced worker. Comparing the present with the original machine, the vertical drill, in addition to the one at the side, is the most prominent feature which attracts attention, but, beyond this, there are several minor improvements which conduce to the comfort of the worker. Perhaps the most important of these is the facility with which the saws can be fitted, as the fumbling which so often happens to fit them into the clamps is done away with by a very simple expedient, which allows them to be fixed with the greatest ease. The tilting arrangement has also been simplified, while the saucer-like receptacle for sawdust underneath the table, where it was sometimes in the way when fastening the saws, has been done away with. The stroke of the saw has been increased, as has likewise the distance between the table and the upper arm of the frame. This by no means exhausts the list of improvements; but the others are of comparative unimportance, although they all tend to make the machine what I consider the best both for amateurs and cabinet makers who do not require to cut anything over, say, $\frac{3}{4}$ in. thick, though, as an experiment, I have cut oak of considerably more. It almost goes without saying that the thinnest material and the finest saws can be used, when necessary, with equal facility. The price of the machine complete is 65s. I understand that the makers are contemplating a lathe attachment, which will be a great advantage to those fret-cutters who wish to do the small turned parts which are so often found in fretwork designs. When this is ready, no doubt I shall have something to say about it; meanwhile, readers who desire to know more about it cannot do better than apply to the Britannia Company direct.

### 5.—Some Useful Books, etc.

**The Amateur.**—I have received the *Amateur* for March, 1891, published by Messrs. Henry Zilles & Co., 24 and 26, Wilson Street, Finsbury, London, E.C. It contains a very good pattern in fretwork for a bracket and towel-roller combined, which seems a somewhat incongruous bringing together of the drawing-room and back kitchen or scullery, for the towel-roller would not be wanted in the former apartment, and an elaborate bracket above the towel-roller is clearly a waste of ornamentation in the latter. The part also supplies an excellent design for an inlaid table in olive wood, curled walnut, and rosewood.

**Development.**—This handy volume on an important branch of photography, written by Mr. Lyonel Clark, C.E., author of "Platinum Toning," forms Vol. V. of "The Amateur Photographer's Library," published by Messrs. Hazell, Watson, & Viney, Limited, 1, Creed Lane, Ludgate Hill, London, E.C. It includes instructions for the use of eikonogen as a developer for instantaneous work and a comparison of developers.

**The Electro-Platers' Handbook.**—Our friend Mr. George Edwinson Bonney, who by this time is well known to all readers of Work as an authority on all matters connected with electro-metallurgy and kindred subjects, has written this volume of Whittaker's Library of Arts, Sciences, Manufactures, and Industries, published at 3s. by Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C., "to meet the wants of amateurs and young workmen desiring a practical manual on electro-plating at a low cost." It is written in Mr. Bonney's careful, painstaking, and explanatory style, and cannot fail to answer the purpose that he has in view.

**Ventilation.**—This is a thoroughly practical and exhaustive volume on the important subject of ventilation, written by Mr. William Paton Buchan, R.P., Sanitary and Ventilating Engineer, author of "Plumbing." It is, as it purports to be, a complete guide and text-book to the practice of the art of ventilating buildings, and contains instructions on air-testing, giving various methods of examining the air of buildings. It is published at 3s. 6d. by Messrs. Crosby Lockwood & Co., 7, Stationers' Hall Court, Ludgate Hill, London, E.C., and forms a volume of Weale's Rudimentary Series.

The Editor.

## SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** In consequence of the great pressure upon the "Shop" columns of WORK, contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Furniture Colouring.**—W. N. (*Sheffield*).—I am afraid you are not such a careful reader of "Shop" as you say you are, or you would have seen not very long ago an answer to a correspondent on the same subject. As your signature is somewhat illegible, and I cannot turn up the inquiry then answered, I am unable to say whether it is not the one you refer to as having been lost. You know it is really impossible to give answers to questions at once, as the "Shop" columns are limited in extent. It is not worth while repeating remarks so lately given, so I can only briefly answer your present inquiry. Take the colouring of your walls, and paint your furniture similarly. The more colours you use, and the more pronounced they are, the greater the liability to failure. Low tones or light, almost white, colours are generally the most successful. Without knowing something of the prevalent colours of the room in which the furniture is to stand, how is it possible to advise you on what will be best either from Aspinall's or any other paint-maker's cards? If you use white polish, it will not affect the colour; but, of course, if you use dark polish, the colour will be modified accordingly. Get a machinist to do what is necessary to your lathe. I do not think you can do it yourself.—D. D.

**Stove and Fret Saw.**—ARTIST IN WOOD.—Your stove seems practicable enough, as it does not differ essentially from many now in use. It it just such a thing as anyone who has to do sufficient veneering to make it worth his while to have a special stove for heating cauls could construct or arrange for himself. No doubt you know that, in ordinary circumstances, the usual open fireplace is quite sufficient. I am sorry to say that I am so dense as to be unable to make head or tail of the description of your new form of scroll saw. Therefore, to say that it is very good would be flattery of the most senseless kind; while, on the other hand, to say that the idea is worthless, might possibly be the means of discouraging you, and preventing what may be a really good thing from being brought forward. To go into all the parts which I do not understand would entail too much time, but if your invention has got further than paper, and a machine has been made on the lines you dimly suggest, let us have a description in which the blanks of your present one are filled up. Such little omissions as source of motive power, disposition of top end of saw, and one or two trifles of that kind, do not exactly help one to understand your meaning. Life is too short to spend many days in trying to work out a mechanical puzzle of the kind you put before us.—D. D.

**Polishing Alabaster.**—MONUMENTAL MASON.—This is an inquiry for "full details," and yet there is no indication, except, perhaps, the signature which points to carved doves, whether the work to be polished is flat, turned, or carved. Space is too precious to go into all the tools and methods employed, so the following summary is submitted with the hope that it will give the information required; if it does not, then write again. I will suppose that the work has already a good smooth surface left from either rifflers, scrapers, or glass-paper. Now use some fine sand-stone or grit-stone, such as robin hood, water of Ayr, or snake-stone, or else trent sand and water, until you get rid of all tool marks; follow on with pumice, either in lump or powder, also with water; next use putty powder and water, and for a finish I am told soap and water is particularly good to use with the putty powder, especially for lathe work. As to the way in which you will apply these materials, that must rest with yourself, as I have no details to guide me. If for crevices in carvings, a soft stick will best hold the polishing powder. For choice, get some dog-wood—that is, what butcher's skewers are made of. Then for other forms, buffs of leather, pads made of cloth, either to use by the hand or to revolve in the lathe, or dollies of wool or list, also for the lathe, may be required, while the hand itself may be used to give it an extra finish.—H. S. G.

**Bird Cages.**—A. T. (*Inverness*).—There are probably few readers of WORK who do not keep a canary or a bird of some kind, and perhaps some of them would like to see their songster in a large cage. I will give instructions how to make a cage—a cage that is roomy, ornamental, and not difficult to make. The one illustrated (Fig. 1) is a square cage, standing upon a table. The eight uprights are of ⅜ in., and the rest is of ½ in. mahogany. The top is in one solid piece, with a round hole cut for the dome. After the wiring is done in the bottom part, the top is simply glued on the eight uprights, as in Fig. 4. To wire the dome, divide round the circle with a compass ½ in.; for the top of the dome, have a round piece of mahogany; divide that into the same number of parts; bore the holes, then cut a number of wires the length, to give the dome a pleasing curve; fasten a wire in the bottom and in the top piece, and bend it to the proper shape; then put one in each corner; and now go all round, bending each wire. For binding and straightening the wire, see page 29, No. 54, Vol. II. of WORK. A simple breeding cage, if it is wanted to hang in a large room for the season only, could be made of ⅜ in. pine, put together as in the drawing (Fig. 2). There is no pretension to ornament: it is a simple

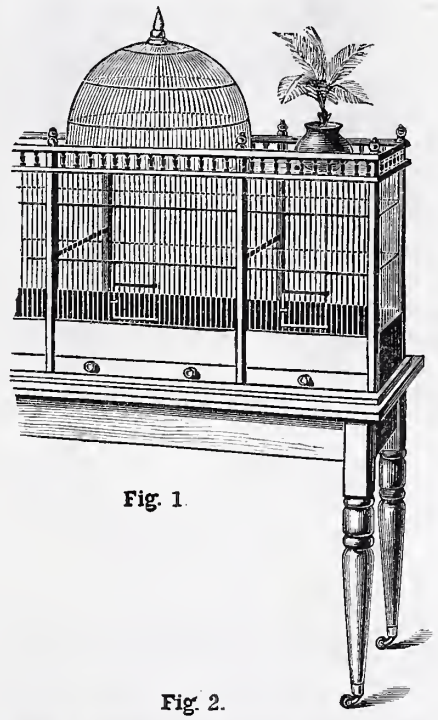


Fig. 1.

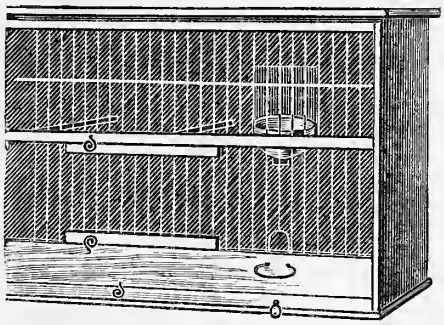


Fig. 2.

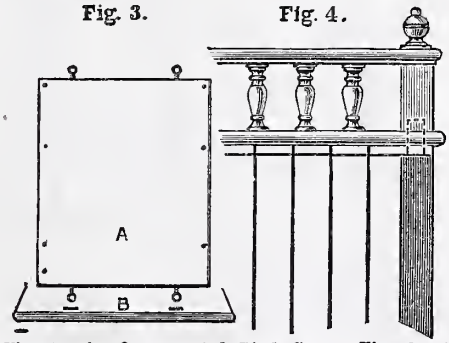


Fig. 3.

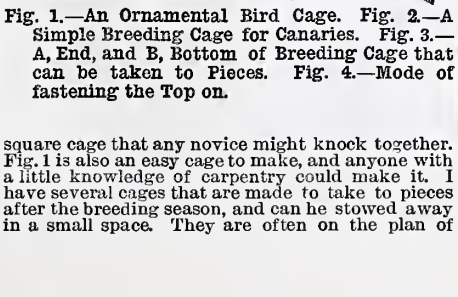



Fig. 4.

**Fig. 1.—An Ornamental Bird Cage. Fig. 2.—A Simple Breeding Cage for Canaries. Fig. 3.—A, End, and B, Bottom of Breeding Cage that can be taken to Pieces. Fig. 4.—Mode of fastening the Top on.**

square cage that any novice might knock together. Fig. 1 is also an easy cage to make, and anyone with a little knowledge of carpentry could make it. I have several cages that are made to take to pieces after the breeding season, and can be stowed away in a small space. They are often on the plan of Fig. 2, but I should not care to keep the birds all the year round in a deal cage. I will now describe how to make a simple breeding cage. List of pieces required:—Two pieces for top and bottom, 24 in. by 11 in.; two pieces for sides, 14 in. by 10¾ in.; one piece for back, 23 in. by 10¾ in.; one piece for false bottom, 23 in. by 10⅜ in.; for front, three strips, 23 in. by ½ in.; one strip, 23 in. by 2 in. Plane all these pieces both sides, and before putting the cage together, stain and varnish the outside and white-wash the inside. Now mark the pieces for the wire, ½ in. apart; you can do this with a rule or a stiff compass, but if you are making several cages, it will save time if you make a marker, as described in WORK, No. 54, page 20. You can bore the holes in soft wood with a hradawl; take care to have it sharp, and cut across the grain; bore holes right through on strip of ½ in., and half-way through the others; cut one of the ½ in. strips into two pieces, 5 in. long, for the door, and put the door together with seven short wires. Having bored the last hole right through, and shaved the other ends so that the door will shut flush, put the wires through the centre strip, and get them all level; get the top strip on next, beginning at the end; pinch each wire with the pliers, and give the pliers a slight tap; leave out seven wires in the centre of the cage for the door, and put the door on the eight wires; cut about 1½ in. off the seventh wire from each end of the cage for the food and water fountains; turn up, and drive the wires into the bottom strip, taking care that they are parallel. Bore holes, and put the wire in for the fountains, and take care to fasten the ends in well; cut a slant for a feeding tin. Now the front is ready: nail the end on the back and front, then the bottom, and lastly, the top and the front strip on to the false bottom; make the fastenings for the door; fit and fix the perches in. The drawings will assist the amateur to make a simple breeding cage. There is a very good nesting basket described in WORK, Vol. II., No. 95, page 699, which I have found to answer the purpose; such can easily be fixed to the back of the cage.—F. H.

**Spokes.**—WOOD-WORKER.—First get your spokes for the heavy cart dressed off. When the hub or nave is turned, you will see that the wood-turner has marked a line with his chisel. This guide-line is nearer to the front than the back. When marking and driving home the spoke in the nave, the face of the spoke at the bottom must be in a dead line with this guide-line. If the wheel has twelve spokes, we divide the nave into twelve equal parts with a pair of compasses 1 in. behind the guide-line; when found, mark the division well by digging the compass-point well in the nave. Next, fix the nave in the pit-frame, and bore half-way through with a 1 in. bit at every mark or division. In boring, always have the bit perfectly perpendicular. When all are bored, get a dressed spoke and place the tang or foot of it just over a hole, and the face of the spoke in a dead line with the guide-line, and let the spoke be placed exactly between the other two holes at each side of the spoke; next run your pencil round the two sides and the back, thus marking the nave. We now pare this mortice out within the lines, and drive in the spoke, using a spoke-hoy or stick set right to guide us in driving the spoke in properly. We now miss a mortice, and go on to the next and serve it in exactly the same way as we did the first; thus six spokes are driven in alternately, leaving a space between every two spokes to receive another after the first six are in. If all the spokes were driven in one after the other, the consequence would be that the nave would burst into halves. In light wheels, the spokes are dressed off differently from the cart fashion, and are driven in the nave on the on and off system alternately; therefore two guide-lines are turned upon the nave, the off guide-line being ⅛ in. behind the on or front guide-line. The strength of the timber for a heavy cart wheel is generally as follows:—Oak nave or hub, length 15 in. by 13 in. (in 6 in. wheels the spokes of English oak are 4 in. by 2 in.); felloes of ash or oak, 6 in. by 4½ in.; hoops or tyre, 6 in. by ⅜ in. thick; height of wheel when finished, 4 ft. 9 in. In 4½ in. heavy cart wheels the strength of the nave is the same; the spokes are 3½ in. by 1¾ in.; felloes, 4½ in. by 3½ in. or 4 in.; tyre, 4½ in. wide, ⅜ in. thick; height of wheel when finished, 4 ft. 6 in. or 8 in. The strength of timber for wheels for a light trap is: nave of elm, 9 in. by 8 in.; felloes of ash, 2½ in. thick; oak or hickory spokes, 2 in. by 1⅜ in. thick; tyre, 1⅜ in. wide, ⅛ in. thick: the lengths of the spokes go according to the height of the wheel. A pair of wheels suitable for light spring-cart for a pony of thirteen hands would be about 4 ft. high.—W. P.

**Platinum.**—J. W. (*Homerton*).—Write your wants fully to Messrs. Johnson, Matthey & Co., Hatton Garden, London, E.C., who will doubtless reply to you.

**Silvering on Glass.**—W. E. L. B. (*King's Norton*) from information given in WORK has succeeded in silvering glass in the ordinary way: he now asks information on chemical silvering. May I ask if W. E. L. B. intends to work simply experimentally or on a large scale for profit? If the former, I think I can help him; if the latter, something more than information will be needed. I have never had occasion to silver by this process, but I have secured information from a reliable source which I am pleased to impart to the inquirer. There are several processes; the following I give with confidence. *Silvering Solution.*—Dissolve forty-eight grains of crystallised nitrate of silver in 1 oz. of distilled water. Add strong liquid ammonia drop by drop, stirring

at the same time with a glass rod—the stirring must be continued until the brown precipitate is nearly, but not quite, re-dissolved. It must now be filtered and distilled, and water added to make up to twelve fluid drachms. *Reducing Solution.*—Dissolve twelve grains of Rochelle salt in 1 oz. of distilled water. Boil in a flask, and whilst boiling add two grains of crystallised nitrate of silver dissolved in one drachm of water. Let it boil five or six minutes after the latter has been added. Filter when cold, and add distilled water to make twelve fluid drachms. *Silvering.*—The glass to be silvered must be *chemically clean.* To secure this, dip it in strong nitric acid. Then wash in liquor potassæ, and finally wash in distilled water. To have the glass approximately clean is not enough. Chemicals are very particular as to what company they keep, and positively refuse to act unless they are consulted. In a glass vessel of a size suitable to the glass to be silvered, equal portions of the two solutions must be poured, and stirred so as to be intimately mixed. Previous to this, some plan must be devised by which the glass can be gradually lowered into the vessel. For example, a piece of wire may be cemented to the side of the glass not to be silvered, and be made to pass through a hole in a piece of thin board; this may be placed across the mouth of the vessel; the glass attached to the wire can then be raised or lowered. The glass, whilst still wet from the bath in distilled water, must be let down into the solution. The utmost care must be taken that the entire surface touches the solution without any air-bubbles between. The vessel must be set in the sunshine in a warm room. The light soon turns the fluid black, which gradually grows clear as the silver is deposited. It must at this point be removed, for if left after the solution is exhausted, the silver will be partly re-dissolved. When the mirror is removed from the bath, it must be carefully washed in distilled water and placed on its edge to drain and dry. When perfectly dry, the silver must be varnished with an elastic varnish or paint to prevent damage. I shall be pleased to give further details if needed.—O. B.

**To Soften Gold.**—H. H. W. (*Pimlico*).—To soften gold or silver after hammering, all that has to be done is to anneal it—that is, make it red hot, and let it cool or quench it in water, when it will be as soft as ever it was. Experience will teach you that the heat should be applied regularly, gently, and gradually; that to make the part near a soldering seam hot first of all will cause it to open; that a sudden quenching is bad. These, and many other things, will be found out by experience, for on the application of heat for soldering and annealing, one of our foremost jewellers (Giuliam of Piccadilly) says that it takes an apprenticeship of seven years to master. This applies only to the work if of good size and of complicated design. For every-day work, no difficulty is likely to be experienced.—H. S. G.

**Silver Foil.**—CAROL.—This preparation is generally believed to be a French production, and from experience with it in the workshop as a finished article, I should say that it would be a very difficult matter to keep the thin silver flat, smooth, and bright while the paint—which I believe is put on when warm—is being evenly applied. You might make inquiries at the flatting mills (Buckland Hop Gardens, St. Martin's Lane) as to the thinness they can flat silver to; if too thick, then try a gold beater. When you have got your silver thin enough, you have to find somebody to burnish it. The next thing will be to obtain the paint. All I know about that is, that it can be bought at jewellers' material shops in various colours—named after the stones. Of its composition I have never thought, but rather suspect if I really wanted to know that, I should get a chemist to analyse some. The foregoing is merely an indication of what I think is the manner of proceeding. The game can never be worth the candle. If, however, you intend going in for it in large quantities, no doubt the Editor will put a query at the end of "Shop," and I will as well spend some time in going into the matter, if you will but write again.—H. S. G.

**Angle Iron.**—W. C. (*West Bromwich*).—The iron mentioned in answer to A. S. (*Forest Gate*) is not *angle* iron, but iron of "rectangular" (oblong) section. I do not think you can get angle iron so small, but upon this point you could get information from any manufacturer of iron bedsteads. I believe they use the smallest angle iron rolled.—F. C.

**Staining and Polishing.**—L. G. (*Middleton*).—To stain your light wood chest of drawers a nice mahogany colour, darken it first with a weak walnut stain, and then finish off with French polish, reddened with a little Bismarck brown. The work connected with the polishing is done exactly as if you were treating unstained wood, but it may be necessary to remind you that if the staining raises the grain, as it probably will, you must rub down with fine glass-paper. If you prefer to use a ready-made mahogany stain, you can buy one at almost any oil shop.—D. D.

**Book on Joinery.**—E. W. C. (*New Wandsworth*).—Joinery and cabinet-making are distinct trades, and the details, etc., given in books are, properly speaking, examples, and not working drawings. You would find Tarn's "Carpentry and Joinery" (2 vols.), published by Crosby Lockwood and Co., 7, Stationers' Hall Court, London, E.C., very useful. "Drawing for Cabinet Makers," by Davidson, published by Cassell & Company, Ludgate Hill, E.C., is also a very good book.—E. D.

**Gun Rack.**—J. H. (*Lancashire*).—This simple device should be found satisfactory accommodation for three guns and cartridges, unless you object to having their muzzles pointing nearly horizontally. The thicker the side brackets are the better—even 1½ in. or 1½ in. would not be too stout. Connect the ends of a back rail to the brackets after some such method as I show in Fig. 3. You must have noticed sufficient details elsewhere, applicable to the construction of the cartridge compartments, which I advise you to have as a box, with lid, in preference to drawers. To retain the guns in the position shown, it will be necessary to have hook-shaped

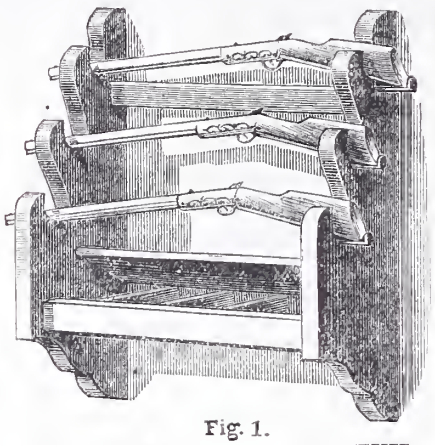


Fig. 1.

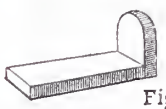


Fig. 2.

Fig. 3.

Fig. 1.—Gun Rack. Fig. 2.—Gun Stock Support. Fig. 3.—How to join Back Rail.

rails, as in Fig. 2, joined to one side of the article, against which will rest the stocks. By placing the guns as I show, their triggers will be less exposed to contact with coat sleeves, when a gun is being taken from the rack, than if stowed each flush with the other.—J. S.

**Concrete.**—H. A. H. (*Manitoba*).—(1) Concrete is made of four parts of broken stones, made to pass through a 2 in. ring, two parts of fine gravel or coarse sand, and one part of Portland cement. These must be measured in a box without top or bottom, and laid on a platform of boards, and turned over with shovel and pickaxe till thoroughly mixed;

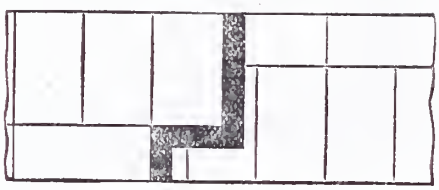


Fig. 1.

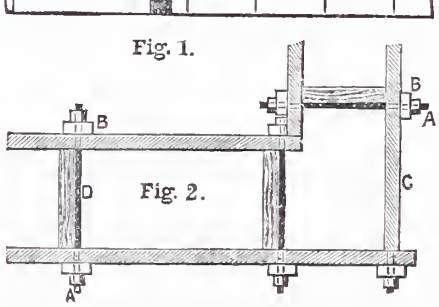



Fig. 2.

Fig. 1.—Binding of Wall. Fig. 2.—Frame for Concrete Building.

then sprinkle water on, and turn over till every part is wetted, but not saturated; it is then fit for use. (2) Walls 16 feet high can be built with it, and if all the moisture is dried out of them, they will not be affected by frost. Should there be any moisture left in, the frost will crack it, but to what extent can only be learnt by experience. If any concrete has been used in the district, you could note the effect of the frost upon it. If you have six months of dry weather after being built, the concrete should be dry. If the climate is wet, you might mould the concrete into blocks—say 12 in. by 6 in. by 3 in.—and wall them as ordinary bricks, binding them as in Fig. 1. For these the concrete must be screened through a ¾ in. screen. (3) The method of building in concrete is by frames 12 in. to 18 in. deep, kept apart by pieces of wood, and a row of ½ in. bolts 3 feet apart at the top and bottom. Washers or iron plates should be put on at the outside, and battens on the outside of the frame, which may be of 1 in. boards. The frame is filled with concrete, and when sufficiently set, the frame is moved along, and again filled, and so on round the building. Then commence a second course, and carry it round in the same manner. When the bolts pass through the concrete, lay a piece of board at each side, to prevent the concrete adhering to the bolts. The holes can be filled up afterwards. Fig. 2 shows the frames. For building flues, use a round core, 10 in. or 12 in. in diameter, with a handle on the top; fill round this with concrete, and, when set, draw the core up. Window and door frames are walled in, a board being fixed at each side of the frame to fill out the thickness of the wall. Two frames will be enough, except for a very large building. After the walls are up, render and float them inside and outside with Portland cement mixed with three times its bulk of sharp sand. (1) The outer walls may be 16 in. or 18 in. thick, and the inner walls 10 in. or 12 in.—M.

**Smelting Furnace.**—J. G. N. (*Manchester*).—A drawing of such a furnace is given in Bloxam's "Metals," page 314.—J.

**Colouring Gold Chains and Whitening Silver Ones.**—NEW SUBSCRIBER.—Your best plan will be to send both sorts to a gilder to be renovated, for there are many considerations that govern the use of the following methods, the chief being the qualities of the gold and silver that are to be coloured or whitened. For colouring, you will find all the details given in a reply to YOUNG AMATEUR in No. 19 of WORK, page 301. If the gold chains are not worn, but only discoloured, you can restore them by laying them in a mixture of chloride of lime one part, water ten parts. Afterwards rinse well in hot water and dry in warm sawdust. Neither of these methods to be used for any quality under 15-carat gold. To whiten silver, neither of the two following methods are to be tried on anything less than standard silver, and they only give good results at the first attempt when the silver is fine, such as is used in filigree work. Cover the work over entirely by the aid of a brush, with borax ground up with water on a piece of slate until it is as thick as cream. Then make it red hot, and drop it into a clean warm solution of vitriol one part, water about thirty parts. If it does not come out white on the first application, repeat the process two or three times. Another way is to cover the work with powdered charcoal and powdered saltpetre, mixed together with water in the proportion of three or four of the first to one of the last. Then anneal and boil out in the vitriol pickle given above, or else make this solution in its place: bi-sulphate of potash one part, water ten parts, and clean your work in that. After either of these, the work must be well rinsed in hot water previous to being dried in warm sawdust. To scratch-brush you can use soap and water, but diluted beer is better. Perhaps this method will do what you require: Take a piece of cyanide of potassium about the size of a lump of loaf sugar and dissolve it in a half-pint of warm water, then immerse your chains for a few minutes until the tarnish has gone off, then rinse, etc. To clean them only, an easy method is to apply whiting moistened with ammonia diluted with at least an equal quantity of water, using a soft brush. If you are thinking of trying any of these, first examine your work to see that there is no pewter solder on it, and in the case of gold there must be no silver solder about. It is safest to do as I advise at the beginning of this reply—send them to the gilder. Your signature is evidently a correct one, or else you would have seen that Mr. Bonney has a series of articles in this paper dealing with the subject of electro gilding.—H. S. G.

**Power of Water delivered through Pipe.**—GOSFORTH.—This must be treated by a formula for the flow of water through pipes, and the head will be $a$ plus $d$, assuming that no tank intervenes. To ascertain the power, we must calculate the discharge at the delivery point, and the *work* accumulated in the water at that point. This will be best shown by an example. Let $a$=10 ft.; $d$=50 ft.; $y$=100 ft.; and $x$=2 ft. The total head $h=a+d=60$ ft. Then if Q=cubic feet of water discharged per minute, we find by Downing's formula:—

$$Q = 2{,}356\sqrt{\frac{h}{y}}\times x^5 = 2{,}356\sqrt{\frac{60}{100}}\times 2^5 = 10{,}270 \text{ cubic ft.}$$

One cubic foot of water weighs 62½ lbs., therefore the *weight* of water delivered per minute will be $10{,}270\times 62\frac{1}{2}=64{,}185$ lbs. As the pipe is 2 ft. in diameter, its area is (from a table of areas) 3⅛ sq. ft. Dividing the quantity by this, we find the velocity per minute $\frac{10{,}270}{3\frac{1}{8}}=3{,}423$ feet per minute $=57$ feet per second. From the laws of falling bodies we find that the accumulated work in a body is equal to the product of its weight and the square of its velocity in feet per second divided by $64\frac{2}{5}$. In this case it equals $\frac{64{,}185\times(57)^2}{64\frac{2}{5}}=32{,}381{,}000$ foot-lbs. per minute. Now one horse-power is equal to 33,000 foot-lbs. per minute; therefore the horse-power given by the water will be $\frac{32{,}381{,}000}{33{,}000}=981$ horse-power.—F. C.

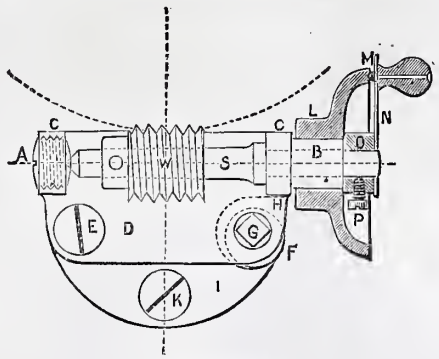
**Musical Box Repairs.**—SECRETARY.—First you say "pins out of barrel." Do I not tell how to re-pin the same in my article? "Three teeth in comb gone." I also state the best remedy unless you purchase

new comb; but three teeth you can insert, as I wrote. Now, as to working—and being a mechanic the job is easier to you—be sure to let it down to the bottom, or pins and teeth are broken by careless unscrewing of the fly-wheel; when spring has great power, off go lots of teeth and pins. Then do as I say—*clean* it thoroughly; not too much oil, and it will go easy and well. If not, see to the worm part. This part may be too far in—"too near its work," as you mechanics would say. If too far away—why, it would go to the bottom in two minutes or less; this you remedy by turning the screw from you (only a quarter-turn, or less) until it works, with pressure of your finger or thumb on the second wheel from worm.—PRACTICAL.

**Slide Painting.**—W. J. C. (*Islington*).—First, the colours used. Most dealers in artists' material supply boxes with all needful colours, etc. But it is not really requisite to procure a box, or, indeed, every colour that may be found in them. The following will be found sufficient for a beginner. W. J. C. doubtless is aware that all colours must be so-called transparent. *Red*—madder lake, crimson lake, pure orange, pure scarlet (this colour has been a difficulty, but a few months ago I received a tube from Messrs. Reeves, 113, Cheapside, London. It is a new paint, and I am informed that it is the result of much patient experimenting; the colour is exceedingly good, though it must be confessed that an absolutely pure scarlet in transparent colour remains to be discovered), burnt sienna. *Yellow*—yellow lake, gamboge, yellow madder, Italian pink. *Green*—verdigris. *Blue*—Chinese, Prussian, indigo, French ultramarine. *Brown*—vandyke, madder brown. (Madder lake and ultramarine are 1s., and the others from 3d. to 6d., per tube.) Varnishes will be needed. From W. J. C.'s letter, I fear he has been working without them, as he says his paint rubs off. Mastic, gold-size, copal, and pure turpentine, will meet his requirements. There is one little omission in W. J. C.'s letter; and that is, he does not say if he is working in oil or water. I am presuming, however, it is oil. Secondly, he asks, "Is there any way of putting them on, as I cannot get them on even?" They can not only be got on, but evenly too. I suppose the difficulty experienced is on large flat surfaces, as the sky. Now, if one looks minutely at a well-painted slide, he will see that the sky appears granulated, if I may so say. Sometimes circular marks similar to "thumb-marks" will be seen; colour is laid on the upper sky, and brought down near the horizon—from the horizon upwards to meet the blue. Yellow-red (or orange) is laid according to the effect required. These two colours are now blended together by means of the tip of the little finger. The finger makes little dabs accompanied by a somewhat rolling movement difficult to describe, but soon acquired by practice; by this means the two colours are blended in a perfectly even manner. If the colour is too thin on the glass, then a little is taken on the finger from the palette and dabbed on. On the other hand, if the colour is too thick, wipe the colour off the finger on the palm of the other hand, repeating this until the colour is brought to the proper intensity and depth. Some workers cover the top of the finger with the end of a white kid-glove, but practical men prefer as a rule to dispense with this addition. The last point referred to is—that when the paint is put on, it rubs off so easily. By this I am afraid that proper precautions have not been taken—first, in the use of proper varnish, such as I have mentioned; and, secondly, the slides have not been stoved in a warm (not hot) oven for the purpose of hardening the varnish. If proper varnish is used and hardened, there is no danger of the paint coming off. It must be understood that the first coat must be perfectly hard before the next is laid on. I have only given the colours as they are procured ready-mixed in the tubes, but it will be understood that any number of secondary colours may be made by a proper mixture of any two of the colours named. There is another word, I am afraid, necessary from W. J. C.'s letter in reference to the use of a medium with his colours. Mix mastic varnish ¾ oz., turps, one teaspoonful, and twenty drops of pale drying oil or gold-size together in a wide-mouthed bottle, and thin down all paints with it.—O. B.

**WORK Binding and Index.**—INDEX.—The price of the covers for binding WORK volume is 1s. 3d., and the Index 1d. of all booksellers. You would do well to have your numbers bound at your bookseller's, as the carriage backwards and forwards would be expensive.

**Wheel Cutting on "Go-Ahead" Lathe.**—INDEX.—If you wish to understand how dividing is done by worm and wheel, please read the article on page 113, Vol. I. of WORK. This will, I hope, make it quite plain how you may get any number of divisions from a given worm and wheel. You wish to fix a worm-wheel on the tail end of your mandrel, and the worm on the back of the headstock beneath: you might adopt a worm-wheel of 120 teeth, and a worm of ½ in. pitch = ·125. Multiplying ·125 by 120, you get the pitch circumference of the worm-wheel, 15 in.; dividing this by 3·1416, you find the diameter to be 4·77—say, $4\frac{25}{32}$. Now then, having 120 teeth in the worm-wheel, one turn of the worm-screw between each cut will give you 120 teeth or divisions; two turns, 60 teeth; three turns, 40 teeth; half a turn, 240 teeth, etc. Or, according to the rule given on page 215 of Vol. I., divide 120 by the number of divisions you require, and you get the number of turns, or the part of a turn, you must give to the screw between each cut. Now you will know that on the end of the screw you can put three different kinds of expedients for counting its revolutions or parts of a revolution; you may have, simplest of all, a divided collar, or a series of exchangeable collars having different numbers of divisions; or, secondly, you can have an index plate, or several plates—a system which is explained in Messrs. Brown & Sharpe's "Milling Machines," to be had from Buck & Hickman, or Churchill, for 6s. 6d.; or, thirdly, you can have a train of small wheels with a click, so arranged as to turn till the click falls into a notch between each cut. The plan explained in Vol. I. is a kind of cross between the two last, and is somewhat simpler than either, and I think it would suit you very well, as you are not continually employed in wheel cutting. The sketch below shows how you might arrange matters. The dotted arc is part of the pitch line of the worm-wheel; W is the worm, S the spindle which carries it; A is the centre screw confining its motion endways (it is made of large diameter, so that the collar of S can be passed through the tapped hole it leaves); B is the place on which the divided collars fit; C, C are the bosses on the plate D; E is the pivot screw which secures the plate D, and round which it can turn when raised into gear by turning the square, G, of the eccentric F; this eccentric bears upon the bottom of a recess H, cut out of the plate I, which plate, I, is secured to the back of the headstock by one or more screws, K, and may remain in position




**Wheel Cutting.**

even if D and its attachments be removed; L is a collar, of which there must be several; they fit on B by pressure of the hand, and have in their edge a number of shallow holes, into which the ball point M drops, and is held there by the spring N; O is the boss of the spring; it is fixed to the worm spindle in any position by the set screw P. Since you say you wish to cut wheels of from 60 to 80 teeth, divide 120 by every number of teeth you wish to cut—thus, $\frac{120}{60} = 2$, which means you require to turn the worm-screw round *twice* between each tooth. Some numbers, being primes, are very difficult to deal with except by the method indicated on page 215: these numbers are 61, 67, 69, 71, 73, 74, 77, 79. Very probably these numbers may not be required, and for the rest you will require ten collars, divided into 3, 5, 7, 8, 11, 13, 17, 19, 21, 23. These you could easily divide yourself by stepping round with dividers, which would be quite exact enough for the collar.—F. A. M.

**Steel Spring.**—H. S. (*Chesterfield*).—Your order is a difficult one to fill, especially as you want the springs of different *tempers;* it would have been easier if different *strengths* would have done. I should advise you to write to Messrs. Grimshaw and Baxter, 33 and 35, Goswell Road, London, E.C. I think clock spring will be the best material to use.—F. C.

**Hinge.**—HELPLESS.—To obtain what you require, you must make or get a spiral spring, which in its length makes one half turn, and in radius fitted to that of the hinge when closed, or it should be rather less, to keep the hinge sides tightly closed. If there is no cavity behind the hinge for the spring to play in, the hinge itself must be recessed. The spring so made is to be firmly fixed by one end to one wing of the spring (the fixed wing preferably), and so set that its free end, after making a half turn, bears firmly against the other wing of the hinge.—F. C.

**Wood Background for Carved Panels.**—B. A. B. (*Hampstead*).—To obtain the basket-work effect, a punch of this style is sold ||| for hammering the uncarved background. Also, I believe, a triangular one ///. But it is obvious that either of these would yield a set mechanical effect, whereas if an ordinary tool—say, a chisel with a blunt edge—is hammered on (in the rougher way shown in the design), the effect can be obtained more roughly, and, therefore, more effectively.—J. G.-W.

**Piano Scale, and Felt on Hammers.**—G. T. (*Chatham*).—Your letter is not very explicit. I gather from it that you, having set your compasses to $\frac{5}{16}$ of an inch, 9 in. and 3 ft. 11 in. do not correspond. I cannot understand exactly what you want to know; so I must surmise. In No. 36 of WORK you will find a portion of a scale, actual size. Now, if you make one octave correct to this, and repeat it until you have the seven octaves, I cannot see how you can go wrong; this will be your top scale, the bottom one is contracted 2 in. at the bass end. The top scale is placed at the bottom edge of the wrest-plank when it is used, as this is the strike-line where the hammers strike. If you placed this scale on the top edge of wrest-plank, it would be decidedly wrong. Read No. 36 of WORK with care; it will explain everything you require to know. Of course, if you commenced your piano before you saw WORK, it is impossible for me to know how you made it, and where you obtained your instructions, unless you divulge it. If this answer does not satisfy you, write again and enter into particulars. The longer the letter, the more complete will be the answer. The felt, as you are perhaps aware, is manufactured on the taper; the thick end is placed at the bass, while the thin end extends to the treble. You can obtain this felt in strips—from 1s. 6d. upwards—from Goddard, ironmonger, etc., Tottenham Court Road, W.C. Of course, the better the quality, the better the tone; you can get a medium quality for 3s. 6d. You require a long-bladed shoemaker's knife, and sharpen on emery cloths; this gives an edge suitable for felt. Take the felt off your treble and bass hammer, and see that your felt is not too wide. If you look at the felt you have taken off, you will see that where it is glued on the wood of the hammer the edges are pared down while it is in the length. Now make a piece of wood $\frac{1}{16}$ of an inch wider than the felt you have taken off. Use this as a gauge to cut your felt by. Springs for putting this felt on may be obtained from G. Buck, tool-maker, Tottenham Court Road, if I remember rightly, at about 3d. each. If you wish to do without springs, you can use pieces of very narrow tape to tie with. To take the old felt off, cut through the centre of the felt with your knife, as it is not glued here; then you can tear it off. Having your glue nice and hot, but not so thin that it will soak in the felt, begin at the bass end. Take the first piece of felt, and glue the top side of the hammer only; then wrap your piece of tape round, or put on your spring. Now miss one piece of felt and one hammer, doing every alternate one, till you have got to the treble end; then go back to the bass, and glue those you have missed. The idea of missing every other one gives you more room to put your spring on. Now, having got all these glued on the top side, start at the bass again as before, and glue the under side of the hammer, not the centre. Pull your felt firmly over (you will find it will stretch a little), and secure as before. You must then trim the sides with your knife; and if you have not cut them neatly (as this requires some practice), apply a warm flat-iron to the sides.—T. E.

**Boiler Injector.**—STOKER.—The apparent paradox of steam leaving one part of a boiler, and not only rushing back into it, but carrying a quantity of water with it—although, on its passage, there is an opening to the atmosphere—may be thus explained. It must first be observed that whereas steam in motion expands in *all directions*, a jet of water moves in one direction only. Suppose we have steam 60 lbs. pressure above the atmosphere; its volume is 380 times that of the water from which it came, and into which it will condense. Then, if it is supposed that steam is leaving a boiler at that pressure through an opening of 380 square inches, and that its speed of motion remains the same, if it is suddenly condensed in passage it will pass through an opening of one square inch, it will remain of the same *weight*, and, therefore, have the momentum acquired from 60 lbs. pressure over the larger area, and being liquid will keep its course in its direction when condensed; so it is easy to see why the condensed steam will jump a break and go back into the boiler, and it is also evident that it will have a great margin of spare energy. Its speed will not increase, for each particle will have its original velocity, but in the condensed form they will close up and act upon less surface—like a few people forming up close together to rush into an open crowd. Now, as for the feed water it takes in, that depends upon the general principle of injectors. If you blow a stream of air through a nozzle into a tube in line with it, its friction against the air through which it passes drags the latter with it and so creates a partial vacuum into which water will flow, and the same occurs with the condensed steam in the boiler injector. This is very old, and a water stream was in remote times so employed to suck in air for a blast at the Cornish mines. If you take a T-shaped piece of glass, open at all ends, and put the stalk in water, and then blow through the horizontal part, you will see the water rise. Barber's sprayers are on this principle.—F. C.

**Oven Thermometer.**—D. G. T. (*Ilminster*).—An oven thermometer should be procurable for about five shillings. Arensberg, Boar Lane, Leeds, or any respectable scientific instrument dealer, would supply you with one.—QUI VIVE.

**Bass Bar.**—ALBERT.—Accepting 9 in. as the width across the waist, the position for the bar should be laid out by making two lines, the first 1 in., the second 1½ in. distant from, but parallel with, the centre joint. The dimensions of the bar—speaking generally, of course—are 21 in. long by ½ in. thick by 1 in. deep at the point where the bridge will stand; from this point it should diminish with a slight curve to ¼ in. deep at each end. The "reeds" of the wood should run vertically through the bar, which ought to be 1½ in. deep when planed up ready for being fitted.—B.

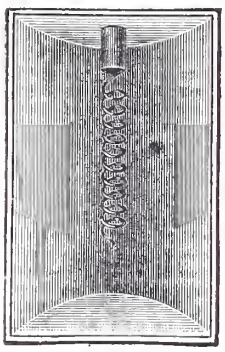
**Fairy Bells.**—CURLY.—The dimensions given on page 814, Vol. I., are correct. No better wood than pine can be used, as it combines lightness with straight, even grain, and a perfect freedom from

knots. The best kind of varnish to use is hard copal. If spirit varnish is used, although it may be handled sooner, it is not nearly so lasting, and will show white marks if scratched or chipped. But better than any varnish is French polish, which also gives a better finish. The figures given in Fig. 3, p. 814, are 2¼ in.—R. F.

**Syphon.**—W. B. (*Highgate Hill*).—The term syphon (although generally employed) is hardly the correct one. It would, perhaps, be more correct to say trap. If your meter is lower than the main, you must put in a T-piece close to the meter. Let the T-piece point downwards, and screw a short piece of barrel (about 12 in. or 18 in.) in it, plugged off at the end. This will catch any water that may collect in the pipes, and can easily be unscrewed and emptied at any time. It will be best to call the attention of the Gas Company's inspector to the fact that a syphon is necessary before putting it in.—T. W.

**Chromic Acid Cell.**—J. A. S. (*Cardiff*).—I cannot understand or explain the erratic behaviour of your chromic acid cells, as I have not experienced such variations as you mention. It would be better to employ a stronger solution, containing 3 ozs. of chromic acid and 3 ozs. of sulphuric acid to 1 pint of water, instead of 1 oz. of each to ½ pint of water. I should suspect a wrong adjustment of the brushes, or a worn condition of their bearing parts, rather than a failure in the cells.—G. E. B.

**Magnesium Lamp.**—DRY PLATE.—One of the most simple and least costly forms of a magnesium lamp is shown in the annexed illustration. It is made of silver-plated sheet copper to the form shown, and the inside is burnished and polished to a mirror-like brightness. The height should be from 6 in. to 7 in., and the width in front about 4 in. A small brass clip is fixed in the roof of the lamp, and to this the spiral of magnesium wire is attached. The spiral is made out of 6 in. of magnesium wire wound on a thin pencil, then stretched out. It is burnt by means of a small spirit lamp. Some few years ago a gentleman advocated in the *British Journal of Photography* the use of granular magnesium mixed with sand instead of magnesium wire. The mixture was held in a small coned funnel of brass over a spirit lamp furnished with a horizontal burner. When all was ready the mixture was released, and the magnesium took fire as it fell through the flame of the spirit lamp. Perhaps some of our photographic friends can suggest a better lamp.—G. E. B.



Magnesium Lamp.

**Booth's Mitre Machine.**—J. F. (*Hyde, Cheshire*).—I should think you could get it from any large tool maker, or from Booth Brothers, Tool Makers, Dublin, Ireland.—R.

**How to Make a Dulcimer.**—TRICHORD.—An article on the above appeared in Nos. 31, 38, and 41 of WORK. The numbers can be had from the publishers, Cassell & Company, London, E.C.; or you can order them through your bookseller.

**Steam Carriages.**—J. W. (*Belfast*).—You would have no difficulty in getting a steam engine fitted to a road carriage. Its weight will depend upon the power required, and that will be ruled by the steepness of the hills you have to ascend. One of Mr. Yarrow's engines, such as he puts in his "Zephyr" yachts, might suit. They are worked with mineral oil vapour instead of water, and mineral oil is the fuel; they are driven from coil boilers. You might write to Messrs. Yarrow & Co., Millwall, London, on the subject. As to a steam engine, you might write to Messrs. Robey & Co., Lincoln; but in each case state just what you want. An electric motor would be cleaner than a steam engine.—F. C.

**Fowls' House.**—E. H. I. (*Norwich*).—The sketches show a portable wooden fowls' house, with nest-boxes and perch inside, so that it can be drawn by a horse into different fields when required. Fig. 1 shows the carcase or framework, with 4 in. by 4 in. sleepers (on which the whole is erected, and to the ends of which the wheels are attached); sills, 4 in. by 3 in.; corner posts, 3 in. by 3 in.; heads, cross-pieces, and intermediate uprights, 2½ in. by 3 in.; joists, 4½ in. by 2 in.; rafters, 2½ in. by 3 in.; ridge board, 1¼ in. by 7 in. All the openings, except those left for the nest-boxes, should have braces going from angle to angle, especially as the structure is going to be subjected to great strain by the motion of moving over rough ground. I have left these braces out in the sketch for the sake of clearness. Fig. 2 shows the thing complete, with the exception of the wheels. These can be got at any large ironmonger's, and are readily fixed to the under side of the 4 in. by 4 in. sleepers. The sides are covered with feather-edge boarding, and the nest-boxes with 1 in. matchboarding. All the woodwork should be yellow. The roof is the ordinary iron roofing. Louvre ventilators should be provided, as shown at each gable, so as to ensure thorough ventilation; and the window is also very desirable. The inside of the hatchway in door should have a sliding or hinged flap to be fastened inside, so that when the door is locked you have the fowls under control. The slope should also be hinged or detachable, to save it from injury in moving. The size and position of perches depend very much on the class and size of fowl you wish to keep, and can easily be added to suit your requirements. If you examine Fig. 1, you will see that the construction is very simple, and can easily be made by anyone who can use a few

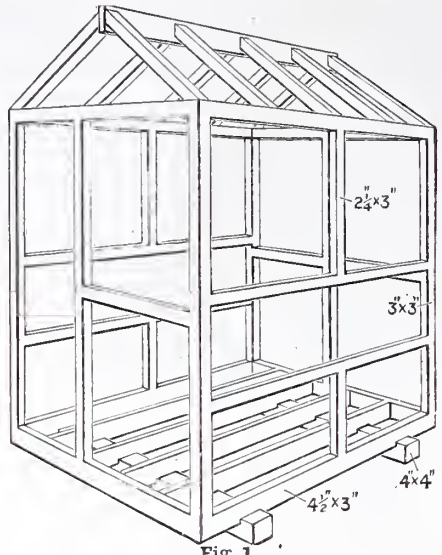



Fig. 1.

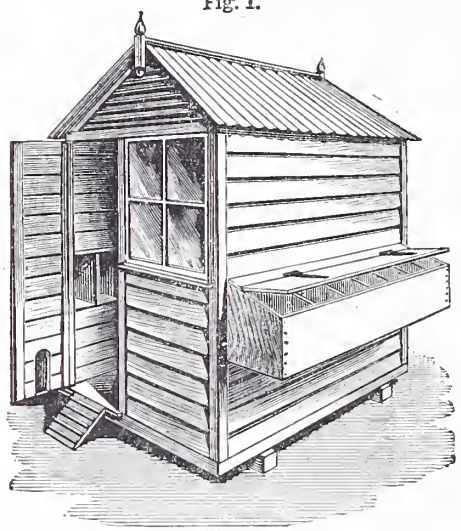


Fig. 2.

Fowls' House. Fig. 1.—Carcase or Framework. Fig. 2.—Fowls' House complete.

simple tools; and most of the joints need only be butted together and strongly nailed. The floor boards should be left loose, to enable the whole to be thoroughly cleansed and lime-whited inside from time to time. I have given the size of house as 6 ft. by 8 ft., so you will see it is rather a large thing for an amateur to attempt. The great advantage of the nest-boxes opening from the outside is, firstly, the convenience of taking eggs without entering the house; and secondly, the nests are kept clean, because it is impossible for the fowls to foul them from the perches above. I am not prepared to state what you would have to pay for materials in Norwich, but the best way would be for you to measure up the quantity of each sort of stuff you require, and go to a respectable timber merchant direct, and ask what he would charge. Write to Messrs. Boulton & Paul, Rose Lane Works, Norwich, asking them for a price.—E. D.

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ANXIOUS; A. MCC. (*Holywood*); B. and W. (*Sheffield*); INDEBTED; J. S. (*Ipswich*); G. W. (*Bradford*); J. W. M.; DIAPASON; R. O. (*Birmingham*); R. A. D. (*Forest Hill*); W. H., W. E. T. (*Newcastle-on-Tyne*); J. J. (*Lifford*); H. W. (*Strabane*); LEMUR; W. B. B. (*Edinburgh*); W. T. (*Stirling*); B. (*Dundee*); M. E. R. (*London, W.*); A. R. (*Scorrier*); F. S. M. (*United States, America*); HEATHFIELD; D. B. (*Norfolk*); J. W. B. (*Huddersfield*); S. T. (*York*); J. H. F. N.; T. W. A. (*Peckham, S.E.*); K. L. (*Walton-on-Thames*); W. H. G. (*London, N.*); F. M. T. (*Swansea*); M. A. H. (*Richmond*); H. C. (*Lee, S.E.*); A. L. (*London, S.E.*); W. B. (*Camberwell*); F. S. P. (*Shipston-on-Stour*); J. S. (*Govan*); W. H. (*Reading*); ONE WHO FINDS "WORK" USEFUL; FAIT ACCOMPLI; EASTWOOD; J. H. (*York*); WHITE; D. P. V. (*London, S.E.*); THE WYE CYCLE CO; J. S. (*Edinburgh*); HOLLOW-WARE; G. J. W.; ANXIOUS; HOUSE DECORATOR; J. K. (*Manchester*); D. M. (*London, S.E.*); C. C. K. (*Stratford*); A. L. (*Nottingham*); GUM POT; A. J. L. (*Peckham*); FOWL; A. D. (*Cardiff*); PHOTOGRAPHER; A READER FROM THE FIRST.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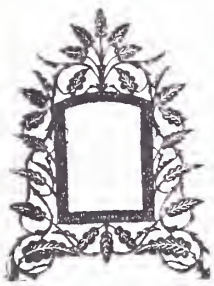

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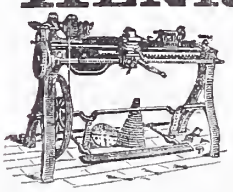

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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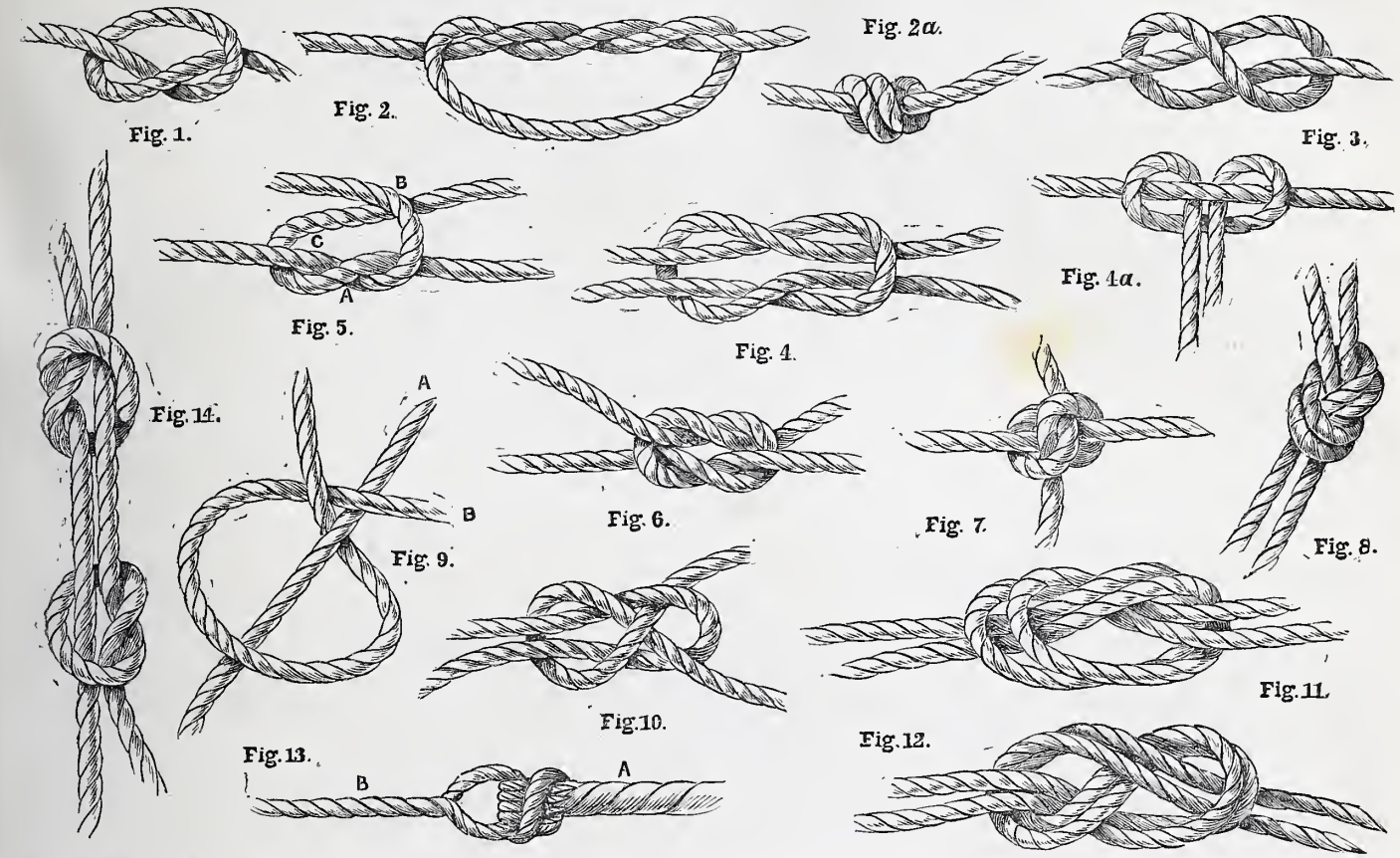



Fig. 1.—Overhand Knot. Fig. 2.—Fourfold Overhand Knot. Fig. 2*a*.—Ditto, closed. Fig. 3.—Figure-of-Eight Knot. Fig. 4.—Reef Knot. Fig. 4*a*.—Ditto, hauled straight. Fig. 5.—Ditto, half made. Fig. 6.—Granny Knot. Fig. 7.—Ditto, closed. Fig. 8.—Overhand Rosette Knot or Bow. Fig. 9.—Weaver's Knot, half made. Fig. 10.—Ditto, closed. Fig. 11.—Overhand Knot joining two Ropes. Fig. 12.—Flemish Knot joining two Ropes. Fig. 13.—Whipcord Knot. Fig. 14.—Fisherman's Knot.

## KNOTTING, SsplicING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Simple Knots and Knots for Uniting Ropes.

Overhand Knot—Fourfold Knot—Figure-of-Eight Knot—Reef Knot—Granny Knot—Rosette Knot or Bow—Openhand Knot—Weaver's Knot—Overhand Knot joining Two Ropes—Flemish Knot joining Two Ropes—Whipcord Knot—Fisherman's Knot.

*Simple Knots.*—Overhand knot (Fig. 1). This is the simplest knot that is made; at the same time it is a very useful one. It also forms a part of many other knots. To make it, the standing part of the rope—that is, the main part in opposition to the end—is held in the left hand, and the end of the rope is passed back over it (whence its name) and put through the loop thus formed. It is often used at the end of a rope to prevent the strands unlaying. It is also sometimes used in the middle of a rope as a stopper knot. If we pass the end of the rope through the bight two, three, or more times before hauling it taut, we then have the double, treble, or fourfold knot (Fig. 2). This forms a larger knot than Fig. 1. It is often used on the thongs of whips, and is then termed a blood knot. Fig. 2*a* shows the knot hauled taut. Fig. 1 also goes by the name of the Staffordshire knot, as it forms the insignia of the county. A Flemish or figure-of-eight knot is shown in Fig. 3. To make it, pass the end of the rope back, over, and round the standing part, and up through the first bight. For the benefit of my non-nautical readers, I may say here that the bight of a rope is the loop formed when a rope is bent back on itself, in contradistinction to the ends. The term is also used for the bend in the shore forming a bay—as the Bight of Benin. The Flemish knot is used for much the same purposes as the preceding knots, but is rather more ornamental.

*Knots for Uniting Ropes.*—The circumstances under which we have to join the ends of two pieces of cordage together are very various, and several methods of doing so are brought into requisition at different times, but it is always of considerable importance that the most suitable knot be employed in each case. The value of some knots consists in the rapidity with which they can be made, and in the case of others in the readiness with which they can be undone, but it is a *sine quâ non* that the knot should hold firmly and not slip when once hauled taut. The commonest knot for joining the ends of two ropes, and probably the knot that is most often made, is the sailor's, true, or reef knot (Figs. 4 and 5). When correctly made it is as perfect as a knot can be. It can be made very rapidly and undone with equal ease, and is very secure when taut. It has, however, one disadvantage—it will not answer when made with ropes of different sizes, as it then slips and comes adrift, but where the

two pieces of cordage are of the same size it is a most secure and reliable knot, the strain on every part being so equally distributed. Though very readily made when once you get in the way of it, it requires a little practice to make it properly. To do this, take an end in each hand and lay one over the other, the right end being undermost; bring the left-hand end under the standing part of the right end, as shown at A, Fig. 5, and over the end at B, round it, and up through the bight at C. The key to the knot I take to be putting the right end under the left when the two ends are crossed at the commencement of the knot, as the left-hand end then comes naturally first over and then round the other rope, and the ends lie parallel with the standing parts, as in Fig. 4. If the ends are not passed correctly, a granny, lubber's, or calf knot results. This is shown in Fig. 6. Though at first sight this seems to be a good knot, yet it is not so in reality, and when any strain comes upon it it slips and becomes useless. Fig. 7 is a granny knot, as it appears when hauled upon. It is considered a very lubberly thing to make a granny knot, and my readers should practise until they can make a true knot rapidly and with certainty in any position. The sailor's knot is invariably used for reefing sails, the ease with which it can be undone making it very valuable for this purpose. You have only to take hold of the two parts on each side just outside the knot and bring the hands together, and the loops slip over one another, as in Fig. 4, and the knot can be opened at once. This knot has a curious peculiarity which I do not think is generally known. If we take hold of the end of one of the ropes in one hand and the standing part of the same rope in the other, and haul upon them until the rope is straight, the knot becomes dislocated, so to speak, and the rope not hauled upon forms a hitch (Fig. 4*a*) round the other part. This property was the secret of Hermann's celebrated trick, "the knotted handkerchiefs." After the handkerchiefs were returned to him by the audience knotted together at the corners, under pretence of tightening the knots still more, he treated each knot as I have described. To the superficial observer the knots seemed as firm as ever, but in reality they were loosened so that a touch with his wand separated them easily. The common bow or rosette knot is a modification of the sailor's knot. The first part of the process of making it is the same, but instead of passing one end singly over and under the other, as in the sailor's knot, both ends are bent back on themselves, and the double parts worked as before. Care must be taken to pass these doubled ends exactly as those described in the sailor's knot, or a granny bow will result. One often hears people say that they cannot understand *why* their shoes are always coming untied, the reason being that they were tied with granny instead of true bows. Another way of joining the ends of two pieces of cordage is shown in Fig. 8. This is merely an overhand knot, made with two ropes instead of one. It is also sometimes called an open-hand knot. It can be made very quickly, and there is no fear of its slipping, but if there is much strain put upon it the rope is very apt to part at the knot, in consequence of the short "nip," or turn, that it makes just as it enters the knot.

Fig. 9 shows the weaver's knot partly made, and Fig. 10 the same knot completed, but not hauled taut. This knot is called by weavers the "thumb knot," as it is made over the thumb of the left hand, and is used by them in joining their "ends" as they break. No one would believe, without seeing them, the rapidity with which they make the knot, snip the ends off, and set the loom going again. It is used by netters to join their twine. It also forms the mesh of the netting itself, though, of course, it is then made in a very different way. In making the weaver's knot, we cross the two ends to be joined in the same way as in the sailor's knot, placing the right end under, and holding them with the thumb and finger of the left hand at the place where they cross. The standing part of the right-hand rope is then brought back over the thumb and between the two ends, as shown in Fig. 9. The end A is then bent down over it, and held with the left thumb, while the knot is completed by hauling on B. We shall meet with this knot again further on.

Fig. 11 shows an excellent way of joining two ropes. It can be made by laying the ends alongside one another, overlapping each other sufficiently to give room for the knot to be made. The double parts are then grasped in each hand and an overhand knot is formed, which is made taut by hauling on both parts at once, as if the knot was single. Though this is the easiest way to make the knot, it is not available where the ropes are fast. In this case we make a simple knot on the end of one rope, but do not draw it taut. The end of the other rope is then passed through the bight of the first, and a second loop formed with it alongside the first. The knot is closed by drawing the two ropes as before. This is in every way an excellent knot, and very secure. Fig. 12 shows the ends of two ropes joined by means of a Flemish knot.

This does not require much description. It is made after the manner of the last knot.

Fig. 13 is the whipcord knot, and is used to fasten the lash to a whip; A shows the thong, and B the lash. The lash is first laid across the ends of the thong, which are turned up over it. The lash is then brought completely round the thong and through the loop it makes, which secures the ends of the thong firmly. If a silk lash is used, the short end is cut off, but if whipcord, the two ends are generally twisted together for a few inches, as at B, and an overhand knot made with one end round the other, which secures them. The remaining part is left somewhat longer, and another overhand knot at the end prevents it from unravelling.

The fisherman's knot (Fig. 14) is one of the most useful knots we have. It derives its name from the fact that it is always used for joining silkworm gut for fishing purposes. In making it, the strands are first laid overlapping one another, and an overhand knot made with one end round the other strand. The strands are then turned round, and another overhand knot made with the other end round the first strand. When the knot is tightened by hauling on the standing parts, one knot jambs against the other and holds securely. The knot is improved by putting the ends twice through their respective loops, as in Fig. 2. The size of the knot is increased by this means, but it will stand a much heavier strain, so that it is advisable to do this whenever the size of the knot is not of paramount importance.

The attention of the reader is called to the illustrations of the various knots mentioned above, which show in the clearest manner possible the nature and character of each knot, and how it is made

# ARTISTIC LITHOGRAPHY.

BY A. J. ABRAHAM.

## Materials.

THE INK—ITS PREPARATION—MIXING THE INK—CHALKS—STUMPING CHALK—EFFECT OF HEAT ON CHALKS—CRAYON-HOLDERS—BRUSHES—HANDLE—CARE OF BRUSHES—DUSTING BRUSHES—LITHOGRAPHIC PENS—INSTRUMENTS.

*The Ink.*—After the student is satisfied that the stone is in a suitable condition for working upon, his next consideration is the materials used in the manipulation of the work, the most important and principal one being the fatty matter which is necessary to preserve the natural qualities of the stone, and with which the drawing must be made. This consists of a black ink, and is sold at all lithographic dealers in two forms, that of a solid stick of ink, and chalk.

Being unnecessary for the student to make his own ink, it will be sufficient for him to know that it is composed of certain fatty matters, such as soap, tallow, shellac, etc., mixed in various proportions, and a black pigment in sufficient quantity to allow the artist to see how his work is progressing, and also how the subject will appear when printed in black. Without this black pigment the drawing would be invisible on the stone, although it would print just the same.

*Its Preparation.*—When the ink is required for use it must be dissolved in soft water, and should be made fresh every day, for if allowed to stand from one day to another, it would get thick, and more water require to be added, in consequence of which the ink would not contain sufficient fatty matter in proportion to the water used for preserving the stone, especially in any very fine work.

*Mixing the Ink.*—The best way of mixing the ink is to warm a small earthenware saucer, cut some small pieces from the ink, and pour sufficient water from a drop-bottle, or one with a small hole cut in the cork, over it to make enough for the day, then rub with the fingers in order to dissolve the ink, until it be of the necessary consistency for working, which will be when the ink adheres to the side of the saucer. Should there be too much water, the ink will glide off, besides which it will not contain sufficient greasy matter as spoken of above; and if made too thick, it will not flow freely enough from the pen, or brush. It should be just thin enough not to spread when working with it on the stone, and just thick enough not to smear when dry.

When working with the brush it is best to use a saucer slightly tilted, but when the pen is used a small bottle is better. A large thimble makes an excellent substitute, and a very good inkstand can be made by taking a small square block of wood and cutting a hole in the centre, large enough in which to place the thimble. Any small bottle would do as well so that it is washed out every day, but the above is, perhaps, as good as anything.

*Chalks.*—These should be sharpened by cutting away from the point in the same manner as charcoal or an ordinary crayon; being of such a soft, greasy substance, it is very likely to break. The ordinary crayon-holder is rather heavy for lithographic chalks, and likely to make them snap. It is preferable to use a holder consisting of a wooden handle with a steel top enclosed by the usual ring for holding the chalk. This allows the slightest pressure required on the stone to be given entirely by the hand, instead of by any weight from the holder itself.

These chalks are made of various density and numbered, the hardest being a copal chalk, which should only be used for outlining very fine clear lines that cannot be made with a No. 1 chalk, which, being the next in order, is also used for outlining and fine tinting generally. No. 2 is a medium chalk, and No. 3 being very soft, is useful for strong shadows and large bold work.

*Stumping Chalk.*—This is not much used except in light even tints for large work, as by its very density it prints stronger than the ordinary numbers, besides which it works very flat and without any texture. It should be used with the stump or a piece of chamois leather.

A good way to use this is to keep a small piece of stone handy with an average grain, and rub a piece of the chalk across or down one side until it is quite black. Then with a small clean pieee of the leather passed over the first finger of the right hand and held firmly, take some of the chalk from the stone, being careful only to rub it one way, and taking it off as evenly as possible; then try it on another part of the stone (always taking care to rub one way) to see the necessary strength required, to take off any superfluous chalk that may have adhered to the leather, and also to make it more even, or it will be likely to work in streaks. The stump or leather being now ready for working with, gum round the edges of the space required for the tint, and when perfectly dry rub the leather evenly over the surface, and the gum will prevent the chalk from adhering to the stone further than it is required. It sounds very easy just to rub an even tint on the stone, but the novice will find it requires practice to obtain an equal pressure of the finger on a surface of only a few square inches.

The student will also find on trial that it is impossible to make a chalk drawing on a polished stone, on account of the even surfaee not allowing the chalk to be scraped away, which is done in the case of a grained stone.

*Effect of Heat on Chalks.*—Heat has a great influence on the chalk, it being often possible to get the same effect with a No. 1 on a hot day in summer as by the use of a No. 3 on a cold day in winter. It is also advisable to have half a dozen chalks in use at the same time, as they are apt to get soft from the heat of the hand, and therefore will not work well.

*Crayon-Holders.*—The artist should have different coloured crayon-holders, so as to easily distinguish the number of the chalk he is using, and he need never throw away the chalk cuttings, for although they are of no use to him, still they make excellent ink for the printer, and a good foreman will be very glad of the perquisite.

*Brushes.*—The brushes used should be very fine red sable, and for fine line work it is much better that the artist should cut away the outside hairs from an ordinary size lithographic brush, leaving only the centre ones for working with, than to buy one the exact size required, which would not be as firm as a larger brush cut down.

Some writers use a brush with the hairs 1 in. long, but as they require very careful manipulation, it would not be advisable for the student to practise with them at first.

Brushes that will not always do for one thing come in very handy at times for a different object; thus a brush that has lost its point, and cannot be used any longer for drawing fine lines, may be very well used for filling in solid—that is, where a portion of the stone is required to be covered with ink, and brushes that are of no further use for ink are often suitable for gum work, but the student must be most careful in keeping the latter apart from those used for ink, as gum aets as a protection against the ink touching the stone, and, therefore, no work would print if drawn with the same brush as that used for gum, or if drawn on any part of the stone where gum has been used.

*Handle.*—A good handle for brushes can be obtained by using a common metal pocket penholder, in which the top can be taken off and reversed to protect the pen, or in this instance the brush, which should be fixed in with sealing-wax, of course not allowing any of the wax to go on the outside of the metal, as it would not then shut in the holder securely.

*Care of Brushes.*—Always wash the brush with a little soap and water when finished with it for the day. Some artists allow the ink to dry in the brush as a protection to the point, but it is a very dirty habit to get into, as the brush must always be washed before using, and it is much easier to do so the same day than if it were allowed to dry with the ink in it, and most people will agree that there is nothing so annoying as to find dirty tools when they are ready and anxious to start work.

*Dusting Brushes.*—The artist also requires a flat camel's-hair brush, about 2 in. in width, for dusting the stone with during the progress of the work, it being most necessary that the stone should be kept perfectly free from any specks of dust, or dirt, etc. This applies specially to chalk work, and is of so much importance that it will be referred to again when the work is explained.

A flat camel's-hair brush of not less than 4 in. in width is required for etching purposes, and should be kept when not in use in a well, similar to those used for copying brushes. It is better to have one that will hang against the wall, and only use sufficient water to cover the hair of the brush, or else the water, in conjunction with the acid used, will rot the metal of the brush.

*Lithographic Pens.*—Lithographic pens are much finer and more delicate, besides being more highly tempered, than the ordinary writing pens, and being very brittle are apt to snap unless carefully handled; in fact, an ordinary pen for fine work on stone is of no use whatever, on account of the difference in the substance of the ink, and the writing or drawing surface, but lithographic pens are so common that they can be obtained from most dealers besides those who deal exclusively in lithographic materials; they therefore need not be further described.

The artist should have several pens in use at the same time, for if one will not work well another will, so he can change about, and frequently a pen that is difficult to manage one day will work splendidly the next. New pens are better for the finer parts of the work, and worn ones for the coarser; and if the pen should get crossed nibbed, which is often the case, all the artist need do is to bend it back on the thumb-nail, when it will work as well as before—that is, presuming it has not snapped during the operation; but the student will soon judge for himself the pliability of the pens.

The artist should always use a good size penholder, and not merely a thin stick of wood, else the hand is apt to get cramped unless there is something firm for it to grasp, besides which the artist will work with much greater freedom; and this applies equally well to crayon and brush-holders.

*Instruments.*—Such instruments as the bow compasses, and ruling pens, are very highly tempered, and are specially made for drawing on stone; they should *not*, if possible, be used for drawing on paper, as it spoils them for stone work, and they should be kept in wadding, or chamois leather cases.

Rulers, straight-edges, eurves, set-squares, etc., should be made of the best materials, for the stone being perfectly level, and having such a polished surface, enhanees the slightest error, which on paper is sometimes toned by its roughness. Steel is a very good metal, and although the student will find it rather more expensive, still, once having invested in steel instruments, he will find them invaluable, and will seldom, if ever, have to buy others; the same cannot be said of wooden ones.

It is presumed that the student already has a knowledge of drawing, and therefore a necessary knowledge of the above instruments and also their use; they are not therefore further described.

In the next paper I hope to finish with the description of the principal various tools, etc., used in lithography, and I shall then be able to at once take up the more interesting subject of drawing on the stone.

## SOME MORE HINTS ON FRAMING.

BY B. A. BAXTER.

CUTTING TENONS—CUTTING SHOULDERS—TENONS OFTEN TOO WIDE—WEDGES OFTEN TOO GREAT AN ANGLE—CARE IN FITTING PANELS—IN PUTTING TOGETHER—MITRES TO MOULDINGS—SCRIBING MOULDINGS.

IN former papers on Woodwork, in pages 482 and 646, Vol. I. of WORK, I have chiefly confined my attention to the plane. This tool, however, though very important, and its efficient use difficult to the beginner, is not the only tool upon which it is desirable to give some explanation or assistanee.

Supposing that the previous remarks made by the above-signed have been read and understood, and that the verbal description has been translated into "something accomplished, something done," let us now try to finish our framing, which was prepared, set out, and was being mortised. Mortises involve tenons, and it by no means follows that our readers who have profited by the various instructions and advice as to mortises are much helped thereby in the cutting of a tenon. We will, as a preliminary, first examine the mortise-gauge. This we have new and bright, with its lacquer still intact and its polish odorous with benzoin. If so, take care. The steel points of a new mortise-gauge are large and prominent—very tusks, rather than teeth—and our beginners must handle the gauge with care, not using much pressure to score the lines deeply on styles and rails, beeause, if so, we cannot be sure of the exact line which lies somewhere in that deep ugly score. We who deal with pencil marks and chalk lines are too apt to forget the difference between our lines, so-called, and the "flowing of points," the "length without breadth" of the mathematician.

However, let us make as narrow a mark as possible—just enough for us to see and to cut by. In setting the gauge to the width of the chisel, let us be as exaet as we can, and until proficient let us always take the precaution to try the effect on a piece of spare wood, applying the chisel to make sure that we have successfully fixed the points the exact distanee apart.

Now, if the mortise is well cut, it will be just the width of the chisel; but it will *not* be well cut if the gauge is set too wide or too narrow. The two gauge lines will be two conflicting masters, and, inexperienced as we are, we shall fail of a good result.

It will not help the fit of the tenon for the mortise to be cut badly. We will suppose ourselves interested spectators while a workman cuts a tenon. He has already marked with a mortise-gauge the lines which are to form the boundary in thickness—equal, as we have seen, to the width of the chisel—and he has also marked the shoulders each side. We notice that he has marked these with a knife or chisel, and not with a pencil, from which we learn that the appearance of the work is worthy of consideration. We notice that he fixes the rail in the bench screw, and, just placing his thumb on the end of the rail, he draws his saw towards him; and, on inspection, we find that the saw has already made a shallow channel for itself just on the edge of the line,

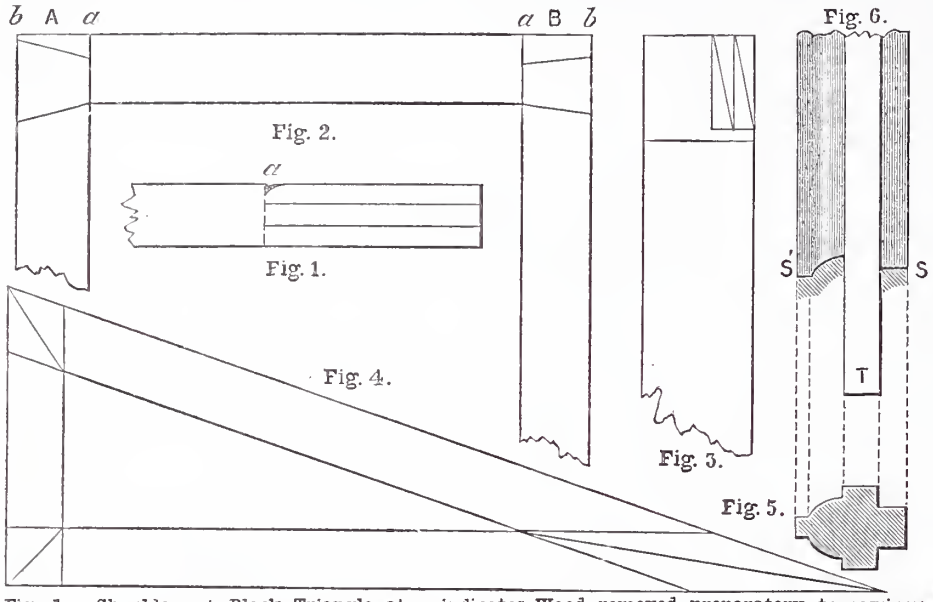



**Fig. 1.—Shoulder-cut Black Triangle at *a* indicates Wood removed preparatory to sawing: slightly exaggerated. Fig. 2.—Diagram showing Difference in setting out Tenons and Wedges—A, injudicious; B, much better: not at all exaggerated. Fig. 3.—Tenon formed at End of Rail, showing Method of cutting Wedges. Fig. 4.—Simple Plan to obtain Mitres: Draw Parallel Lines equidistant from Inner Edge of Frame; join Intersections and Angles of Frame. Fig. 5.—Section of a Sash Bar. Fig. 6.—Diagram exhibiting Scribed End of Sash Bar—S, S, Shoulders; T, Tenon. None of these Diagrams are drawn to Scale.**

the channel itself being outside the thickness of the desired tenon.

We see, too, that he began the tenon at the point farthest from him, accurately to the line, and that he gradually brought the cut to the nearer edge, until, with the same accuracy, one edge of the saw just seemed to scrape the fine line made by the mortise-gauge. Asking him how to manage tenons on long pieces, he tells us that sometimes tenons must be cut on the stools, turning the wood once or twice during the progress of the work. In order to cut tenons successfully, therefore, we must learn the difference between cutting *on* a line and cutting *up to* a line.

Still another point: the saw must not be allowed to penetrate past the shoulder, if the appearance of the work matters at all.

The tenons having been sawn, the shoulders may be cut—removing what are called the cheeks. This is done with the tenon saw, unless in very small work, when the dovetail saw is more suitable. Having the shoulders marked with a knife, we may be allowed to remove a little wood from outside the line, as in Fig. 1.

The line of entrance of the saw is more correctly determined by so doing, and if properly sawn, the joint at the surface is a knife-cut one, as correct as our square or bevel, modified by our skill in using it.

It is most important to exercise care in cutting shoulders that the saw is not allowed to cut too deep, as the tenon would be spoilt by so doing.

I have already said that the proportions of a tenon and its mortise partly depend on what panels, mouldings, rebates, etc., are present; but we ought not to go far from the usual custom of making the tenon about one-third of the thickness of the stuff. As far as the other dimensions are concerned, clearly a tenon right through must be as long as the style is wide; in width, however, we may use judgment.

The present writer has often seen professed workmen make the tenon so wide, that when the work was wedged up and the superfluous wood of the styles cut off, the tenon looked dangerously near the extremity of the style, and the wedge looked like forcing the little piece of wood which retained it right away (Fig. 2).

This leads to the subject of wedges, about which a word or two might be spoken. Our experienced readers are asked to pardon the writer because he wishes to insist on a point so obvious to them. A thick, rapidly increasing wedge does more harm than good, and a young carpenter might do much worse than consult a lathe-man as to the angles which *jam* and those which do not. He will be told that if you want a wedge to hold, like a drill in its socket, the taper must be slight and gradual; while if you want freedom of motion, only obtaining definiteness of position, the magnitude of the angle must be increased.

Wedges, however, as we understand them—of wood, and used for framing—are compressible, and if the tapering receptacle is not cut to the same angle as the tapering wedge placed in it, the compression at the point and the head of the wedge is unequal.

It would, perhaps, be best to have the compression equal, but it would be better to have the compression greater in the interior of the mortise than at the outer edge (at *a* rather than *b*; see Fig. 2).

There is no doubt that this error proceeds from school teaching, in which diagrams of the inclined plane and the wedge are drawn, the wedge generally with an angle about double that of the inclined plane. I distinctly remember being informed (?) that a wedge is really *two* inclined planes fixed together, and my contention that I could see no real difference (as drawn for the boys' instruction) between them, except that the wedge was drawn as an isosceles triangle and the inclined plane was drawn as a right-angled one, the angle opposite the shorter side not being very seriously different in each case. Improved wall-sheets and better illustrations have changed all that.*

However that may be, wedges need not be short and rapidly tapering; but they are still wedges—and are more efficient ones too—if more gradual in the taper.

The wedges for our purpose are usually cut out of the waste wood of the width of the tenon, by which means they are, at any rate, the right thickness. Fig. 3 gives an idea of what I mean.

Panels are often an embarrassment to the beginner—it is so easy to make them other than flat, square, and parallel (by square, the workman means that the angles are right angles).

It is also easy to make the grooves for the reception of the panels the right depth in most places, and yet leave some part of the groove not down to the depth intended.

For each of these faults, greater care is the only and sufficient remedy; and, as practice makes perfect, so the necessity of care only seems to make itself understood when some failure occurs, or, if not actually occurring, its likelihood is pointed out.

That is just the reason why I have called attention to these matters, which, though trifles in themselves, yet are no trifle if they prevent the work from going together as it ought.

In gluing up the framing, we ought not to insert the wedges until the shoulders are in contact, or very nearly so, and wedges ought not in any case to be driven hard—so hard as to smash them—as may be sometimes seen, even in the work of those who ought to know better. Every blow of the hammer ought to be delivered with judgment, otherwise the joints are apt to go up at one corner of each, instead of uniformly, as they ought.

The directions given in my last paper as to setting out the styles may prove useful for gluing up. As may be remembered, the worker was advised to mark out on the edge of the style the outline of the section of the rail; and if the mortise has been truly cut and the tenon just easy, the wedges will give that slight adjustment which will be

* I think not. Theoretically, the teaching was, and is, right enough. The positions of the wedge and inclined plane are altogether different. The inclined plane proceeds from a point in, and is inclined to, a *horizontal* line, supposing, for illustration's sake, that the plane is viewed in side elevation or profile. A wedge, mathematically speaking, under the same conditions is formed by two planes proceeding from the same point in, and inclined at equal angles to, a *vertical* line. Therefore, the surfaces of a wedge *are* two inclined planes, nothing more and nothing less. Moreover, the wedge of Mr. Baxter's schoolboy recollection was a mechanical power shown in its best form for splitting and rending, while the wedge of his later experiences is, or ought to be, cut to suit a certain inclination, and is rather a half wedge—the wedge being divided in the vertical line—used for purposes of locking up, gripping, and compression, and not for splitting.—Ed.

sufficient to bring the rail to the exact place indicated by the setting out.

If, as we are supposing, our framing has any mouldings, a word or two on mitres will fitly conclude this paper. Mouldings, to be perfect, ought to intersect, by which is meant that perfect meeting of edges, angles, and curves which makes it evident that their section is alike; or that, if "raking," the section is properly modified, and that the angles at which the moulding is cut are the correct angles. Let us suppose the angles at the corners of our framing are right angles, then the mitres, or angles at which the mouldings are cut, must be 45°. The angles of intersection are very easily drawn on a panelled framing which has mouldings inserted afterwards, as is often the case. All that is needed is a small piece of wood for a gauge, and, moving it round the panels with a pencil in contact, the place of the moulding can be outlined, and by joining the intersections the correct mitre of each angle, however different, will be obtained. (See Fig. 4.)

In ordinary cases, where the angles are (in workshop phraseology) square, the use of a template for all stuck mouldings is all that is necessary. For mouldings that, instead of being mitred, are scribed—as sashes—the use of the template to indicate the portion to be cut away is similar to its use in mitreing, except that in this case only one of the surfaces requires treatment.

We will suppose a sash bar is to intersect with the style or rail (Fig. 5). A little consideration will show that it can either be done by mitreing or by scribing—in the case of mitreing, by using the template as a pattern to cut off the angles to the point of contact at the edge on both bar and rail; in the case of scribing, using the template only on the bar, as an indication of the portion to be cut away, being the counterpart of the moulding on the rail which remains intact. The learner may see from this that mitres require only to be cut at the proper angle, while a scribe requires the use of chisels and gauges of suitable sizes and curvature, according to the style and contour of the moulding.

On the other hand, scribing has the great advantage of allowing some adjustment. For instance, if the bar just mentioned happened to be a trifle thicker or thinner than its fellow by which the rail was set out, if scribed the fit would be equally perfect; whereas, if mitred, every divergence from the size marked on the rail would be unpleasantly apparent.

Leaving our friends to try some experiments in mitres, scribes, and other joinings, and strongly advising them to spend a little time in such practice, I can only hope—what is sure to be the case—that their success will be in accordance with their industry and perseverance.

## SCREWS USED IN METAL WORK.

BY P. B. H.

THEIR USES—WHAT IS A SCREW?—HOW TO OBTAIN A SPIRAL LINE—DESIGN OF V-THREAD—SQUARE THREAD — TRAPEZOIDAL THREAD — CONVENTIONAL METHOD OF SHOWING THREADS—RIGHT- AND LEFT-HANDED SCREWS—HOW TO DRAW A SPIRAL LINE.

ONE of the—or I might, with perfect truth, say the—most useful pieces of mechanism ever invented is the screw in its various forms. It is employed for such an infinite variety of purposes—in some cases having to bear enormous strains, and in others scarcely any. It is used almost universally (the rivet, its great rival, alone excepted) to hold together two or more pieces of the same or varying metals or materials. It is used as a means of imparting motion in gearing, as in the worm and wheel, the worm being simply a fixed screw turning on its axis. A great many presses are worked by, and owe their great power of compressing substances into small bulk to, the screw, which in these machines is subject to great strains. The breech mechanism of our large and small guns, where the strain is likewise enormous, is kept in position by a screw. Then, again, the fine adjustments of the microscope and the almost inappreciable movements of the measuring blocks in the machine for measuring to the 1,000,000th part of an inch owe their minuteness and accuracy to the screw, which in these two cases is subject to a very slight strain. From these few instances it will be seen between what extremes the screw can be usefully employed. Many others could be given, but the reader himself will, no doubt, recall to mind a number.

In this article I shall confine myself solely to the screws used in metal work, not to those employed in wood.

The forms of the threads vary according to the purpose and the material for which they are employed. I shall show later the principal forms of threads, and the method of drawing them, both conventionally and accurately.

Most readers have some idea of a screw or spiral, but there are, no doubt, many who do not know how to define it and how it is obtained. I once saw, in answer to the question, "What is a screw?": "It is a short pitch spiral"; and in answer to "What is a spiral?": "It is a long pitch screw." This definition gives no accurate information to anyone, though almost everybody has some idea, though faint, of what a spiral is, and that "spiral" and "screw" are used by many persons almost synonymously. Yet the above definition is not quite clear, so I shall endeavour to show how to obtain a spiral line practically, which is, I consider, the best method of impressing it on the memory, as it gives you a very simple way of making one yourself.

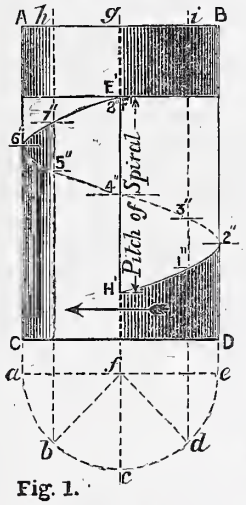


Fig. 1.

Fig. 7.

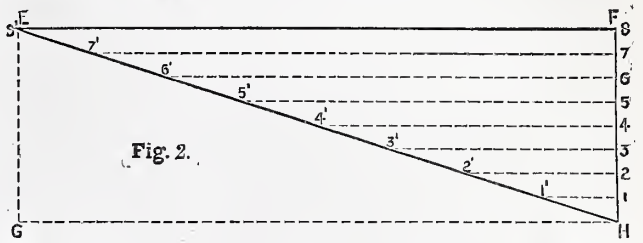


Fig. 2.

Fig. 8.

Fig. 9.

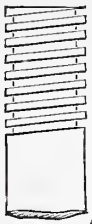


Fig. 10.

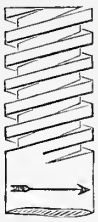


Fig. 11.

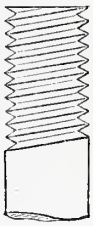


Fig. 12.

Fig. 13.

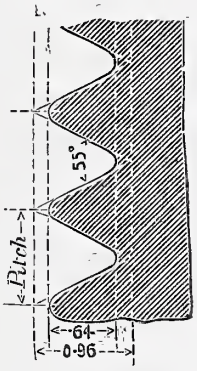


Fig. 3.

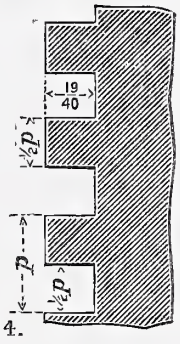


Fig. 4.

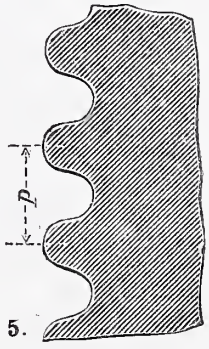


Fig. 5.

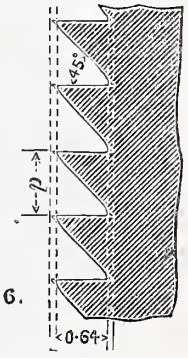


Fig. 6.

**Fig. 1.—Formation of Spiral of Screw round Cylinder. Fig. 2.—Diagram showing Increase or Diminution of Pitch. Fig. 3.—Whitworth Screw Thread. Fig. 4.—Square Screw Thread. Fig. 5.—Whitworth Screw Thread, rounded. Fig. 6.—Trapezoidal Screw Thread. Figs. 7 and 9.—Conventional Modes of drawing V-Threaded Screw. Fig. 8.—Ditto, Small Square-Threaded Screw. Fig. 10.—Ditto, Single Square-Headed Screw. Fig. 11.—Ditto, Double Square-Headed Screw. Fig. 12.—Ditto, Double V-Threaded Screw. Fig. 13.—Ditto, Single V-Threaded Screw.**

Take a cylinder, A B C D (Fig. 1), of any convenient size; then take a rectangular piece of paper, E F G H (Fig. 2), the length of which must be exactly equal to the circumference of the cylinder—that is, the points E G must coincide with F H respectively when the sheet is wrapped round the cylinder. Having got this correct, cut off the dotted portion, E G H, of this rectangle. Take the remaining triangle, E F H, and wrap it again round the cylinder, making F H (Fig. 2) parallel with the axis. The points E and F should now coincide at $E^1$ $F^1$, and the line $H^1$ $E^1$ in its winding round the cylinder forms a spiral or screw, the pitch of which is equal to the depth F H. The pitch of a screw or spiral is the distance the thread or line rises during one complete revolution. For instance, if you turn the cylinder once round in the direction of the arrow, meanwhile following the line from $H^1$, it will have gradually risen

from H′ to F′ or E′, which distance, as before stated, is the pitch of the spiral. By increasing or diminishing the line F H (Fig. 2) the pitch is increased or diminished. By this means the pitch can be varied from the smallest fraction of an inch, as in some watch screws, to as much almost as you like, if the body round which it winds is big enough. A good illustration of a long pitch small diameter screw is the egg-whisk, where, by sliding a wooden nut backwards and forwards along a twisted wire shaft, the whisk rotates first in one direction and then in the other. Spiral staircases are the largest pitch screws I can think of. When once the method of obtaining a spiral line is grasped, the student will follow with comparative ease the drawing of screw or spiral threads, as these only consist of combinations of spiral lines.

Unwin defines a screw as "a cylindrical bar on which has been formed a helical projection or thread." These projections, in order to suit the different purposes for which they are intended, are of various shapes, of which the four principal forms are shown in section in Figs. 3, 4, 5, and 6; but the two first only—viz., the V and the square thread—are in very general use. Fig. 3 shows the ordinary V or triangular thread, as used in all English workshops. The use of a common thread was early recognised by our manufacturers to be of the very greatest importance, and as Sir Joseph Whitworth was the first to propose a uniform system of threads, it has received his name. The Americans use a somewhat similar thread, called "the Sellers," after the introducer.

In most books treating on machine design and engineering formula, there are tables giving the pitch or number of threads to the inch for a given diameter of screw.

Fig. 3 shows the method of designing the Whitworth thread. Draw two parallel lines 0·96 of the pitch apart. Set off the pitch on one of these lines, and at the points so obtained form angles of 55°, as shown. Again, draw two parallel lines centrally between the first two, and 0·64 of the pitch apart. The threads where these lines cut them, or one-sixth the depth of the thread, are rounded off at the top and bottom. The rounding off facilitates the cutting of the screw, and renders it less liable to damage.

When these screws are used in conjunction with nuts, they are termed bolts, and one of their drawbacks is that, when tightened in their nuts, as will be seen from the slope of the threads, the greater the force used to screw them up the greater is the tendency to burst the nut.

For wrought-iron pipes a finer pitched screw thread is used, and is known as the gas thread; it does not cut away quite so much of the metal of the tube.

Fig. 4 shows a square thread, and there are, compared with the V thread, so few used that there is no real standard, each screw being designed for its special work; but the pitch is generally twice that of the triangular thread for the same diameter of bolt. In designing it, the pitch is first settled, and this divided by two gives one-half for the thread and one-half for the space, the depth of which is slightly less than one-half—or, say, $\frac{19}{40}$—of the pitch. These square-threaded screws are generally used to transmit motion. The surface of the thread being normal to the axis of the screw, there is with this form of thread no oblique pressure on the nut, as in the preceding (Fig. 3).

Fig. 5 is the same as Fig. 4, only the threads are completely rounded. This screw is employed where it is subject to very rough usage.

Fig. 6 shows a form of screw thread called "trapezoidal," which is used when the screw has to resist a pressure acting in one direction. Here the surface bearing the strain, as in the square thread, is normal to the axis, so that there is likewise no tendency to burst the nut. The method of designing is almost the same as in Fig. 3. Draw a vertical line, and set off thereon the pitch. From each of these divisions draw horizontal and angular lines at 45°. Through the point where the horizontal line from one of the divisions cuts the angular line from the one above it, draw a line parallel to the first one, which will pass through all the inner angles of the teeth. Then, as in Fig. 3, draw two parallel lines, 0·64 of the pitch apart, centrally between the first two lines. These will cut off a portion of the angles, which should be rounded as shown.

Of course, to draw screws accurately in most machine drawings would take up too much time, and it would be almost impossible in some cases, owing to the smallness of the screw. On this account I have drawn Figs. 7, 8, 9, 10, 11, 12, and 13—which show the conventional methods of drawing threads on bolts—of varying size. Figs. 7 and 9 represent the ordinary V-threaded screw, the first (Fig. 7) being delineated by thin parallel, equi-distant, slightly inclined lines. Fig. 9, being larger, shows a short thick line between two fine ones; this gives a much neater appearance to it than if the lines had been the same. Fig. 8 represents a small square-threaded screw, shown by two fine parallel lines for the thread, while the space between the two threads is slightly increased. Figs. 10 and 11 show respectively a single and double square-threaded screw, somewhat larger than Fig. 9, therefore shown in more detail. The threads in these are represented merely by straight lines, but more in detail than in Fig. 8. The method of obtaining the various points from which the lines are drawn will be shown later in the larger scale drawings of how to draw an accurate V and square-threaded screw. Figs. 12 and 13 show respectively double and single V-threaded screws, which are likewise formed by straight lines.

There are, of course, right- and left-handed screws: those I have drawn are all right-handed. A right-handed screw, when turned in the direction of the arrow (Fig. 11), will, if a nut be placed at the end, enter it; a left-handed one would, however, work out. Another simple way of distinguishing between them is: hold the screw vertically opposite you, when if the threads in passing round the body rise from the left-hand side to the right, then the screw is right-handed; if they rise from the right to the left, then the screw is left-handed. The spiral line (Fig. 2) is also right-handed. A good illustration of a right and left-handed screw working together is the adjustable coupling between railway passenger carriages.

Having shown what a screw or spiral is, and how to obtain it—also the various shapes of threads and the conventional way of drawing the same—we now come to the accurate delineation of the threads of a screw, which, however, through want of space in this number, will have to appear later. But as it may, at first sight, seem rather difficult for beginners to grasp the method, on account of the number of construction lines, I will, before closing this paper, show how the simple spiral line H′ E′ (Fig. 1) is drawn.

Divide the pitch H F (Fig. 2) into any even number of equal (in this case eight) parts, numbered 1, 2, 3, etc. Draw horizontal lines through these points, till they cut H E in 1′, 2′, 3′, etc. As H 1 is an eighth of the pitch H F, the line H 1′ is an eighth of H E. It is also true that all horizontal lines, drawn through any of the divisions in the pitch line to cut the diagonal line H E, cut it proportionately to the pitch: for example, the distance H 4 is half the pitch, therefore H 4′ is half the length of H E, the line forming the spiral. Now, the whole of the line H E just completes the circuit of the cylinder while rising the distance H′ F′ (Fig. 1); therefore H 4′, the half of this line, will complete one-half the circuit while rising one-half the distance—that is, one-half the pitch. Therefore, for every eighth of the pitch rise there is an eighth of the line H E wrapped round the cylinder. If, now, we could mark off the points 1′, 2′, 3′, etc., in their respective positions on A B C D (Fig. 1), a line drawn through them would represent the path of the line H′ E′, or the spiral desired. To do this we proceed as follows:

Draw a horizontal line *a e* below the cylinder, and equal to its diameter, as shown (Fig. 1); draw a vertical line *c f g* through the centre of the cylinder, cutting *a e* in *f*. With *f* as centre, and *f a* or *f e* as radius, describe a semi-circle. Divide this semi-circle into four equal parts at *b*, *c*, *d*, *e*—that is, half the number the pitch is divided into. From *a*, *b*, *d*, and *e* set up vertical lines: the lines from *a* and *e* correspond with the sides of the cylinder.

Now, if a complete circle had been drawn below instead of a semi-circle, the vertical construction lines from *b*, *c*, and *d* would have passed through the points of division in the corresponding half; so a semi-circle is all that is necessary for our purpose.

The lower part of the spiral shall commence on the line *c g*, therefore (supposing Figs. 1 and 2 to be in proper relative positions) produce the line H G (Fig. 2) till it cuts *c g* in H′; this will give the starting-point of the spiral, which, in this case, winds upwards to the right: therefore, from *d*, one-eighth of the circumference to the right of *c*, set up a perpendicular, *d i*. Now, as already explained, for every one-eighth of the circumference the spiral travels it rises one-eighth of the pitch: therefore, produce the line 1 1′ till it cuts *d i* in 1″—this gives the first point in the spiral: then produce the line 2 2′ (Fig. 2), till it cuts the side of the cylinder B D—that is, the vertical line from *e*, which is $\frac{1}{4}$ of a revolution from *c*; this gives one more point in the spiral, viz., 2″. Here let me remark that I have drawn the curve from 1″ to 2″ without any intermediate points, as, from continued practice, I know that it takes some such form. For exercise, however, the readers might subdivide the $\frac{1}{8}$ pitch between H 1 and H 2 into any number of convenient parts, so long as they divide the one-eighth part of the circle *d e* into the same number; then set up perpendiculars from them and draw horizontals from the pitch, when extra points would be obtained between 1″ and 2″ to draw the curve more accurately. After passing 2″, the curve commences to wind behind the cylinder.

If the semi-circle *a c e* had been completed, and divided into eight equal parts, the point showing the next division would have been on the vertical line passing through *d*, as before remarked; therefore, to obtain the next point in the spiral, we may make use of this line. We now prolong the line 3 3′ till it cuts *d i* in

3″, three-eighths of the pitch above H″. For the above reason, 4 4′, produced till it cuts *c g*, will give another point, 4″; 5 5′ will cut *b h* in 5″; 6 6′ will cut A C in 6″. The curves joining all these points must be dotted as it winds round the back of the cylinder. To proceed, 7 7′ produced cuts *b h* in 7″; 8 8′, or E, is represented by E′ coinciding with F′. The curve from 6″ to E′ is drawn in full, as it again winds round in the front of the cylinder.

If the readers of this article will thoroughly master the why and wherefore of these proceedings, they will find no difficulty in understanding the remaining portion, which shows how to draw both the V and square-threaded screw, single and double, and which, as before stated, will appear in a future paper.

## A MODEL ELECTRO-MOTOR.

BY GEORGE EDWINSON BONNEY.

Atkinson's Electro-Motor—The Field Magnet Castings—The Armature and its Bearings—The Brush Rocker and Brushes—The Commutator—Winding the Armature—Winding the Field Magnets—Fitting the Parts Together—Testing for Fault in Insulation—A Cheap Galvanometer.

The small electro-motor shown in the accompanying illustration at Fig. 1 is suited to the requirements of amateurs who have a lathe and employ it in turning parts of machines as a hobby, and who have a fancy for making up pretty little machines for bazaars and exhibitions. It is a machine that will look very well indeed when good workmanship is put into the fitting and polishing of the various parts, and its parts will also require some careful fitting to make them run well. When properly made, it will drive a small polishing or dental lathe, or a small fretwork machine, or a small drilling machine, or even a light sewing machine, with a battery power of some three or four quart cells of a chromic acid type, or the equivalent current from any other source. Full sets of castings and all other requisites are supplied at a low price—3s. 6d. for the castings, and from 1s. 9d. to 2s. for the wire—by Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham.

These castings consist of two malleable iron field magnet sets of cores and bridges, as shown at Fig. 2, each measuring $4\frac{1}{4}$ in. in length by $2\frac{1}{2}$ in. in width; one malleable iron casting (Fig. 3) for the armature, measuring $2\frac{1}{8}$ in. in length by $1\frac{3}{8}$ in. in diameter; two gun-metal castings, $1\frac{1}{2}$ in. in diameter (Fig. 4), for ends of the armature; two brass castings of four-legged spiders for the bearings of the spindle; one brass casting of a pulley, $1\frac{1}{2}$ in. by $\frac{9}{16}$ in.; one brass casting of a smaller pulley, 1 in. by $\frac{1}{2}$ in.; two brass end-pieces, $2\frac{9}{16}$ in. by $\frac{3}{4}$ in. (Fig. 5), to form feet for the field magnets; one brass casting for brush rocker, $2\frac{1}{2}$ in. in length (Fig. 6); two brass castings of brush-holders (Fig. 7); two brass castings of set screws (Fig. 8); castings for the brass nuts, brass tube for commutator, and a strip of phosphor bronze for the brushes.

These having been obtained, we will set about fitting and finishing the various parts and putting them together.

*The Field Magnet Castings.*—These, as received from the vendor, will be rough, but not so rough as some I have seen—in fact, these are clean and tolerably smooth, but they will require a few touches with a file to make them fit and have a presentable appearance. All nodules and roughness must first be filed down with a flat bastard file. The channel for the armature must next be smoothed with a half-round file, care being taken not to alter the contour of the arches, nor to more than merely smooth the casting. The corners of the cores should now be rounded a little, to prevent them from cutting into the insulating cover of the wire as this is being wound on. The outsides may now be smoothed and the ends trued to make the whole fit well together. The top casting is a little thicker than the under one. The under field magnet casting will have the two brass feet or holding-down pieces, shown at Fig. 5, fitted under each end, and must therefore have two small holes drilled and tapped under each end to receive two small screwed studs, which pass through the flanges of the brass feet and the ends of the lower field magnet castings into the iron of the top casting, as shown in Fig. 9. Similar small holes for set screws, to hold the feet of the spiders, must also be drilled and tapped in each of the corners of the tunnel arches (as shown at Fig. 9) above and below the tunnel at each end, and round-headed brass studs may be screwed to fit these. Thus prepared, the castings may have a coat of Japan black and be set aside to dry.

*The Armature* is of the Siemens H girder type in one solid casting of malleable soft iron. This must be filed smooth and true at the ends, and the channel also made smooth with a file. The gun-metal end-pieces shown at Fig. 4 will be fitted to the ends of the armature, and these will hold the steel spindles. It will be well, therefore, to take these together. Get two 2 in. lengths of $\frac{1}{4}$ in. steel rod, and turn them down to $\frac{3}{16}$ in., so as to have them true and smooth. Turn the end-pieces smooth, drill a $\frac{3}{16}$ in. hole in the boss of each, and fit one end of each spindle into each boss, then sweat or shrink them in, as may be deemed best. The end-pieces will be secured to the ends of the armature, after being fitted true to it, by small brass studs; holes must therefore be drilled through the end-pieces and into the armature to receive them. The castings are marked with dots where these holes should be drilled. In one of the end-pieces we must drill two extra holes for the ends of the armature coil to come through, and these holes must be bushed with small tubes of ivory or of bone. When the ends are fitted on, mount the armature in a lathe, and true it by taking a very light cut over it, just enough to take off the rough skin. This done, mark all the screws and screw holes to act as guides in putting together, take off the ends, and dress the web and channel with shellac or good sealing-wax varnish, then set aside to dry, ready for winding.

The brass spindles, shown at Fig. 1, fulfil the double purpose of clamps to hold the field magnets together and to form bearings for the armature spindles. These must now be drilled with holes to fit the spindles, holes in each foot to receive the holding studs, and small oil holes in each bearing, then filed smooth, and polished neatly. The projecting boss of one of these bearings must be turned to form a pivot for the brush rocker, which will fit on this like a loose sleeve, and the insides of the spider legs and bodies should also be turned smooth.

*The Brush Rocker.*—The casting for this is shown at Fig. 6. The hole in the centre must be turned to fit the pivot on the boss of the bearing above-mentioned; then there must be a small hole drilled and tapped in the edge of the rocker to receive a small brass set screw for fixing the rocker on the pivot in any required position. The small brass castings, shown at Fig. 7, must then be turned and filed to the form shown at Fig. 10, to form brush-holders, and these are held in holes drilled through the ends of the rocker. The part from A to B, Fig. 10, is first turned down to $\frac{1}{4}$ in., and a thread chased on it to receive a brass nut. The hole in the end of the rocker is drilled $\frac{1}{16}$ in. larger, and this is to be bushed with vulcanite or a bit of asbestos board, with a collar of the same on each side, to insulate the brush-holder from the rocker. A fairly good bush can be made from a small washer of rubber cut off from the end of a piece of rubber tube, and two collars of thin cloth to come between the shoulder of the brush-holder and the rocker on one side, and the nut and the rocker on the other; but these are liable to be destroyed by oil. The plain end to the right of the chased thread must be pierced transversely with a $\frac{1}{16}$ in. hole to receive the conducting wire, and this hole is met with another, drilled in from the end, and tapped to receive the thread of a binding screw furnished with a milled head, as shown at Fig. 11. The other end of the brush-holder is turned down smooth, a $\frac{1}{32}$ in. slot is to be cut up to the shoulder, one side of the holder filed flat, and a $\frac{1}{16}$ in. hole drilled through both, the lower half of the hole being tapped to receive the screwed part of a brass set screw.

*The Brushes* are strips of phosphor bronze foil, 2 in. by $\frac{7}{16}$ in., cut from the roll sent with the castings to the form shown at Fig. 12. Six of these strips are placed together to form a pad. The ends at one end are soldered together, and a slot, $\frac{1}{2}$ in. by $\frac{1}{8}$ in., cut through the whole in the middle to receive the adjusting and tightening stud. A set of these are, of course, at each end of the rocker.

*The Commutator.*—As on this form of armature there is only one coil, the two ends of which are connected to two parts of the commutator, a two-part commutator, made out of a ferrule of brass split into two equal parts, will be required. The piece of brass tube sent with the castings has an internal diameter of $\frac{11}{16}$ in. This is fitted on a boxwood boss $\frac{1}{2}$ in. in width, which is then bored with a hole to exactly fit the spindle at that end of the armature with the wire holes drilled in the end. The ferrule is now to be scribed into two equal parts, and on each side of the dividing lines scribe two more lines, so as to have the three lines on each side $\frac{1}{4}$ in. apart. Through the centre of the two side lines drill a small hole into the boxwood to receive two short brass screws. Countersink the mouths of these holes, and screw in the screws tightly. Do the same on the other side of the commutator. This done, cut the ferrule into two equal parts with an oblique cut as shown at Fig. 13. This is best done with a hack-saw, so as to make a clean cut through the brass into the boxwood beneath. The boss, with its split ferrule, may now be pressed on the spindle, and trued up in the lathe. In pressing on the ferrule, let the inner ends of the oblique cuts coincide with the wire holes in the armature ends.

*Winding the Armature.*—This is a simple matter. Measure off 60 ft. of No. 20 double cotton-covered copper wire, roll into a hank, and soak for a quarter of an hour in melted paraffin wax, then hang up to drain and cool. When cool, take the armature in the left hand, and the wire in the right. Place

the commencing end of the coil (with 2 in. left free) at the left side of the channel, and hold it down with the left thumb whilst the wire is wound closely around the web of the armature in regular coils, side by side, to the right side of the channel, then back again with the same care and regularity, until all the wire has been wound on in regular and even layers. Then twist the two ends together to keep them from springing apart and the coil from unwinding. Test each layer for insulation as they are wound on, and test the whole coil again when complete.

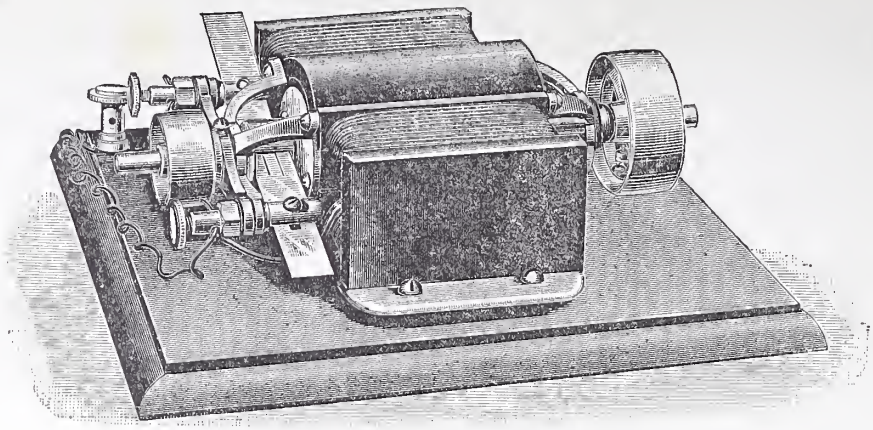


Fig. 1.—Model Electro-Motor: Siemens Bridge Type, complete.

The end-pieces may now be put on, then the ends of the armature coil may be brought out through the bushed holes in the ends and connected (by soldering each end) to each part of the commutator. The ends should be soldered to the inner edges of the commutator pieces, along which they may lie to the length of ½ in. The coil may now be given a coat of sealing-wax varnish to set the wires; then set aside to dry,

*Winding the Field Magnets.*—The field magnets of this little motor must be so wound as to cause the arch above the armature to assume a magnetism of opposite polarity to that of the arch below the armature. It matters but very little whether we have a north pole at the top and a south pole at the bottom, or a south pole at the top and a north pole at the bottom, providing both are not north poles and both south poles. This desired end is accomplished by winding the core on one side of the arch in one direction, and the core on the other side of the arch in the opposite direction. Thus, if we wind the left-hand core of the top magnet from left to right overhanded, we must wind the opposite or right-hand core in the opposite direction, namely, from left to right underhanded. This will ensure a north polarity to the upper arch. In commencing to wind the lower cores from the left-hand side, we must wind the left-hand core overhanded and the right-hand core underhanded. This will ensure a south polarity to the lower arch, as shown in the diagram (Fig. 9), if the current is sent through the wires as shown by the direction of the arrows. Wind each core regularly with three layers of No. 20 double cotton-covered copper wire, and test each layer for insulation. When the last turn of wire on each core has been reached, cut off the wire so as to leave 6 in. over and above that needed to make the turn; pass this in under the turn of wire so as to form a kind of half-hitch, and draw this tight to prevent the wire from unwinding; then give the whole a dressing of sealing-wax varnish to secure each coil in their places, and to give the coils a finished appearance.

When the machine is being put together, these coils must be connected together as here described, and shown at Fig. 9. The finish end of the first coil at A must be bared of the cotton covering and cleaned with emery cloth; so also must the commencing end of the second coil on the next core at D. Dip both cleaned ends in some soldering fluid, tin them with a hot soldering bit, twist the tinned ends together with a pair of pliers, then give them a final touch with the soldering bit to solder them together. Each end must be thus treated and connected, namely, A to B, C to D, and E to F. The two ends, C D, may pass down holes made in the motor base, and be connected beneath the base. The two free ends above the upper arch will then go, one to one of the brushes, and one to one of the terminal binding screws on the base, if the coils are to be connected in series with the armature; or both of these wires will be connected to the brushes if the coils are to be connected in parallel with the coil on the armature.

*Fitting the Parts Together.*—The field magnets may first be fitted together, the ends of the coils soldered and tucked in out of sight, the screws holding the two cores, inserted and screwed tight, and the brass

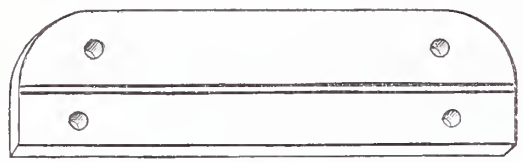


Fig. 5.

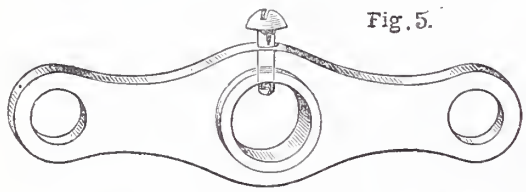


Fig. 6.

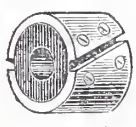


Fig. 13

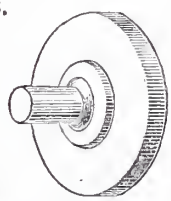


Fig. 4.

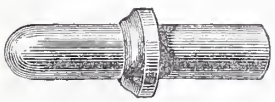


Fig. 7.

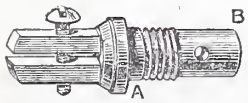




Fig. 10.

Fig. 11.

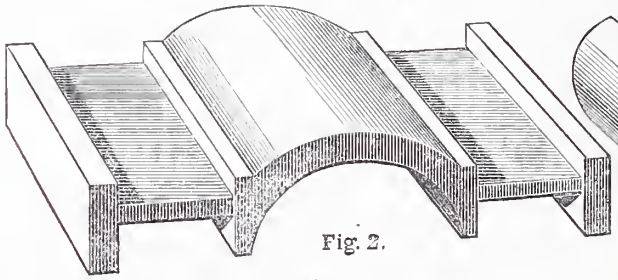


Fig. 2.

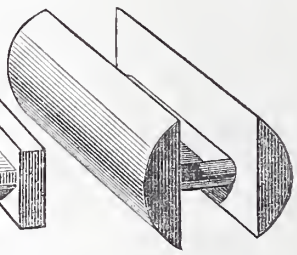


Fig. 3.

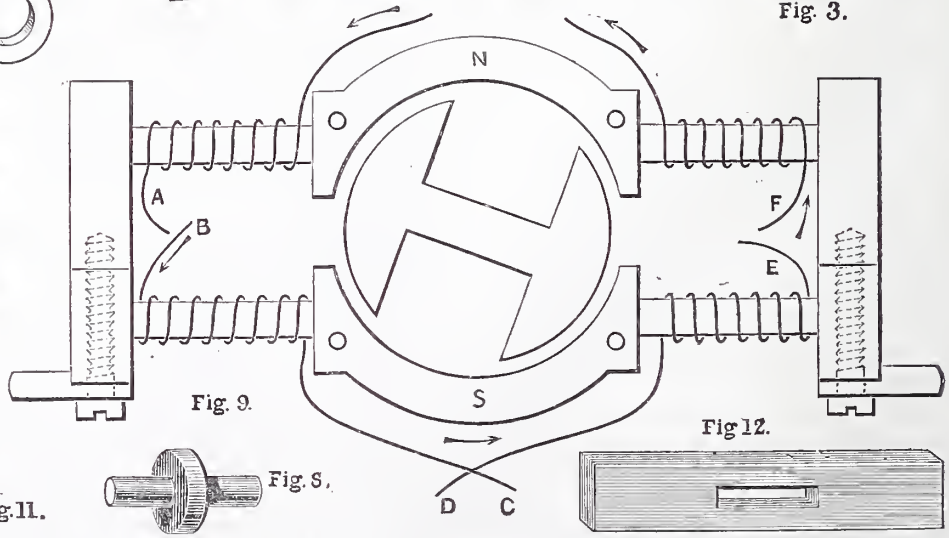




Fig. 9.



Fig. 8.



Fig. 12.

Fig. 2.—Field Magnet Casting of Electro-Motor. Fig. 3.—Armature Casting. Fig. 4.—Gun-Metal Casting for Armature Ends. Fig. 5.—Gun-Metal Foot for Electro-Motor. Fig. 6.—Rocker for Brush-Holders. Fig. 7.—Casting for Brush-Holder. Fig. 8.—Casting for Screw. Fig. 9.—Sectional Diagram of Electro-Motor, showing how it is fitted and wound. Fig. 10.—Brush-Holder complete. Fig. 11.—Brass Screw with Milled Head. Fig. 12.—Brush. Fig. 13.—Commutator.

feet screwed on. We should next fit on the already turned and polished spider bearing to the opposite end from that of the commutator; then put in the armature, slip the other bearing on its spindle, and screw this bearing in its place. Now turn the armature around by hand, and see that it runs true in the tunnel, not touching it anywhere, but parallel with it on all sides. The back pulley should now be fitted on the spindle, and tightened on it by means of a small set screw passing through the boss on the outside. The rocker may next be fitted on, and secured to the outside of the bearing by a small set screw. One of the brushes will have its free end bearing on top of the commutator, and the other brush will press lightly against the under side of the commutator. Their relative positions will be determined by the direction of rotation of the armature, the commutator running off from the brushes, but not against them to ruffle them up. The right angle to set these must be found by experiment. The rocker can be easily moved until the best effect has been obtained, then fixed in this position by the set screw. The smaller pulley is now slipped on the spindle, the armature brought forward until it runs freely in the position where it ought to work, then the pulley must be tightened on the spindle to prevent undue end shake of the spindle in its bearings. A little end play or shake is always admissible, but side shake, due to loose fitting in the bearings, must never be allowed in electro-motors. The motor may now be mounted on a wood base made of oak, teak, or mahogany, and furnished with brass terminals to the wire coils, as shown at Fig. 1. The little motor sent me by Mr. Atkinson is mounted on a polished oak base 10 in. by 8 in., furnished with carved oak legs at the corners, and holding-down clamps of polished brass at the sides. Thus fitted and finished, the price complete is 42s.

As it is advisable to test the insulation of the wire whilst winding it on the cores and armature, we must be provided with a galvanometer of some sort, and a cell of some battery. Almost any battery will serve the purpose. Connect one terminal of the battery to the commencing end of the coil being wound on. Connect the other terminal of the battery to one stud of the galvanometer. To the other stud of the galvanometer connect about a foot of copper wire, and use the bared end of this to touch and scrape the iron on which the coil is being wound. If the needle of the galvanometer is deflected—that is, moves from its position of rest—then the bare wire is touching the iron, and the bare place must be found by unwinding the coil. Cover the fault with a few strands of soft cotton soaked in melted paraffin, or with a bit of silk ribbon, then proceed again. If the galvanometer needle does not move, proceed with the winding, and test again further on. A small galvanometer, suitable for this purpose, is sold by Mr. Atkinson for 3s.

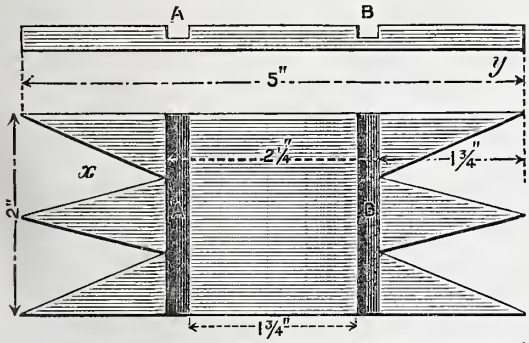



Fig. 1.—Pattern of the Six Parts of which Puzzle-Box is made in Plan (*x*) and Side Elevation (*y*).

Fig. 5.—Full-size Design for End (Monogram).

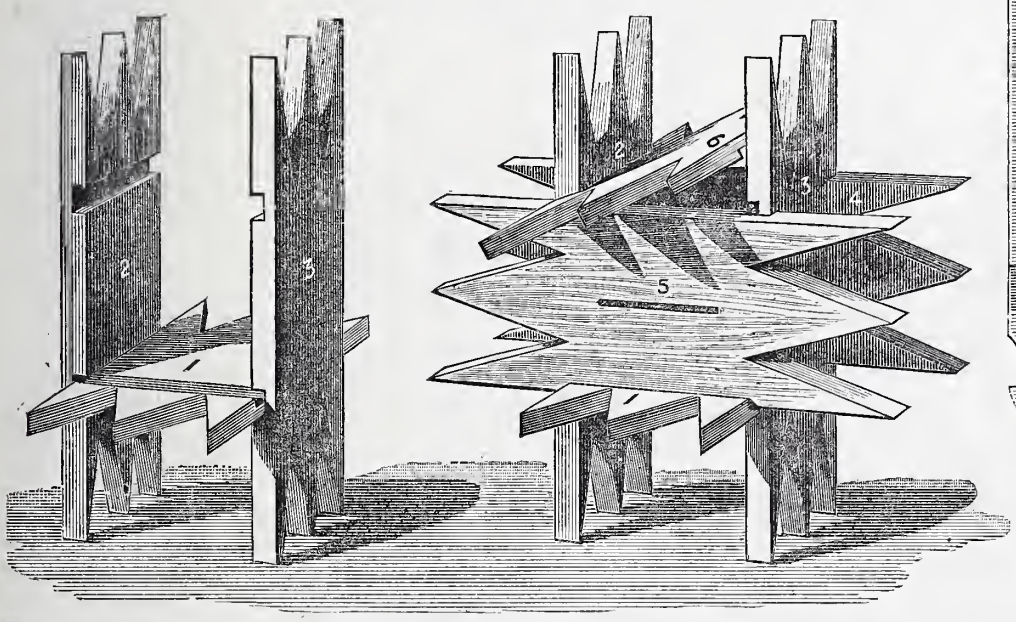



Fig. 2.—Commencement of putting Parts together. Fig. 3.—Completion of putting Parts together.

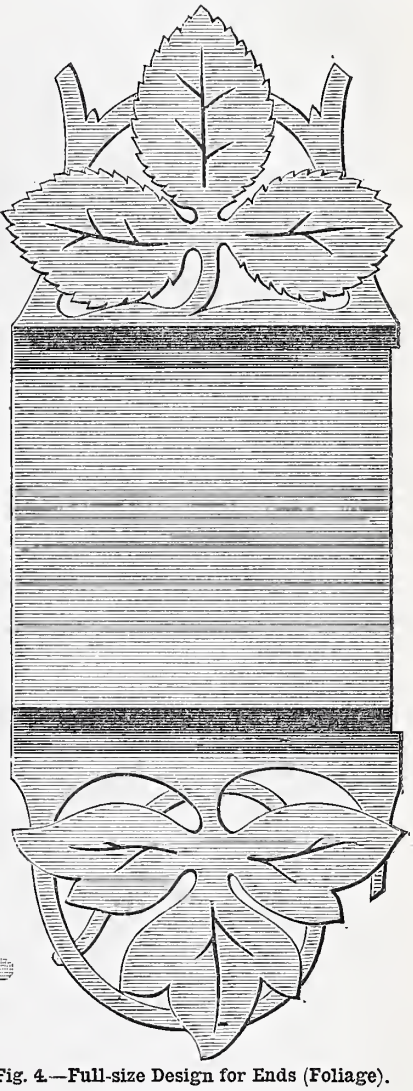


Fig. 4.—Full-size Design for Ends (Foliage).

## HOW TO MAKE A PUZZLE MONEY-BOX.

BY FRED CROCKER.

Setting out the Pattern—Cutting the Ends—Putting Together—Puzzle Picture Frames.

The subject of the present paper suggested itself to the writer on being asked to contribute some small article for sale at a bazaar, and, judging by the results, I should think that if any reader of Work should find the same task put before him, he could not make a more satisfactory and desirable article. The following notes will describe the method of manufacture:—

Procure a strip of wood—Honduras mahogany will do very well for the purpose—2 ft. 6 in. long × 2 in. wide × ¼ in. thick: this must be dry, or the box will soon fall to pieces. Cross-cut it into six 5 in. lengths. Take one piece for a pattern, and set it out exactly as shown in Fig. 1. Groove it at A and B, making the grooves ⅛ in. deep and ¼ in. wide. Cut the ends as in Fig. 1, or as shown in the other designs, Figs. 4 and 5; then make the other five pieces just the same as No. 1, with the addition that one of them will require a slot for putting in the

money. This may be mortised with a fine bradawl and cleaned out with a key-hole saw and piece of glass-paper. The slot should be 1¼ in. long, so that it will just pass a penny, and our box is ready for putting together. The sketches will explain the method of doing this. For clearness, I have numbered each piece. Put No. 1 (see Fig. 2) on the table; add Nos. 2 and 3; then 4 and 5, as shown in Fig. 3; finally put No. 6 in position. Force it down with the thumbs. It will be found that Nos. 2 and 3 will spring sufficiently to allow No. 6 being forced into its place. It will then key all the others; but if the wood is brittle and there is danger of splitting, it may be eased at the side, as shown in Fig. 4.

Figs. 4 and 5 give suggestions for cutting the ends if the reader has a fret-saw. In Fig. 5 it is supposed that the box is to be given to a child, the ends being cut with his or her monogram.

Of course it is not necessary to adhere blindly to the dimensions given. The pieces may be made 2½ in. wide, and the grooves made further apart accordingly, bearing in mind that in all cases the distance from out to out of grooves must equal the width added to the depth of both grooves. Again, the box may be made with the ends plain or simply rounded; and if no better material is handy, the cedar of a cigar-box may be utilised. It is scarcely necessary for me to add that each piece should be cleaned off with glass-paper before putting together.

Puzzle picture frames are put together in much the same manner, each corner being a miniature copy of the money-box.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* Work *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* Work *without charge, the notices given partake in no way of the nature of advertisements.*

### 6.—The Indiarubber "Grip" Handle Cover.

Messrs. P. B. Cow & Co., 46 and 47, Cheapside, E.C., send a specimen of their new Indiarubber "Grip" Handle Cover (Caffarey's Patent) for enabling those who use them to obtain a firmer grasp and hold than can be obtained by the hand alone without any intervening medium on the handles of tennis rackets, cricket bats, sculls, handles of cycles, and clubs and sticks for golf, lacrosse, polo, and hockey. The cover is in the form of a bandage with a rough or embossed surface externally, and a smooth surface internally, fitted with a stud and eye at one end, the stud being reversible, so that the cover may be put on so as to bring either surface, as may be preferred, in contact with the hand. Being, as it has been said, in the form of a bandage—the sample before me, intended for a cricket bat, being 36 in. long and 1¾ in. wide—it is wrapped round the handle, starting from the end without a stud, each fold overlapping the preceding one, the operation being completed at the other end by slipping the eye over the stud. It may be said that this new handle cover is entirely free from the objections that attach to the old tubular form of cover, the chief of these being the difficulty of pulling the latter on to the handle owing to its being, of necessity, made somewhat smaller than the handle it is intended to fit—a difficulty "frequently resulting," as the manufacturers point out, "in pinched fingers, loss of temper, and splitting the cover." As a matter of course, that which is difficult to put on is also difficult to remove; and conversely, that which is easily applied can be taken off with equal facility. This gives the new cover an additional advantage over the old one, and enables any cricketer who has occasion to change his bat to transfer the handle cover from one to the other in a very short space of time. The manufacturers claim that the new cover is "most effectual, very durable, and inexpensive." I have no doubt whatever as to its utility and durability; and with regard to its cheapness, it will be sufficient to say that covers for all articles cost only 1s. each, the only exceptions being those for cycles, which cost 1s. 6d. per pair, and scull handles, which are sold at 2s. per pair. They further state that a tennis racket handle cover "may be used for a cricket bat, and *vice versâ*, the only difference being in the length. In the case of oars and sculls, the rower can produce his cover, and apply it to any scull he may happen to use. With golf this is a great advantage, the clubs being frequently changed. The 'Grip' rolls up into the smallest possible compass when not in use, so can be readily carried in the pocket. For cycle handles, which vary so much in size and shape, the same handle cover will fit equally well all sizes and shapes, an advantage hitherto unattainable in any other handle cover. When the old form of cricket and tennis bat handle cover works loose, it becomes practically useless. The 'Grip' never works loose." I do not see, myself, why the new covers should not be turned to good account for augmenting the grip on the handles of pickaxes, hatchets, adzes, heavy hammers, and similar tools. It would obviate, for amateurs, at all events, that salivatory process which is sometimes necessary to assist in attaining a firmer grasp on the handle of a heavy tool that has become polished by the friction resulting from constant use.

### 7.—Proctor's "Defiance" Writing Inks.

Messrs. John M. Proctor & Co., St. Ann's Ink Works, Nottingham, have submitted samples of the various inks and writing fluids manufactured and supplied by them, and also some dry inks or inks in the form of powder, which can be rendered fit for use in a very short space of time by dissolving the powder in cold water, and shaking it until the powder is dissolved. Having made trial of these inks, I can say with pleasure that they are excellent, and satisfy in every way the requirements that men and women generally are apt to insist on when selecting an ink for their personal use. The most noticeable points with regard to these inks are—firstly, their perfect fluidity, which secures perfect freedom in writing, and enables the writer to skim over the surface of the paper, *currente calamo*, as the phrase goes, and to get a marvellous number of words on the paper with a single dip of the pen. For my own part, I am accustomed to write very fast and very small; and to do this with clearness and legibility one requires a light touch, a fine pen, and ink free from the clogginess, if I may use the expression, that seems inseparable from many kinds of ink, which are so muddy in themselves and contain so much sediment as to render them well-nigh intolerable. The special ink about which I am now speaking is, I take it, the cheapest of Messrs. Proctor & Co.'s inks, being an ink prepared for the use of schools, and supplied in nine-gallon casks at 1s. per gallon. They supply inks that are higher in price, but, as far as I am concerned, I am perfectly satisfied with this inexpensive ink without going to a higher price. Secondly, as the ink is so perfect a fluid, it neither clogs the pen nor causes the formation of an incrustation about it, which soon corrodes it and renders it useless. To go at length into the various inks supplied by Messrs. Proctor & Co. is not possible, owing to their number and variety, but what may be said of one kind may be said of all. The varieties include blue-black fluids for writing and copying, black inks for writing and copying, violet-black ink, inks of special scarlet, bright red—an excellent ink — machine-ruling inks, fancy coloured inks in mauve, magenta, purple, green, blue, and violet; endorsing inks for indiarubber stamps; and multiple writing ink of a violet tint for graphs. The dry inks for mixing with water will be found useful by travellers and emigrants. Prices of the various inks manufactured by Messrs. John Proctor & Co. will be supplied on application. I noticed some little time ago, in Work, a sample board covered with Proctor's "Defiance" Slate Composition; and may now take this opportunity to call attention to Proctor's "Defiance" Slate Paper, faced with the composition for diagrams, drawing examples, etc. The composition does not wash off, and it is said that the paper is so durable that it may be used any number of times. It is sold in two sizes—3 ft. by 2 ft., at 6d. net, and 4 ft. by 3 ft., at 1s. net. The slate paper will be found extremely useful, not only in schools where something supplementary to the blackboard is required, but also in lecture-rooms and class-rooms where the lecturer requires a medium that may be speedily available for the diagrammatic illustration of his remarks.

### 8.—New Patent Non-Conducting Covering for Steam Pipes.

The Cortex Calorifuge Company, Limited, 3, Fenwick Street (offices), and 19, Hanover Street (works), Liverpool, send me a letter and pamphlet relative to a patent cork covering for steam pipes that they are now manufacturing and supplying, which is known as the Cortex or Cork Covering. The Company's manager, Mr. H. E. L. Grundy, writes:—"We are manufacturing a new kind of non-conductor for the covering of curved or straight steam pipes, to prevent radiation and reduce the consumption of coal, and carry steam a much longer distance, either inside or outside of buildings. The covering is made of pure solid cork, and can be bent to suit any diameter or shape of pipe. The cork is cut into long strips; the ends of each are bevelled, and then joined and coiled into strips of eleven yards. A covering of linen at the back of the cork enables it to be bent and wrapped around steam pipes with the greatest ease. It is a natural non-conductor, and in its wild state has to resist heat, frost, and water, so that it is specially adapted for non-conducting purposes, being so durable and light." Of course, we all know the nature of cork, and are acquainted with many of its adaptations for mercantile purposes; and being well aware of its qualities and characteristics, there is no difficulty in accepting all that Mr. Grundy says with reference to it. Moreover, it is highly commended by various engineers and naval architects who have tested it on the steam pipes of large steamers. It is made to suit various sizes of pipes in strips from ¼ in. to ⅝ in. thick and 1½ in. wide, and is sold by the square foot, and according to thickness, at 1s. 6d., 1s. 7d., 1s. 8d., and 1s. 9d. per square foot. The coils in which the cork covering is supplied are between 11 yds. and 12 yds. long. To fit it on to the pipe, the coil is first unrolled on to the pipe loose, and then lies slack about the pipe. One end of the cork is then secured with string or wire, and the slack is tightened up by wrapping it closely round the pipe. The ends of the cork strips being bevelled and covered with a solution, all that is necessary in order to join them is to press the two ends together and overlap the spare linen backing of the cork which is left at each end for the purpose. When this is done, the cork coil should be overlaid in the contrary direction with a linen tape, specially prepared with a solution which is applied to the inside surface of the linen. This linen, with the dressed surface innermost and touching the cork, or rather, the linen with which the cork is backed, is wrapped tightly and closely round the cork covering, and the operation is completed. In the case of curved pipes, a little must be cut from the edge of the cork on the inside, or the gaps on the outside must be filled in with small pieces of cork covered with linen. A very neat appearance is imparted to the covering by applying a coat of white lead or zinc to the linen envelope. This tends to preserve the linen, which, it should be said, is supplied at the rate of 3d. per square foot. The Editor.

## SHOP:

A Corner for Those who Want to Talk It.

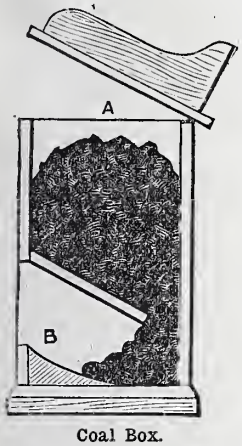
*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Fretwork.**—F. C. (*Leytonstone*) writes:—"Some time ago, in a letter to WORK, I suggested an easy method of taking a number of copies of a fretwork design—viz., clamping two pieces of wood together with several sheets of paper between them; then cutting out in the usual manner. This gives you two copies of the design in wood, and as many in paper as you please. Now suppose if, instead of using paper, you place a sheet of thin metal, such as is used for cutting stencil plates, between the two pieces of wood, then cut out, it will make very little difference in the working of the saw, and you will have a stencil plate from which any number of designs may be reproduced."

**Coal Box.**—H. B. (*Haydon Bridge*) writes:—"I would respectfully suggest to W. H. P. (*Hornsey*) an improvement on his coal box (see page 731, Vol. II.). If he will put the coals in at top (A), putting the top on hinges, he will get more room for coals, and his top will be as available for table purposes as ever. I would also have the floor of the box curved downwards, as at B, so that when the coals were thrown in at A, the box being empty, none would find their way out at the bottom. His idea is a good one. As I use stoves with coke, broken to sizes, according to strength of the wind, I intend making one."



Coal Box.

### II.—Questions Answered by Editor and Staff.

**Varnish.**—D. B. (*Durham*).—As has been frequently stated in the "Shop" columns, varnishing is not a good way to finish furniture of any but the commonest and roughest kind. The best "varnish" is French polish. This you can make by dissolving shellac (6 oz.) in methylated spirit (1 pint). It is not suitable for brush work. Ordinary varnish making cannot be well practised by an amateur. You will find it better and more economical to buy what you want ready made, as you can easily do in your own neighbourhood.—D. A.

**Incubator.**—T. M. (*Deptford*).—The T-shaped tube and regulator work as sketch, Fig. 1, the parts being lettered as in the original drawing (Fig. 1, page 589, Vol. II.) The difference is, as you will see, that the damper lever must be altered as shown, when the float will open damper instead of closing it, as you imagine. You will economise heat by turning the end of the flue pipe, D, up through the tank, as I have shown, instead of outside, as shown by Mr. Walker. The regulator I recommend is a glass tube filled with mercury and ether (see Figs. 2 and 3). If you can, run the lifting rod, E, up through centre of machine. Fig. 2 is best; but if you place regulator at back of egg drawer, Fig. 3 will be preferable, as the bent arm will project over the eggs. It consists of a glass tube of about ⅜ in. calibre, bent as shown, and the end A sealed over. When obtained, fill the tube sufficiently with mercury, C (shaded dark), then add a small quantity of dilute ether, and agitate the tube until the fluid assumes the position B (shaded light), with a small air bubble at the sealed end A. This operation is difficult to describe, but is easily done when you know how. If you place your forefinger over the open end of tube, and turn it upside down and about a few times, the ether, being of the lightest *s.g.*, will assume the uppermost position, and by a few dexterous manipulations can be confined in the sealed end. This having been accomplished, fit a small float, D, to slide easily in tube. This may be made of a piece of ivory, nicely turned to fit; or a small cork can be fitted. Into this float fit a stiff straw or a piece of fine hard wire, E, to act as the lifting rod actuating the damper; and after testing, cut same to required length. A small braeket, F, made of any sheet metal, with a hole drilled in it to fit rod, will keep it straight and prevent float jambing in the tube. The action is thus:—Ether boils at a very low temperature and gives off a vapour. Being imprisoned, it cannot escape, and therefore forces the mercury round into the long limb. This, in turn, raises the float, and this, with its rod, tilts the damper lever, and allows the heat to pass straight away instead of going through the tank. This will be found a most sensitive regulator, and is the best I know of. I think I have made all clear; if not, write again.

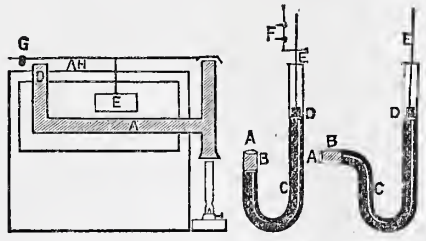
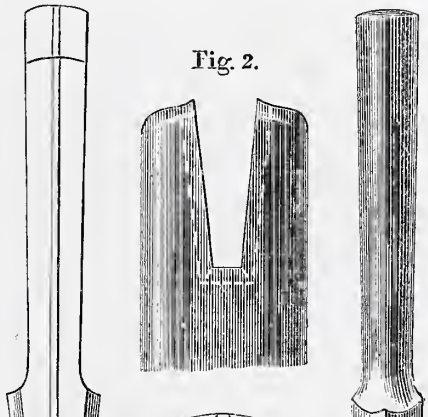


Fig. 1. Fig 2 Fig. 3.

Incubator Parts.

I cannot suggest any improvement in the damping arrangement described by Mr. Walker *for a hot-water machine*, my remarks as to improved damping being confined to machines of the *hot air* class. Give eggs a sprinkling every day during the latter half of period of incubation with warm water, and during the last day or two a few seconds' soaking in water at about 100° Fahr. will minimise the chance of a goodly number being found "dead in shell."—Leghorn.

**Cricket Bat.**—No Name.—You do not state whether you wish to make a new spliced bat or want to repair a broken bat. In the latter case, how can I advise you without a tracing of the fracture? In the former, I may tell you that there is considerable art in splicing a bat to ensure a springiness when a blow is struck, so that such elasticity may act as a secondary force. Celebrated makers use pieces of whalebone half-way up the handle, and one-third down the bat to achieve this result. Some make the handle of lancewood; some of willow, which seems the favourite wood for the bat itself. If I were making a bat, I should have the handle turned of hickory, and left 6 in. longer than I wanted for handle, and then plane it to a wedge shape, as shown in the illustration, marking the bat at the same angle, but cutting it smaller, so that a V-joint is made as shown in diagram in section. This can only be done with a chisel, carefully getting the four surfaces, A, B, C, D, to fit accurately; the end of the handle should be also chamfered off, fore and aft, and the bat itself recessed inwards to receive this V-shaped joint, taking care to make it $\frac{1}{16}$ of an inch too short when in place before gluing, and driving it home when you are satisfied with the fit. If you like to go to the trouble of gluing up the handle first with a strip ⅛ in. thick of whalebone between two pieces of hickory before it is turned, you may attain more "springiness." The after-process of stringing the handle will ensure that the joints will not re-open above the splice, whilst the wedging below will compel that portion in the bat to keep close. To add to the springiness, taper the round part towards the lower part of the handle, so that being thinner the spring may date from the junction of bat and handle, and not below, or the strain may shake the splice. Then wind on the string (good fine whipcord well waxed with cobbler's wax is best), and soak the bat with raw linseed-oil, or better still, oil it with raw oil every two days for a month, feeding the butt end with all it will absorb, which will prevent the blows on the bat from the hard ball from even marking it; by well rubbing it with oil thus day by day a very high polish will result. You say you do not like pins, but I strongly recommend, after the handle is housed home and the glue is set, boring with a $\frac{3}{16}$ in. Morse bit two holes right through bat and handle (bored through from the side, of course), and then *rosewood* dowels, $\frac{3}{16}$ in. full, driven right through with thin glue to obviate any tendency of the handle to spring *below* its junction with the bat, which I hold to be fatal.—J. W. H.



Cricket Bat Splices.

**Binding Work.**—W. K. S. (*Liverpool*).—You made a big mistake in trying to wash off the glue from the back of sections of the monthly part. The proper method is to scrape them carefully with a knife, which must be used with caution and intelligence. It is possible to make a greater mess with the knife than with the water, but it is possible to take all the glue away if care is taken. There is a certain method of using the knife so as not to cut or tear, which I cannot express in writing, but which I could easily put you up to in five minutes, but you must try and find it out for yourself. Use the knife, and be careful, and you will succeed, I hope.—G. C.

**American Clock.**—D. H. (*North Shields*).—I cannot help you to design a ease, but if you bring the weights down as you suggest, you must allow the pendulum to pass to and fro in *front* of them, and let there be an inch at least between; and bear also in mind that by having a double line, as you suggest, instead of single as before, that your weights must each be double the present ones—that is to say, that as they weigh about 3½ lbs. each now, the ones you make must be about 7 lbs., because each line takes half; therefore there will be 3½ lbs. pulling the clock, and the other 3½ lbs. pulling at the knot where tied up. The drop, of course, must be the same as before.—A. B. C.

**Polishing and Burnishing.**—G. N. (*No Address*).—It depends on the shape of the articles. Sometimes a leather buff charged with fine emery or crocus is used; sometimes a burnisher, which may be a half-round file ground and polished quite smooth. No special apparatus for turning small wood handle, only dexterity acquired by practice.—J.

**Gold Leaf.**—Trefaldryn.—Your note reads as if you had seen a gilder at work (who had already sized the pattern on to a bracket or brackets) take a leaf of transferred gold, and press it over the place where the pattern was already sized in, and being nicely done, when he removed the transfer-paper the design or pattern was left quite clean on the bracket, the transfer-paper retaining all the superfluous gold not taken up by the design. You can obtain every description of tiles of Craven Dunnill and Co., Jackfield Works, Salop. Write for illustrated price lists, stating quantity required.—E. D.

**Gas Engine.**—L. T. (*Harlesden*).—There is not space in "Shop" to give full instructions for making a gas engine, and partial ones would be useless. The standard work on gas engines is that of Mr. Dugald Clerk, C.E. In reply to your second question, you may certainly put a copper fire-box and copper tubes in an iron boiler; it is a common practice in locomotive engineering.—F. C.

**Proportions of Engine.**—Faithful Reader.—If you will state the parts of the engine for which you require formula, the description of engine, and the work for which it is required, I will send you full particulars.—F. C.

**Electric Lighting.**—Turbine.—A turbine is the best motor to use. You should send *full particulars* to some firm of electrical engineers—such as Messrs. Cooper & Paterson, Victoria Street, London, from whom you may get complete information, and an estimate of the cost of an installation, such as the power at your disposal will serve.—F. C.

**Book on Electric Bell-Hanging.**—James.—"Practical Electric Bell Fitting," by F. C. Allsop. Price 3s. 6d., post free, from Allsop & Co., 165, Queen Victoria Street, London, E.C.—G. E. B.

**Wood Carving.**—J. M. (*Newport Pagnell*).—It is impossible to give you any very definite advice. You had better find out the best shop where carving is done in the nearest large town, and see if you can arrange with the master to take you on as an "improver." I should think there were good places within reach of you; and if so, you would do better there than by coming to London, unless you can afford to come up for a day or so, and go the round of the shops. Try Rogers, of Maddox Street, London.—M. E. R.

**Making Blacking and Ink.**—A Labourer.—As an ordinary paste blacking for shoes, the following is recommended by Dr. Ure:—Ivory black 2 lb., treacle 1 lb., olive oil 4 oz., well mixed together. Add 4 oz. sulphuric acid; and when this has ceased to act on the ivory black, add also ¾ oz. gum Arabic in powder, 5 oz. vinegar, and ½ oz. sulphate of iron dissolved in 5 oz. water. All must then be well mixed together. A cheaper paste than the above may be made of ivory black 1¼ lb., treacle 1 lb., olive oil (or some cheaper oil may be substituted—rape oil or fish oil will do) 2 oz.; well mix into paste with strong vinegar. A liquid blacking may thus be made:—Ivory black 3 oz., treacle 2 oz., sweet oil ½ oz. On these pour ½ oz. sulphuric acid. Afterwards well mix these up with ¼ pint vinegar and ¾ pint water. Or, here

is another cheap and favourite liquid blacking :—Ivory black 2 lb., treacle 1 lb., sweet oil 4 oz., sulphuric acid 4 oz.; to be mixed to the proper thickness with beer bottoms. It may be observed that the use of sulphuric acid (oil of vitriol) in blackings is neither good for the leather or the sewing of shoes. A harness blacking which needs no labour in polishing is thus made:—Gelatine 4 oz., gum Arabic 3 oz., dissolved in ¾ pint of hot water. Strain and place in pan over fire; then add 6 oz. treacle, and afterwards sprinkle in 6 oz. powdered lamp-black. Boil till the mixture thickens, stirring all the time. As regards our ordinary writing inks, they are made of iron (in the form of copperas or sulphate of iron) and of gallic acid (in the shape of nut-galls) boiled in water with a little gum to give body and adhesion. If A LABOURER will get No. 31 (Vol. I., page 493), he will there find receipts for making inks of various colours, with other information on the subject; but we may here give him the rule by which the ink used in the Court of Exchequer, long regarded as of special excellence, was made, and which was divulged before a Committee of the House of Commons:—Galls 4 lb., gum 1 lb., copperas 14 oz., and rain-water 4½ gallons. —S. W.

**Banjo Matters.**—SUSSEX BANJOIST.—The number of brackets you mention (twelve) are not sufficient for a 12 in. hoop. You ought to have at least twenty-four, and not more than thirty. If you use more than thirty brackets you only add to the weight of the banjo, without having any additional advantage. I am not surprised at your banjo not being a success, considering that you have used only twelve instead of twenty-four brackets. You must have enough to pull the vellum tight, for however good a rim you may have, if your vellum is not very tight it will not sound up to the mark. When your vellum is pulled down and fairly stretched, it should feel almost like a piece of board on applying pressure of thumb or finger against it. To get it like that, you must put it on with the band standing well up, and then pull down carefully a little at a time until the top of the band is level with edge of hoop; but as some vellums stretch more than others, the band is often pulled below the level of the edge of rim (or hoop) before the vellum is properly tight. Pulling down the vellum requires care and judgment, not to be taught by written instructions. There is nothing like breaking a few vellums in the pulling down for teaching what ought and what ought not to be done. Never wet a vellum after it is put on the banjo; if you do, and you pull the vellum tighter, you are almost sure of breaking it. I should as soon think of filling the inside of a violin with water as to wet a vellum after it has been put on. The metal to use for hoop is German silver edges spun over steel wires, and lined with oak, maple, or sycamore. It is also important that the band is strong, say about ⅜ in. deep, ⅛ in. or $\frac{1}{16}$ in. thick, and having a recess turned in it to keep the brackets from touching and cutting the vellum; or notches could be filed in to receive the heads of the pulling-down wires, and so keep them clear of the vellum. The longer the handle, and the larger the hoop, the lower and deeper tone you will get, and also more powerful. A banjo with a 20 in. handle and a 12 in. or 13 in. hoop cannot be tuned up to concert pitch, but must be tuned a tone lower; the strings of such a long banjo would not stand if pulled up to pitch. The best and most convenient size will be one with 18 in. handle and 12 in. hoop, or 19 in. handle and 11 in. hoop. A banjo made to this size, and properly strung, can be tuned up to concert pitch to play with piano or other instruments. The higher your bridge, the louder the tone; if you have your bridge too high, you will not feel so comfortable when playing as you would with a lower one. It will give you a better idea which suits you the best if you try two or three bridges of different heights. In starting the vellum when putting on, the pulling-down wires ought to be put on opposite one another, as shown in your sketch, and when you have got them all on, commence to pull down at one, and follow on right round the hoop. After the vellum is on and dry, you must not on any account give one but a turn and then go to the one opposite, but must go to the next one, and so on round the hoop. If you carry out my instructions you will get the proper banjo tone. The great secrets are experience, good workmanship, and the best materials.—J. G. W.

**Hammock Chair.**—H. B. (*Hammersmith*).—You are not quite clear as to what a rivet is, and what a bolt is. What you want are some ¼ in. bolts and nuts 2½ in. long—that is to say, if you are working in 1 in. stuff—as it will be double thickness; but go to any ironmonger, and you will get them. Rivets are entirely different things, and used for another purpose altogether. I can quite see you had a trouble to get what you wanted if you asked for rivets.—J. B.

**Chords for Organette.**—R. B. (*Pallas Green*). —This question much resembles one which has already appeared in "Shop," and R. B. would do well to look out for it. I should like to answer R. B. as follows:—The chords possible on an organette depend upon the number and relation of the reeds —in all probability the organette will only play in two or three keys, and the question would be easily answered if this information had been supplied. If R. B. knows anything of music or the tonic sol-fa notation, it would help him, but in ignorance of this, I may say that the keynote chord—that is, the first, third, fifth, and eighth of the scale—is the most useful and important chord. It can be used in any position or inversion, but not at the first and last chord; there, inversions are not to be used. Next in importance is the similar chord founded on the fifth as a root, and harmonising the fifth, seventh, and second of the scale. This chord may also be used in an incomplete form, inverted or rearranged as to the upper intervals. Of still less importance is the similar chord founded on the fourth, supplying harmonies for the fourth, sixth, and eighth. This chord may also be inverted or the upper intervals transposed. Thirds are to be used freely: every chord should have one in its composition, but not always between the same two parts, or minor effects would be produced where least desired. A succession of perfect fifths is not tolerated; even two in succession are objectionable, and fifths without thirds are not pleasant. Octaves are pleasant, but not a continuation of them between the same parts. It is, however, allowable to play a bass part with octaves added below, and a treble part with octaves added above. Here also we need to know the compass of R. B.'s organette. In addition to these three chords, which are subject to many changes of position, giving variety, there are many more artificial chords, sounds for which are not probably provided on R. B.'s instrument.—B. A. B.

**Bar Magnets.**—W. H. O. P. (*Hackney*).—In London! and yet you cannot get a pair of round bar magnets. Why, I wonder at you! Take a walk down the Strand some Saturday afternoon and look in the opticians' windows, and if you do not get a pair, I'll eat my hat. But if you cannot get them round, you will certainly get them flat. Take the nearest you can get to the size you want and make the holes in the case to fit them. Flat magnets will do just as well as round ones for your purpose. It is not necessary when buying these to state the purpose you have in view. Ask for round bar magnets at any electrician's or optician's, and I am sure you will get them.—W. D.

**Blocking, Burnishing, Relief, etc.**—JOINT.—(1) A good dry powder for blocking Dutch metal on cards, etc., may be had from Messrs. Berry and Roberts, St. Bride's Street, London, E.C. You might try powdered resin or gum sandarach. Tie in a small muslin bag, and dust over the card. Lift the metal in the stamp, as you cannot "lay on" on the top of the powder. (2) Very likely the want of experience is the cause of your colours looking smeary and spreading, if, as you say, you use the best colours and varnish. But what are they? Use dry colours and white crystal varnish, and grind them well on the slab. Put it on the die with a hard brush, and wipe on hard paper. Do not use turps. (3) I gather that you do want experience. The gold burnishing is done in the way you have been trying to do it. But what in the world do you put the piece of thin copper upon your die for? Allow your work to become thoroughly dry, and re-stamp again and again. (4) Do not be afraid of wearying me. There are different methods of doing relief stamping in two or more colours. One of them is by getting two or more dies, which, put together, make one complete—that is, supposing you want to have J B interlaced, each having a different colour, you get one die with J on it, and one with B on it. You put in B first, and stamp the paper with it, gilding it if you like; then you put in J, with a different colour, and stamp upon the top of B. Of course, the dies are cut specially for this class of work; and when finished, it looks as if it had been struck with one impression. Another method is by painting in the different parts of the monogram on the die, and wiping and stamping in the usual manner. (5) See question 2 for answer to this.—G. C.

**Water-Tube Boiler.**—GENERATOR.—The tube you propose is very old, and its use has been several times patented in different forms, notably in "Field's" boiler. It would not answer as you have shown it, as there is no provision for circulation. I do not know that the matter to which you refer is patented; that can only be ascertained by a search at the Patent Office, or one of the Public Libraries where the Patent Specifications are kept. —F. C.

**Glue, etc.**—B. W. (*Walthamstow*).—You should have no difficulty in applying the glue to the dovetails in the ordinary way with a brush. The smaller the work the smaller the brush, and, possibly, the greater the quantity of glue comparatively which may have to be cleared off afterwards. Your second question has revived my expectations of some day getting an inquiry about the correct amount of moisture necessary to stick a postage-stamp on an envelope, together with a request for a full description of the process, or some undertaking of similar difficulty. Run the saw at the speed you find most convenient. If you have steam, the speed will be different from what it will be if you only use foot power and a light machine. The quicker you run the saw the more work you will be able to accomplish in a given time.—D. A.

**Sheet Brass.**—TIMBRE.—You can get sheet brass of any length, breadth, and thickness you require at Messrs. Warner & Sons, Crescent Foundry, Cripplegate, London, and of Pontifex and Wood, Shoe Lane, London, E.C., and in Birmingham of Messrs. W. Tonks & Co., Limited. I expect the reason you have to pay high is for special sizes of sheets not usually kept in stock. With regard to your second query, you do not say whether the sheet brass to which you refer is "finished" or rough. If it is ordinary sheet brass as it comes from the makers, of course, polishing pastes are of no use, as they will not remove scratches and dents; you must get up a good surface with emery cloth of different degrees of coarseness till you have a smooth surface. It should then be burnished and rubbed up with a leather, and as to the colour of it, that depends on the mixing of the metal; no process of cleaning or polishing will alter that. Articles of cast brass can be to some extent altered in colour by dipping in aquafortis or a mixture of aquafortis and other acids, but this I expect would not be applicable to the articles you make. In reply to your third question, there are several lacquers or enamels of the kind you require. One is called 'Zapon;' it is of American origin, and it can be procured from the Frederick Crane Chemical Company, Newhall Hill, Birmingham. It is stated to be far superior in lustre, transparency and tenacity to lacquer, and much easier of application, and to be proof against damp, salt air, fly speck, etc. There is also the patent Silico enamel, which the advertisement states is used for protecting bright, polished, or plated surfaces, without altering the appearance, to be invisible, washable, and durable; not sticky or greasy to the touch. To be had in 1s. bottles of the Patent Silico Enamel Company, 118, Crawford Street, London, W. Messrs. Townshend & Thompson, brass founders and art metal workers, Ernest Street, Birmingham, advertise their goods as sent out covered with a perfectly transparent enamel of greater permanency than ordinary lacquer. But, whether it is the same as Zapon, or whether they would supply it to you, I cannot say, but a letter would no doubt receive their attention.—R. A.

**Brass Casting.**—SHOPMATE.—Plaster of Paris is not suitable for ordinary brass casting—proper venting being impracticable. It is used in type-founding. To cast brass you must mould in sand, and the best way is to get a small quantity from a local founder. Several articles would be required to give sufficient information to enable you to do brass casting; these will be forthcoming when some other sets of papers are concluded.—J.

**Veneer.**—A. W. (*Manchester*).—The ebony knife-cut veneer you will get from W. Daniel, 77, Church Street, Shoreditch, E.C.—A. J. H.

**Developing Prints.**—PHOTOGRAPH.—First prepare three solutions—one of neutral oxalate of potash, one pound, to three pints of hot water, slightly acidified with sulphuric acid: call this A. Another. Protosulphate of iron, one pound, to a quart of hot water, and add half a drachm of sulphuric acid: call this B. Another. Bromide of potassium, one ounce; water, two pints: call this C. These solutions keep well separately, and must be mixed just before use. To develop: In a suitable tray, place six ounces of solution A, one ounce of solution B, and half a drachm of solution C. Mix in order given, and use cold. After exposure, soak the paper in water till limp; then immerse in the developer, avoiding bubbles. The image should appear slowly, and should develop up strong, clear, and brilliant. When the shadows are sufficiently black, pour off the developer, and flood the print with water to which acetic acid has been added in the proportion of half a drachm to the pint; pour this off and repeat two or three times, using fresh acid water each time; then rinse well in pure water, and immerse for ten minutes in a fixing bath, made of three ounces of hyposulphate of soda to a pint of water. Wash for an hour or two in several changes of pure water, and dry. With regard to exposure, very much depends on the density of the negative and light. An average negative, held about 18 in. from a No. 4 Bray gas-burner shielded with ground glass, would probably require about ten or fifteen seconds' exposure. The exact time must be obtained by experiment. Some negatives are done in two or three seconds, some requiring as many minutes. As a rule, a thin negative gives the best result with bromide paper; very dense negatives are quite unsuitable.—D.

**Cycle Construction.**—A METAL WORKER.—This correspondent would like to see in WORK papers on Cycle construction, particularly the "Safety." Let him refer to WORK, No. 107, where there is a full description of how to make a "Safety" bicycle. As to cycle repairing, I shall continue to tell any inquirers all I can to help them on in putting to rights their own machines.—A. S. P.

**Simplex Dynamo.**—T. H. (*Farringdon Road, E.C.*).—The dimensions of the No. 1 Simplex dynamo solid armature, described on page 758, Vol. II. of WORK, are given on the same page in the "List of Dynamo Electric Machines—Simplex Type." It is 3½ in. in diameter by 2 in. in depth. —G. E. B.

**Gold Transfers.**—A NEW READER OF "WORK." —This correspondent will get the transfers from Iliff and Son, publishers of the *Cyclist* and *Photography*, 12, Smithford Street, Coventry.—A. S. P.

**Industrial Exhibitions.**—REX.—You cannot do better than watch the advertisements in the daily papers. All exhibitions are well advertised beforehand. There is one coming on at Glasgow.

**Glass Embossing.**—G. N. (*Stratford, E.*).—You wish to know if there is anything you can add to fluoric acid to give a ground appearance to etched glass, and you do not want to use the gas process. There is nothing I know of that you can add to the acid to give the effect you desire. The gas would do so, but as you do not want to use that, the only thing you can do is to grind it afterwards with powdered emery. If you wish for a very fine grain, get the finest flour emery, put it in water, let it

settle, then pour off the water gently, and use the top strata, which will be finer than the bottom, the coarsest grains settling first.—W. E. D.

**Camera Lens.**—F. H. (*London, S.E.*).—The lens is probably an old quarter-plate combination, but it is impossible to give any definite opinion without a careful examination. As to the size of camera suitable—probably a quarter-plate camera; but it is easily ascertained if the lens is fixed in one end of a box and a piece of ground glass with lines ruled upon it, representing the different sizes of pictures, is held so that the image from the lens falls accurately upon it. When the image is seen sharply defined, note must be made of the space covered. —D.

**Slide Rest.**—AXLE.—If AXLE wants a thorough good compound slide rest for a 5 in. centre lathe, he had better write to Mr. William Gladstone, Stafford, where he can get a set of castings for 8s. 9d.; or if he still desires to make his own patterns, he can procure a tracing half size for five penny stamps. —T. R. B.

**Taking Out a Patent.**—R. W. S. (*Leeds*).—The claims as sent would not be allowed, as they contain what would be held to be only coverable by a trade mark. If a provisional specification is to be put in, it requires to be very carefully considered and prepared both as to the title and the description, supposing it is intended to obtain a valid patent, and one that the law will support. If a provisional is lodged as the first step, drawings should not be included. In the complete specification, all that is recorded in the provisional and covered by the title may be enlarged upon, but no new part not covered by or included in either can be introduced without vitiating the patent. All must be strictly confined to what has been foreshadowed in the provisional. The article in WORK which R. W. S. should read and study is that contained in No. 44, Vol. I., page 694, and no protection in any colony or foreign country can be applied for or obtained in Great Britain. Each colony and foreign country has its own laws, rules, and regulations, independent of all or any in force here. The cost of a patent entirely depends on the amount of work in the shape of skill, knowledge, time, and ability required and called into action in preparing the documents, and doing all that is needed in a proper and efficient manner. A patentee must get his documents recorded in the Patent Offices of each country which has joined the convention before the expiry of seven months from the date of his application in Great Britain, if he intends to patent abroad. If an invention is patented only in Great Britain, any colony or foreign country may—*i.e.*, persons residing in it—manufacture and sell the same if the inventor has not protected his rights within the time specified. A valid patent can be obtained in America after the application for a provisional has been made here, provided the patentee protects his rights there within the time required by the convention, and sell the same when obtained. Of course it is to be assumed that R. W. S. has carefully ascertained whether his invention is novel, useful, and not in use or described before; otherwise he would only waste his time and money applying for and obtaining what would be of no good when patented, as the British Patent Office makes no investigation as to these points, but grants the patent entirely on the declaration of the applicant that he is the "true and first inventor," and that the invention is "not in use, to the best of his knowledge and belief." It is of the first importance for R. W. S. or any other intending patentee to be certain on this point, in order to prevent waste of money, time, and trouble, and experiencing the disappointment which inevitably attends on neglect of proper and needed precautions. Above all things, R. W. S. should avoid attempting to obtain a valid patent by his own unaided exertions. To do work of this kind as it ought to be done requires nearly a lifetime of practice and experience and extended practical knowledge and skill, which rarely, if ever, falls to the lot of inventors and would-be patentees to have acquired.—C. E.

**Carvings.**—J. C. (*Belper*).—If you want carving patterns for the decoration of ordinary household furniture, you will only be able to get them from some friendly carver who may be willing to exchange with you or sell you some, as there is no regular supply of them, nor, so far as I am aware, are any published for sale. If you only want small carving patterns for fancy articles, you will be able to obtain them from Harger Bros. or from Zilles. Those published by the former would probably suit you best.—D. A.

**Wheel.**—J. B. (*Tyldesley*).—You can make a lead wheel by casting from a pattern; you can make a wooden wheel, and glue and peg leather around it for buffing; and you can get an emery wheel from a score of firms—say, Sterne, of Glasgow; Lloyd, of Steelhouse Lane, Birmingham; or of any tool merchant.—J.

**Wheels.**—J. F. (*Leeds*).—You can always tell which is driver and which is driven, by bearing these two fundamental rules in mind:—(1) In a *simple train*, the pitch of the guide screw bears the same ratio to that of the screw to be cut as the number of teeth in the driving wheel bears to the number of teeth in the driven wheel. (2) In a *compound train*, the pitch of the guide screw bears the same ratio to that of the screw to be cut as the *product* of the number of teeth of the driving wheels bears to the *product* of the number of teeth in the driven wheels. It does not matter which of the driving wheels goes on the lathe mandrel. Certainly the driving wheels do not gear into one another. A driver gears into a driven, and in a compound train the second driver is on the same stud as the first driven. For taper turning, you swivel over the top slide of the compound rest.—J.

**Machine Design.**—T. W. (*Manchester*).—The best is Professor Unwin's "Elements of Machine Design," published by Longmans.—J.

**Steel.**—J. S. B. (*No Address*).—The best place that I know of for getting tool steel at reasonable prices is at Messrs. Pfiel, Clerkenwell.—J.

**Model Yacht.**—A. A. B. (*Brighton*).—I must point out that E. O. N. asked for directions for making a model yacht, whereas you ask for a design for same. I would explain that Fig. 1 herewith answers your wants. R is the rudder, which is exaggerated somewhat; M is the mainsail; F, the foresail; J, the jib; and T, the gaff topsail. In a breeze, a jib-headed topsail (shaped like the jib with no yard attached) is hoisted in lieu of T. The best plan as to sails is to get the boat built, sparred, and rigged, then hoisting the gaff into position: the sails are readily cut out in newspaper as patterns. Do not stretch the sails along their respective spars, but allow them to stretch with the wind, and pull out the slack from time to time afterwards, as required; and if the main and gaff topsails show any tendency to "belly," the upper sides may be hollowed slightly to flatten them. The jib should have a cord run along its foreside (like a piping cord), so as to take the strain in hoisting; and the jib must be hoisted tight. Your want No. 2 is sufficiently met in Figs. 2 and 4, at page 652 of No. 92, the overhang of counter being lengthened or reduced, according as the club rule under which the boat is raced enforces water-line or overall measurement; and as to your want No. 3, you will find the sections given at Fig. 2 herewith will, if followed, turn out a very presentable craft. *x x* give the midship section; 1 and 2 are placed about equidistant between *x* and the stem; 6 is under the counter; while 5 is just at the foreside of the stern-post; and 3 and 4 are placed about equidistant between *x* and 6. Finally, you will scarcely find two model yacht sailors agree as to the best form of hull, and to become a successful hand one must not be afraid of experimenting; and indeed, herein lies the chief pleasure of the pastime.—W. H. M.

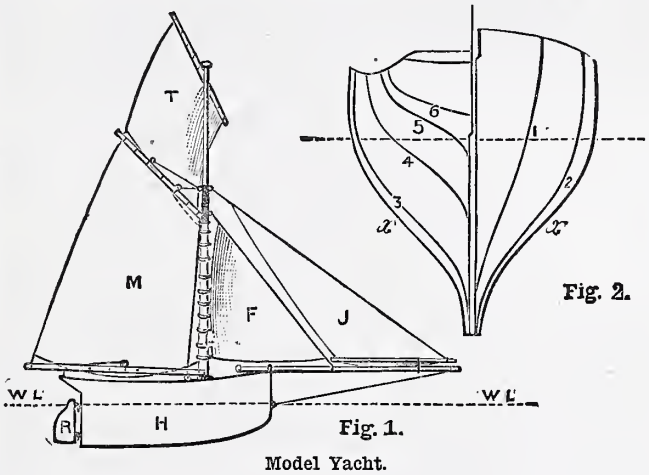



Fig. 1.

Model Yacht.

Fig. 2.

**Soap Making.**—D. W. (*Liverpool*).—An article on the above subject appeared in WORK, No. 103. It contains all the information you ask for.

**Bent Iron Work.**—IRONSIDES.—There is no particular instruction requisite, only to learn the art of bending graceful curves with the pliers, and holding them securely to one another with clips. It is a pretty branch of amateur work, requiring only a pair of tinmen's snips, and two or three pairs of round and flat-nosed pliers. The wire is cut from sheet iron of thin gauge. A very little practice will enable you to turn out neat work.—J.

**Unpickable Lock.**—APPRENTICE.—Try Chubb and Co., or any well-known lock-maker in London, for an unpickable lock.

**Books on Dynamo Construction.**—APPRENTICE.—"The Dynamo: How Made and Used," by S. R. Bottone, Wallington, Surrey, post free from the author for 2s. 6d.; "How to Make a Dynamo," by A. Crofts, Dover, Kent, price 2s., post free from the author; "Practical Dynamo Building for Amateurs," by F. Walker, price 2s. 1½d., post free from Iliffe & Co., 3, St. Bride Street, London, E.C.; "The Dynamo," by W. B. Esson, price 7s. 6d., Whittaker & Co, Paternoster Square, London; "Dynamo Electric Machinery," by Prof. Thompson, price 16s., Spon & Co.—G. E. B.

**Book on Electrical Engineering.**—APPRENTICE.—There cannot be said to be any *best* book on electrical engineering. The nearest approach to such a book is "Electricity in the Service of Man," published by the proprietors of WORK. "Electricity in Theory and in Practice, or the Elements of Electrical Engineering," by Lieut. Bradley, price 10s. 6d., published by E. & F. Spon, London, is also a useful book on the subject.—G. E. B.

**Electric Night Light.**—APPRENTICE.—Gassner dry cells are suitable for lighting up a 3 c.p. lamp at short intervals of not more than five minutes at a time occasionally during the night, but will soon run down if frequently used on intervals of fifteen minutes. An 8-volt lamp will require a battery of at least six large Gassner cells; these will cost 4s. 6d. each, and furnish current (for this purpose) for fifty hours; then they can be re-charged with current from a dynamo, and their power thus restored. —G. E. B.

**Model Gülcher Dynamo.**—APPRENTICE.—I should not advise you to attempt making a model of this type. The tracing you send is an excellent one, and the extracted data most suitable to accompany such a picture, but you would require working drawings of a reduced design to enable you to make patterns for the eastings, etc., and these I cannot make for you. Far better choose a Manchester or a Simplex as a model, and work to the instructions given in my papers on "Model Electric Lights," page 758, Vol. II. of WORK. A 360 Watt machine, giving a current of 60 volts pressure, would yield a current volume of 6 ampères, which would be sufficient to furnish 100 c.p. in electric light, and absorb a little over ½ h.p. The 5 ampère switch would therefore not have sufficient carrying capacity.—G. E. B.

**Barometer Tube.**—COCKER.—Gauge-glass tubes will crack in a similar manner after being polished inside with a wash-leather mop. The cause is probably due to an electrical condition of the glass, due to the friction of the leather pad. Use a brass wire instead of iron wire, and put a clip of brass wire in the end of the tube after cleaning it. Perhaps some reader of WORK will kindly suggest some other remedy. Do not make a hole in the wash-leather bottom of the cistern. If you do this to admit air, it will be ruined, as the mercury will come out through the hole. The atmosphere presses on the wash-leather, or "kid leather," and this presses on the mercury. As the barometer tube fits tightly into the wooden box, this is air-tight, and its upper part is a vacuum, when the tube with its column of mercury is fixed in position.—G. E. B.

**Electric Bell Wires.**—COCKER.—No. 32 B.W.G. copper wire is much too fine for use in the construction of electric bell coils. The smallest useful size is No. 24. Are you sure of the size sold you by the dealer? He must have been either a fool or worse. I do not say that this size cannot be used in constructing a bell, but it must be a very small one, and would need several battery cells to ring it. The wire is quite useless for the coils of a 5 in. bell. This size should have magnet cores 3¼ in. by ⅝ in., fitted with bobbins 3 in. by 1¾ in., and wound with No. 18 silk or cotton-covered copper wire. Use at least three cells of the largest Leclanché size as a battery.—G. E. B.

**Gold and Silver Solutions.**—G. V. (*Esclairmonde*).—To detect the presence of gold in a solution of cyanide of potassium, place in it a strip of clean bright zinc, freshly scoured. In a short time some of the gold will be precipitated on the zinc, and may be known by its colour. To detect the presence of silver in a solution of cyanide of potassium, place in it a strip of bright copper, freshly scoured. In a short time some of the silver will be precipitated on the copper, and may be distinguished by its well-known whiteness. To recover gold from its solution in cyanide of potassium, heat the solution, and drive off the water as steam until a pasty mass only remains. Dry this, and fuse it at a bright red heat in a fire-clay crucible. When the brown residue has cooled, digest it in nitric acid, and wash the brown powder on a filter with water. Dry this, and fuse to a button in a fire-clay crucible, using dried borax as a flux.—G. E. B.

**Polishing.**—W. D. H. (*Edinburgh*).—The cabinet to which you refer has probably been finished by what is known as ebonising, and your friend is, no doubt, quite correct in assuring you that it is not made of real ebony, which is very seldom used by cabinet-makers—so rarely indeed that it may practically be considered as non-existent. Any kind of wood can be ebonised, but those most commonly treated in this way are Honduras mahogany (haywood), American walnut, American white-wood, beech, and birch. None answers better than the first named. If the wood is sound, it does not matter if it is of bad colour or stainy. To ebonise, all you have to do is to stain the wood black, polish in the usual way, and then dull by dusting down with fine emery powder. The stain had better be bought ready-made. Darken the filling with black. A better colour can be got by using black polish than the ordinary kind. It is only necessary to put a little gas-black into the polish. Apply the emery powder with a brush or a soft cloth, and let the

motion be in one direction—with the grain—only. The powder soon removes the bright gloss from the surface of the polish. The bright parts are got by simply not rubbing them down. The composition for picture frames can be got from any gilder or picture-frame maker.—D. D.

**Hodge's Mitre Shoot.**—W. N. (*Winsford*).—Any large tool dealer—such as Melhuish, Fetter Lane, London; or Moseley, High Holborn, London—could supply you with one of these tools.

**Tricycle House.**—A. N. G. (*Bristol*).—A paper upon this subject appeared in WORK, No. 64.

**Transferring or Copying Printed Matter.**—G. M. (*Liverpool*).—There is a process which has been used for transferring the printed picture to white wood for ornamental purposes. The wood is varnished, and when so far dried as to be only very slightly sticky, the engraving is well pressed or rubbed upon it. The varnish is too dry to adhere tightly to the clean paper, but it adheres closely to the printing ink, which is, of course, of the nature of oil paint. The paper can be moistened and removed, but an impression of the engraving will remain on the varnished wood. However, if a part of the ink is taken away, the blackness and solidity of the original painting must suffer. Would not some photographic process be really better? When the printed matter is on one side of the paper only, I presume that a copy might be transmitted to sensitised paper without the aid of a camera; or, with a camera, producing a good copy under any circumstances would be easy.—S. W.

**Couch Scroll.**—KILDONA.—To make measurements of couch scroll clearer, perhaps the artist intends it to mean 2 ft. 8 in. from the floor to top of the scroll, which would be about right. The drawings are freehand. That from the top edge of box to top of scroll is about 20 in.: measured perpendicular, 16½ in. Nearly every couch made has a different pitch of scroll.

**Picks.**—JAMES.—I obtained my lock picks—which I find answer all ordinary purposes—from Messrs. Harding & Sons, Long Lane, London.—T. W.

**Chime Clocks.**—J. S. (*Edinburgh*).—The prices of chime clocks vary considerably, but the price of any ordinary chime bracket would be, in case complete, from £30 retail up to, say, £100, according to style of case, etc. I hardly know where the best place would be to get the movements only, but I should think Smith & Co., Clerkenwell; Thwaites and Reed, Clerkenwell; Evans, Birmingham; or Potts, Leeds, would supply them.—A. B. C.

**Irregular Watch.**—NOVOCASTREN.—I am doubtful if I can assist you much without seeing and examining your watch, but I am rather inclined to think that it may have become magnetised. Have you been in or near any place where a dynamo is, or anything else electrical? If not, have you at any time given the watch a blow or let it fall, and so cracked either jewel-hole or end-stone of the staff, or flattened the end of staff pivots? If neither of these has happened to it, then has the mainspring been broken or changed?—A. B. C.

**Clock Tools.**—A. B. X. (*Guildford*).—I do not think you can better either of these two—viz., Haswell & Sons, 49, Spencer Street, Clerkenwell; and Grimshaw & Co., 35, Goswell Road, Clerkenwell. From these I get nearly, if not quite, everything I require. For clock wheels, trains, and castings, I go to I. Mayes, 55, Red Lion Street, Clerkenwell. Also, I occasionally do a little (tools, materials, etc.) with Hunt & Son, 21, Ironmonger Street, St. Luke's.—A. B. C.

**Bicycle Wheel.**—SPRING.—Of course he must spring the fork wide enough to let one end free, when the other will pull out if the holes are not too tight-fitting on the shaft. The forks usually stand a considerable amount of spring outwards, and they have to be sprung in this way in order to get the wheel in.—A. S. P.

**Phonograph.**—F. W. B. (*Ardwick*).—The article on the Phonograph has not yet appeared. The promise given had nothing to do with Edison's latest instrument. Detailed instructions, with drawings, will be given, which will enable anyone possessing sufficient mechanical ability to make a phonograph. It would certainly be a "breach of patent," as you say, to make one of Edison's instruments for your own *use*. The cylinders are not on sale, neither are the instruments; they are let out at a very high rental.—W. D.

**Chronometer**—AUXILIARY asks me to give him a few hints regarding the construction of a chronometer detent for a bar movement. I do not clearly understand what is meant by "bar movement," but, in any case, I am afraid it is almost impossible on paper to say anything sufficiently lucid about the construction of a chronometer detent to be practically useful. A chronometer detent is the most delicate and exact piece of mechanism in the whole range of watch making, and it is difficult to learn how to make it even when side by side with a tutor. But to explain how to construct such a piece of work merely by describing the process in print is, I am afraid, almost out of the question. I take it for granted that AUXILIARY is acquainted with the shape and the purpose of a detent, and that he is anxious to make one himself. But I think he would be wise not to attempt to do so. It is the work of a chronometer maker, who is a specialist in this branch of the art, and it would be much more practical to send to a chronometer maker in case he requires a new detent applied to a watch. This, in fact, is what watchmakers of approved skill and experience usually do. It really requires a man who has all the appliances at hand and almost daily practice to construct a good detent. Of course, if AUXILIARY is a watchmaker, and in the course of his business has to handle job chronometers, he will frequently be face to face with little difficulties which, perhaps, he cannot overcome. If, therefore, he will specifically state any of these difficulties, I shall then be very pleased to supply him with any information concerning the case he presents for my consideration.—HERR SPRING.

**Rusty Milk Pan.**—A. D. (*New Cross*).—The defect in your pan of rust spots, causing holes in an almost new article, is unfortunately one that it is difficult, if not impossible, to account for; it is known in the trade as "pilling," or "rust spot." There was some considerable discussion on the subject in the *Ironmonger* some years ago, between makers and users of tin plates, as to the cause of this serious defect, but, as far as my memory serves me, there was nothing definite arrived at, except that the best brands of plates were as liable to it as the commoner ones. Milk is a non-corroding fluid, and as a rule, articles used in dairy work last a very long time, so that it cannot be from the action of the liquid. I should think myself that it is caused through there being rust spots on the iron before being tinned, and that a rusting action continues after the process of tinning, eating the iron away between the two coats of tin. I can detect a plate that will "pil"; the places are indicated by a few little marks like tiny pin-points. Select for your next bottom a perfectly smooth and brightly tinned plate, and have a good stout one; rejeet any that have little depressions in them, or the marks I have mentioned. Many ironmongers stock what are termed "perfect" or "prime" plates: these, being all selected singly, are certainly more likely to be free from defects than the others, which are termed "wasters," and with which the ordinary jobbing man repairs most articles brought to him. I do not see why you must have a new bottom every time you have a hole or two come; would not a tiny drop of solder over each hole meet your requirements, especially as your pan is only a counter pan, and gets no special wear or knocking about? As a final suggestion, try a thin *tinned* copper bottom: this will last a very long time indeed.—R. A.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Preserving Ice.**—J. R. (*Middlesbrough*) writes:—"How can I preserve about half a ton of ice gathered here from a pond? I want to keep it until July or August next. I have at my disposal a wine-cellar 20 by 12 ft."

**Knitting.**—H. B. S. (*Lockwood*) writes:—"Will anyone tell me if the fancy check stockings which are usually understood to be hand-knit can be made by machine, and if so, by what machine?"

**Leclanché Battery.**—C. F. W. N. (*Forest Gate*) writes:—"Will any reader kindly inform me where I may obtain a Leclanché battery or any other small battery to work an alarum bell, and what it will cost?"

**Fan Covering.**—PHONO writes:—"I am cutting a fretwork fan, and shall be glad to be informed as to where I can get it covered."

**Regulator.**—W. P. B. (*Colnbrook*) writes:—"Can any kind reader of WORK instruct me as to making regulator for egg incubator?"

## IV.—QUESTION ANSWERED BY A CORRESPONDENT.

**Newspaper Cart.**—ESSEM writes, in reply to L. M. N. (*Liverpool*) (see page 765, Vol. II.):—"I send you herewith three rough designs for such a light conveyance as you ask for."

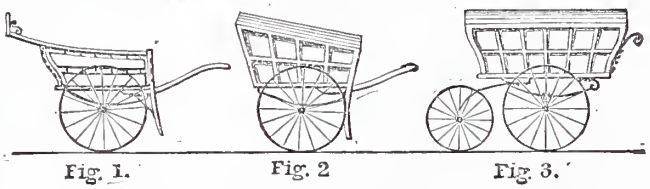


Fig. 1. Fig. 2 Fig. 3.

Newspaper Carts.

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. L. D. (*Rochester*); CHARLIE; S. T.; R. C. (*Sussex*); W. E. (*Liverpool*); V. S. (*Sheffield*); A. H. K. (*Birmingham*); J. R. N. (*London, N.*); CRANK; J. L.; J. B. C. (*Liverpool*); SCENERY; W. H. (*Hants*); AMATEUR; NOVICE; NEW ZEALAND; BELTING; T. J. (*Shemield*); PHŒNIX; W. W. J. (*Broughton*); X. Y. Z.; H. C. (*Whetstone*); A. S. W. (*London, N.W.*); J. B. (*Bury*); C. M. J. (*Perth*); I. S. (*Newcastle-on-Tyne*); BASSO PROFUNDO; R. B. (*King's Lynn*); J. W. (*Kendal*); G. P. (*Edinburgh*); A. F. M. (*Glasgow*); J. H. M. (*Beau Parc*); C. A. N. (*Wolverhampton*); SNOBBERY; A SNOB IN THE COUNTY OF DORSET; W. R. R. (*Carlisle*); J. W. B. (*Wakefield*); AMATEUR ELECTRICIAN; W. G. S. (*Manchester*); RED LINE; A. B. X. (*Guildford*); J. L. (*Holloway, N.*); R. C. (*Exeter*); R. A. F. (*Shepherd's Bush*); JOINER; H. K. D. (*South Shields*); W. C. S.; E. J. C. (*London, S.E.*); J. T. (*Nottingham*); G. M. (*Brixton, S.W.*); M. W. (*Manchester*); B. S. (*Acton, W.*); P. F. (*Manchester*).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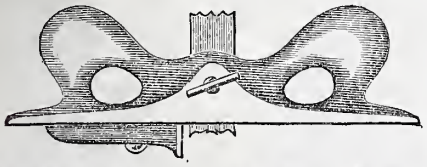

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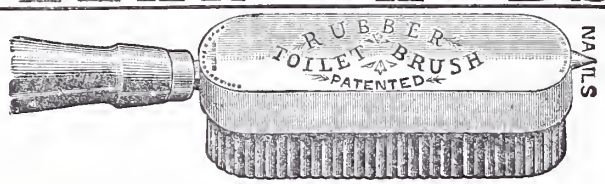


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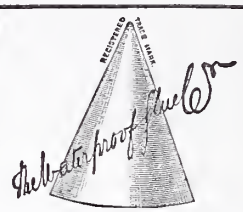


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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 110.] SATURDAY, APRIL 25, 1891. [PRICE ONE PENNY.

Figs. 1, 2, 3, 4.—Designs in Wood Carving for Frame of Butter-Dish.

Fig. 6.—Design for Centre of Panel, etc. Figs. 7, 8.—Designs for Corners of Panels.

DESIGNS FOR FRAME OF BUTTER-DISH AND OTHER ORNAMENTAL WORK IN WOOD CARVING.

## A BUTTER-DISH, AND OTHER DESIGNS FOR WOOD CARVING.

BY W. H. GRIMWOOD, INSTRUCTOR TO THE SCHOOL OF WOOD CARVING, SOUTH KENSINGTON.

DESIGNS FOR BUTTER-DISH, MEDALLION, AND SPANDRELS, WITH INSTRUCTIONS.

THERE are few arts that are more fascinating in themselves, more useful for decorative purposes, or better suited to the requirements, power, and resources of amateur wood workers of either sex than wood carving; and it is *par excellence* an art that women can take up, and in which they may attain considerable proficiency. I think I may assume without fear of contradiction that every amateur who takes up any manual art likes to have the work of his or her hands, as the case may be, on view as frequently and prominently as possible, and that to this end, designs that are applicable to the elaboration of household furniture, or the ornamentation of articles used on and for the table, are perhaps more acceptable than any other. With this view I have supplied, at the Editor's request, four designs for butter-dish frames, or wooden discs or platters, hollowed out in the centre to a sufficient extent to receive and hold a shallow glass dish for butter, to be obtained at most shops in which glass and earthenware are sold.

Of these designs, two are arranged on conventional lines, or, in other words, exhibit a natural object—in this case the buttercup and its foliage—conventionally treated; a third, a seventeenth century design, and the fourth a design in Italian style. In treating the butter-dish, the designs for which it must be understood are confined to the circle in which are placed Figs. 1, 2, 3, and 4, the design selected having to be carried in continuance of the portion given, right round the sloping edge of the dish, care must be taken, first, to turn, or get turned, a disc suitable for the purpose in view, in accordance with the section given in Fig. 5; and having obtained this, to ground to section given for carving very slightly at the sides and deepest in the centre, or the effect will not be so good. Lime or sycamore may be the material used for the dish, or, better still, holly or Italian walnut. Unlike bread platters, the frames do not require washing, which spoils the colour of the wood. The glass, being loose, can be removed whenever it is necessary to wash it, and a brushing with beeswax only is all that is required to keep the frame in order.

As the Editor has a deeply rooted objection to anything in the form of waste, whether of space in a page of the Magazine or otherwise, and strictly charged me to avoid any indiscretion of the kind, I have given in the space occupied by the glass in the butter frame a design which has no connection whatever with the butter-dish itself, and which is intended as a medallion for the centre of a box-lid, drawer front, panel, etc. This subject, which is shown in Fig. 6, should be grounded out to the depth of $\frac{1}{4}$ in., or carved in high relief. Amateurs must ever bear in mind that the higher the relief the greater will be their difficulty, unless they understand modelling. I may remark that all grounds may be stamped, punches in different patterns being supplied for this purpose.

The designs given in Figs. 7 and 8 are suitable for corners of panels, or may be utilised—as indeed may all the designs—for *repoussé* work. The whole as placed in the page can be used for a square panel, one design, as a matter of course, being used for the four corners, and one of the four designs given for the ring encircling the central medallion. Moreover, spandrels should be selected to suit the conventional or natural design selected for the ring surrounding the centre.

Further, the wood carver must understand that the same designs will apply, with necessary modifications, for borders, frieze, uprights, and mouldings, flat or on the round. If flat, the ground should be of the same depth all through. Lastly, they may be enlarged to suit the requirements of wood carvers to any size, due care being taken to preserve the proportion between the different parts of the designs. A little tasty knowledge of drawing and skill in adaptation is all that is necessary to secure their successful application to the purpose in view.

## ELECTRO-GILDING BROOCHES, CHAINS, RINGS, ETC.

BY GEORGE EDWINSON BONNEY.

IMPERFECT ELECTRO-GILDING—HOW TO CLEAN THE TRINKETS BEFORE GILDING THEM—DOCTORING SOLDERED JOINTS—HOW TO MAKE AN ALKALINE COPPERING SOLUTION — USE OF THE COPPERING SOLUTION — SCRATCH-BRUSHING AND FINISHING ELECTRO-GILT ARTICLES—POLISHING ELECTRO-GILT TRINKETS.

*Imperfect Electro-Gilding.*—We may take a brass ring from a man's finger, and, seeing that it is bright and clean, conclude it will not need cleaning before hanging it in the gilding bath. We therefore merely wipe the ring with a scrap of rag, tie a bit of copper wire to it, and hang it in the gilding bath. In a few moments it has received a coat of gold all over, and bears the appearance of a golden ring. We then rinse it in warm water to free it from the cyanide salts, wipe it dry with a rag, and hand it back to the wearer, gilded. This looks very well at first sight, and vast numbers of brass rings thus gilt are sold by cheap Jacks to gullible youths and maidens. Rub the ring a little with the palm of the hand. The very thin coat of gold can be thus rubbed off in a few moments, leaving the bare brass plainly visible. All trinkets may be thinly gilt in a similar manner, and the thin coat of gold can be as easily rubbed off. If the ring or any other similar article is left in the gold bath for a few minutes, it will take on a brown coat instead of one having a golden tint. This brown coat is merely the matt appearance assumed by electro-deposited gold, and this will entirely disappear on brushing the coat with a brush of fine brass wire kept lubricated with stale beer. But on brushing in this way an imperfectly cleaned ring as it comes from a person's finger, we may notice that the ring assumes a brassy appearance, because the gold went on loosely over the sweaty parts of the ring, and these loose particles of gold were readily detached from the imperfectly cleaned spots by the wire brush, because they did not adhere to the brass, but only to the film of dirt on the brass. This non-adherence of electro-deposited coats becomes more apparent with thick coats than with thin ones. To get a perfectly adherent coat of electro-deposited metal, we must thoroughly clean the surface on which we intend depositing the coat. Let the ring, or brooch, or pin, or coin appear to be ever so clean to the eye, it must have contracted a trace of animal grease, or sweat, if it has been handled or worn, and this film of animal matter must be taken off before we can deposit a coat of adherent metal on the article.

*Cleaning the Trinkets.*—All animal matter, such as grease, oil, and sweat, may be loosened from the surface of metal by boiling it in a solution of strong alkali, such as soda, potash, or ammonia. A strong solution of washing soda may be used if nothing better can be obtained. Pearlash is a better cleanser; American pearlash, or potash, is still stronger; and the best cleansers (in general use by professional platers) are commercial caustic soda and caustic potash. A piece of either of these, about the size of a walnut, dissolved in half a pint of hot water, will be enough to clean a dozen or two of small trinkets or chains. First dissolve the potash or soda in hot water, then string a few trinkets on about 6 in. of No. 20 or No. 22 copper wire, and swill the bunch for a few minutes in the hot liquor. Transfer from the hot caustic solution to some clean warm water, and well rinse the trinkets in this, to clear off the loosened grease. When the caustic liquid is cool, put it in a closely stoppered bottle to exclude the air, and thus preserve it for future use. After the grease has been loosened, if there is no corrosion on the article, it must be briskly brushed with a little whiting, or prepared chalk, or finely powdered pumice, again rinsed, then hung in the gilding solution to receive its coat of gold. If the trinkets are corroded, the corrosion must be removed in a pickle made of two parts sulphuric acid, two parts water, and one part nitric acid, after which the articles must be rinsed in clean water. Chains of a strong pattern may be rolled up in a mass between the two hands with a little whiting, and rubbed until polished; but those of more delicate construction may not be treated in this way, but must be carefully brushed. Filigree work will require very careful treatment in cleaning, and the gold should be deposited on it with low battery power, to prevent browning the deposit, since it cannot be well brushed bright afterwards. Long chains of a delicate pattern should be threaded on a long thin copper wire passed through the links at intervals of from 2 in. to 3 in., or the wire should be wound spirally around the chain, to assist in conducting the current to all parts equally. Ear-ring and brooch pendants made of metal beads strung on silk should be suspended in a small basket of platinum gauze, in order that the beads may be placed in connection with a conductor of electricity, since silk will not conduct the electric current. This class of goods should not be put in the caustic solution, as this will dissolve silk, and cause the beads to drop off. It is also important to note here that all trinkets containing hair, photos, and other material likely to be injured by the hot gilding solution, must not be put in the caustic solution until the hair, photo, etc., has been removed. It is also advisable to remove glass and stones liable to injury from this cause, and to re-set them when the work is finished. Trinkets made of aluminium only will not receive a coat of gold, but will dissolve in caustic solution and in the gilding solution. The brush used in brushing articles before gilding may be an old, but clean, tooth-brush, or any clean brush with stiff bristles.

Whilst finishing the articles, we shall note the condition of their surface. If this has been scratched, or dented, or bruised, or pitted with corrosion before it was taken in hand to be gilded, the marks of injury cannot be

obliterated by polishing and burnishing afterwards. All such blemishes must be removed before the articles are cleaned, if they are to be removed at all, and this can only be done by hand, either by pressing out the dents with suitable pieces of wood, or removing the scratches with a fine file and burnishing the filed spot. All repairs must be done first, as it will be difficult to repair electro-gilt goods when finished.

*Doctoring Soldered Joints.*—If there are any joints made with soft solder, these will be difficult to coat with gold. If they are small, they may be doctored up in the following manner :—Get a piece of blue-stone (sulphate of copper) about the size of a broad bean, wet it, and rub on the soldered joint for a minute or so, then touch the joint with a piece of bright iron or steel. Both the iron and the joint will take on a coat of copper and cover the solder. Rinse the joint in clean water, and hang the article in the gilding solution, when it will take a coat of gold.

If there are several soldered joints or much soft solder about the article to be gilded, or if it is desired to coat a pewter medal, lead cast, zinc ornament, piece of tinned iron, or article composed wholly or partly of iron, tin, lead, or zinc, it will be advisable to first coat it entirely with copper in an alkaline coppering solution, made up in the following manner :—

*Alkaline Coppering Solution.*—Dissolve one ounce of copper sulphate (blue-stone) in one pint of hot rain-water. Add strong liquid ammonia to this, in small quantities at a time, and stir well between each addition of ammonia until the green precipitate first formed by the ammonia has all dissolved, and the liquid assumes a beautiful blue tint. Then add cyanide of potassium dissolved in water until the blue tint disappears, and the liquid has the appearance of old ale. It should now be heated to boiling point; then set aside to cool in the open air, and not be used until the next day. At least three cells of a battery will be needed to deposit copper from this solution, and perhaps four cells, arranged in series, may be required to force the copper on a soldered joint; but the copper thus deposited will be firm and adherent, and may be polished. This is not the case with thin coats of copper deposited from acid solutions of copper. Use a piece of good copper, such as electro-type copper, as an anode in the coppering solution. If a crust of green salt forms on this whilst working, add a little liquid ammonia to the solution; but if a blue crust forms on the anode, add a little cyanide of potassium to the solution. A mere film of copper will be all that will be required on the article to protect it from the action of the gilding solution. If the film does not go on evenly in a few minutes, take the article out of the bath, and briskly brush it with a brush made of brass wire, then return it to the coppering solution. This solution may be worked cold or hot, as may be desired; but the deposit is brighter from a hot solution than from a cold one. It is not only used in coppering articles to be gilded, but also to coat iron, tin, zinc, lead, pewter, and similar metals, before they are silver-plated, since silver will not adhere to those metals. It is also useful to give an 18-carat gold appearance to gilded or pure gold goods. This is done by merely flashing a film of copper over the surface when finished, then flashing a film of gold on this, rinsing at once in hot water, and drying off in clean sawdust. By careful working in this way, a clever workman can get any desired tint of gold on the surface.

*Finishing Electro-Gilt Articles.* — On taking strongly gilt articles out of the electro-gilding solution, they will be found to be coated with a brown powder. This powder is finely divided gold in a crystalline condition, the mass of crystals absorbing, instead of reflecting, the light. To remove this brown appearance, the articles are briskly brushed with a brush made of fine brass wire speeially drawn for the purpose, and named scratch-brush wire. Scratch-

Fig. 4.—Scratch-Knot made of Scratch-Brush Wire.

brushes are made up in various forms, to suit the kind of work to be brushed by them; but the usual form of the ordinary scratch-brush is that of a small boxwood cylinder with bunches of wire sticking out on all sides. This is mounted on the spindle of a lathe, and revolved at a high rate of speed, whilst the work to be scratch-brushed is held to the brush by the workman. The ends of the brass wires wear down the points of the gold crystals, and render the whole surface smooth. To prevent the brass from wearing off in the shape of dust and cutting the gold coat, the brush is kept lubricated with stale beer, and is covered with a hood, to prevent the lubricant from being splashed over other things in the workshop. When a plater has not a suitable lathe. the scratch-brushes are made like narrow plate-brushes or a tooth-brush with a wooden back, and are manipulated by hand. Amateur platers and gilders with small means are content to use scratch-knots made by themselves out of bunches of scratch-brush wire, as shown at Fig. 4. The wire is sold in knots: *i.e.*, small hanks, in three grades—heavy, medium, and fine—at prices ruled by the market price of brass wire. The fine wire is most suitable for gold work. Get a knot of fine scratch-brush wire and a few yards of No. 20 soft copper wire. Fasten one end of the copper wire to a nail or hook driven in a wood post, lay the hank of brass wire on the other end of the copper wire, and wind this tightly around the hank until all the middle of the hank has been covered with the close coils of copper wire, then tuck in the free end, and fasten it off. Next cut off the loops at each end with a pair of sharp shears or with a sharp chisel, whilst resting the loop on a block of wood, and thus form two brushes, one at each end. First rub the freshly-cut ends on a rough stone, to dull the points of the wire before using the brush on an electro-gilt surface. When the ends are too much burred by use, cut them off with a sharp chisel, and unwind the binding wire a few coils at a time, as needed, when the brushes wear short. With even such scratch-brushes as these, some good work can be done by hand, but it can be done more expeditiously with a revolving scratch-brush. Rest the work on a sloping piece of board over a vessel placed so as to catch the drips of stale beer, and work the brush from left to right, away from the workman, going over all the surface until all the brown appearance has been removed. Do not leave any of this in the crevices.

Lastly, rinse the work in warm water, and dry it in hot boxwood sawdust. Then polish with dry rouge on a plate brush, or burnish with highly polished steel burnisher, or one of highly polished bloodstone, using newly made soapsuds as a lubricant.

## THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

SPECIAL TOOLS — PURFLING GAUGE — KNIFE — ROUTER—IRON CRAMPS—PLANES—APPLIANCE FOR BENDING RIBS—THICKNESSING GAUGE—STEEL SCRAPERS — HAND SCREWS — SPRING DIVIDERS, ETC.—CARVER'S SCREW—FILES AND GOUGES—JOINTING — TRUEING UP—MARKING BACK AND BELLY FOR RIBS—BENDING RIB STRIPS—GLUING RIBS—PLANING DOWN RIBS —MARKING BACK AND BELLY FROM RIBS—SAWING OUT BACK AND BELLY.

**Special Tools.**—In addition to the ordinary tools which are found in any joiner's shop (both professional and amateur), such as smooth plane, trying plane, saws, chisels, and the like, there are some special tools which would not be found there, and of which I will give a short description; but from the illustrations my readers may gather, perhaps better than from any description I might give, the manner in which some of these things are "fixed up."

*Purfling Gauge.*—The purfling gauge or cutter (A, Fig. 5) is a steel shell 4½ in. long by ¾ in. broad and ⅜ in. thick, with a projecting end half an inch long and $\frac{3}{16}$ in. in diameter; carrying a brass roller, which brings the thickness to ⅜ in. Half an inch from the bottom of the shell are two thumb-screws, one in each side; these are for adjusting and fixing the steel blades or cutters which run longitudinally through the instrument. I have ground the cutters in my gauge to "spear" points, and they answer very well.

*Knife.*—B is a knife such as is sold by stationers for erasing, but is ground to a long keen point. Two or three of these should be at hand; they are used for deepening the groove in which to lay the purfling, for trimming the sound holes, and many minor purposes, and should be kept as sharp as the proverbial razor.

*Router.*—The router (C) is a small bent chisel with which the piece marked by the purfling tool is taken out.

*Iron Cramps.*—Two forms of iron cramps are shown in D and E; six of the smaller are required for fixing the ribs on the model. F is a cramp which is sold by the dealers for fixing the back and belly to the ribs. G is one of my own design and make, and is, I consider, a great deal better than F. It is lined with cork on both the inner sides, and cannot possibly injure the most delicate instrument. The small cramp (P) is used for fixing linings in the waists; the other linings need no cramps.

*Planes.*—I is a small oval iron plane, with toothed blade, slightly round both in length and width. J is a similar plane, but with flat bottom. This is the most useful little tool for a number of purposes.

*Appliances for Bending Ribs.*—The apparatus for bending ribs (K) is of totally different construction to the one generally used; it is a piece of ¾ in. iron pipe, cut open all the length, and is heated by gas, as the illustration shows. The tube is fixed in an iron vice, and the gas heater is suspended from it by wires passing round each end of the tube.

*Thicknessing Gauge.* — The thicknessing gauge, or automatic measurer, is one of the most important tools in a fiddle-maker's "kit"; the one here given (L) is my own make, but was, like the bending apparatus, invented by my esteemed tutor, Mr. Wm. Tarr, of Manchester, now in his eighty-third year, and who is, I understand, the oldest living English violin maker, three of his 206 double basses having been made in 1829.

This gauge is extremely simple in its action, gives the most accurate measurements, and is not likely to get out of order. The small point of the gauge being held lightly underneath the back or belly, the thickness of which you desire to know, the ivory rule, the point of which traverses the surface, shows it at a glance in thirty-seconds of an inch.

*Steel Scrapers.*—M and N are steel scrapers, having one flat edge and three different round ones. The edges should be ground square across, the scraper placed edgeways in a vice, and sharpened by drawing the polished back of a gouge, or a proper "scraper sharpener," along the edges, at an angle of about 60°. A scraper sharpener is a piece of ½ in. round polished steel, and is fixed in an ordinary tool handle. When the scrapers become dull, draw the sharpener flat along the sides; this turns the "burr" to the edge again, then sharpen them in the vice as at first.

*Hand Screws.*—Hand screws (O) are often wanted; two or three sizes should always be in the work-room.

*Spring Dividers, etc.*—At Q is shown a pair of spring dividers, which are used for measuring distances very finely. The spring callipers (R) will be very useful, especially when finishing the neck. A pair of strong steel compasses (S) must be obtained. Never use the dividers for any purpose for which the compasses are intended.

*Carver's Screw.*—The point of the carver's screw (T) is to be firmly screwed into a carving block, and the stem passed through a hole in the bench, underneath which the wing nut is screwed on the stem. The carving block may be turned in any position, and, by tightening the nut, instantly made fast again.

*Small Square.*—A small square (U) is an absolute necessity, being in frequent requisition for such purposes as squaring the rib ends, testing the truth of blocks, etc.

*Fine-Toothed Plane.*—A fine-toothed plane, such as cabinet makers use for veneering, is frequently required, more especially if you use sycamore, which is strong in "figure."

*Files and Gouges.*—Several half-round files, different sizes, and of varying degrees of fineness, will be necessary, as also the "omnipotent" *gouges*, without which we cannot possibly get along. The "sweeps," or curves, given in Fig. 5 will be sufficient for our requirements, but a fiddle maker, it may be said, cannot have too many kinds of gouges.

*Oilstones.*—The oilstones for sharpening the gouges, both inside and outside, will, of course, be essential, as well as a good oblong oilstone set in case for sharpening plane knives and chisels.

*Shell Bits, Cutting Gauge, etc.*—Some violin makers use, for cutting the circular extremities of the sound holes, steel cylindrical shell bits, with diameters of ¼ in. and $\frac{5}{16}$ in. respectively. These holes may also be bored by the same sizes of centre-bits, but great care must be taken not to use too much pressure, as the sound holes lose much of their beauty if the sharp corners be broken off. A cutting gauge, for reducing the edges of back and belly to their proper thickness, and a slightly tapered shell-bit for boring the peg holes in the handle, will also be wanted.

**Jointing.**—We have now all the wood, models, and tools ready, and can commence our work by jointing the back and the belly, the pieces for which should be cut through as at B, Fig. 1 (page 4, Vol. III.); the insides of each piece should be planed quite true—*always plane the back across the grain*, otherwise you will jerk pieces out of it; then placing the true side downwards on the shooting board, with the trying plane make along the thick edge a perfectly square joint. This, to an unpractised hand, will be a matter of great difficulty, and an amateur would be well advised to get this process done by a cabinet maker who is accustomed to making fine joints. There is so little wood to spare, that if you should be so unfortunate as to make a bad joint you may not have room to remedy the defect. When both pieces are planed so true that you cannot see between them when placed together and held up to the light, hold both edges before the fire till quite warm, then fasten one piece in the bench vice with the planed side towards you; place the other piece with the true edge touching it, and very quickly go over both edges with fresh glue, very hot; now put the loose piece in position, and rub it slowly backwards and forwards, pressing firmly the while. When you have rubbed out as much glue as possible, which will be known by the amount of suction that ensues, and the pieces are quite even, sponge the joint both sides with hot water and remove the jointed piece from the vice; put it aside to set, and proceed to joint the other pieces. Whilst the back and belly are laid away to harden, take the inside model, and into each of the six recesses glue a piece of the 1 in. pine, width to suit, and rather longer than the depth of model; use only a small quantity of glue for the back of each block, as they will have to be forced out again when the ribs are finished; but for safety, cramp them into position with your iron cramps, and put the whole in a warm place to dry. After your joints are thoroughly hard (twelve hours at least should be allowed for this purpose) you must plane the flat sides of each piece quite true every way—lengthwise, crosswise, and diagonally.

*Truing up.*—For "truing up" the back, I use a plane of the same size as a "jack" plane, but bearing a coarse toothed iron, almost vertical; this was made to my own drawings by Varvill, of York; and if any reader wishes to have a similar one, I will supply details. For truing the belly use the trying plane.

*Marking Back and Belly for Ribs.*—The back and belly are now ready for marking from the ribs, and as these are not made, we must get them together.

Take the inside model into which the six blocks have been glued, and plane these down to the level of the model, but take care not to injure the latter in doing so. With a straight-edge continue the centre lines on the model, across each of the end blocks. Place the inside pattern to the centre line, and even with the model all round, next carefully trace the outline on the blocks; now turn the pattern and mark the other blocks in the same way. This done, write on each block, inside the marks, figures corresponding with those on the model, and repeat the whole process on the other side. With gouge No. 4 cut out the hollows in the insides of waist blocks; if you find that the wood is cutting inwards, turn the model over, and cut from the other side. Do not cut within the marks, and carve only the *insides* of waist blocks at present. *Make twenty small cuts rather than one too deep.* You should now fix the model edgeways in a wood vice, as you did when trimming it up after being sawed out, and, with the round side of a file to fit the sweep, take out all the inequalities which may have been made in carving, and make the hollows square across. The filing gives a better gluing surface for attaching the ribs.

**Bending Rib Strips.**—The next operation is to prepare the rib strips for bending. With one of the iron cramps fasten one of the strips by its extreme end to the bench, and place a small piece of wood or cork under the cramp, so that it will not damage the rib; and with the veneer plane work from the cramp to the end of rib, and take off the rough part of the wood. Now loose the cramp, turn the rib end for end, and plane the part which the cramp prevented you getting to previously. When all the strips have been treated in the same way, fix them on the bench again, and with a flat scraper, which must be very sharp, take out all the plane marks. Use the scraper diagonally, to cross the figure of the wood.

Divide the strips with a sharp knife, and the square into lengths of 5½, 7½, and 9½ in. One strip will make two top or 7½ in. ribs; the other two will each make one bottom and one waist rib. The next process is one which demands both steadiness, care, and patience, as accidents are very likely to happen, and another rib may have to be planed up. Fix the bending apparatus (K, Fig. 5) in an iron vice, attach an india-rubber tube from the gas to the heater, and light the gas, but observe that it does not light at the wrong place. Turn the gas very low, and when the tube is sufficiently hot to scorch very slightly a piece of paper held on it, the ribs may be bent as shown in Fig. 6.

Begin with the waist ribs, and make sure that the figure of all the ribs matches in inclination; it is better to mark each rib to the blocks before bending any of them. Do not hurry the bending; use only gentle pressure; when hot enough, the ribs may be bent any way you wish. It is safer to have near you a small bucket with cold water and a sponge in it, and if the tube gets too hot you can then cool it a little. Frequently try the waist ribs in course of bending into the places already prepared for their reception. The others you may bend to fit the inside pattern.

*Gluing Ribs.*—Now make a "caul" or small block of wood (the 1 in. pine will do very well) to fit each of the hollows, and mark them to their places; then put them on a stove or near the fire to get hot; this causes the glue to set much sooner. Lay a coat of glue on one waist block, place the hot "caul" against it, and putting the end of an iron cramp into the hole exactly facing the hollow, cramp it close up, but see that both edges are a little "proud" of the model. You will not be able to glue both ends of each rib at one operation; let one end set before gluing the other, as the cramps might be in the way of each other.

When all the ends of waist ribs are fast, in proper positions, you should with a flat toothing plane cut the ribs down level with the model.

Now carve the remaining blocks in the same way as you did the waists, but you must cut through the end of each *waist rib* as well as the block to which it is attached, otherwise a nasty joint may result. Correctly file all the six blocks and make "cauls" to fit each, then mark them to their places. Glue and fix each of the corners, leaving top and bottom until the last. There is no necessity to make a joint with the ribs at the top, as both ends will be cut away when you fix the neck. If the bottom joint of ribs is not good, the defect

may be remedied by inserting a piece of purfling or fancy wood, but this must be exactly true to the centre mark. I have a weakness for putting in a narrow strip of ebony, and think it looks very well when finished: the bottom nut or rest crossing the top of this piece makes a "capital" T.

*Planing down Ribs.*—When the ribs are firmly set you should proceed to plane them down to the model, and finish them in the following way: set your compasses to $3\frac{3}{4}$ in., and from the point where the short line crosses the centre line of model, describe a circle, whose circumference gives the points at which the ribs should be square across. Fasten the model edgewise in the vice, and file each curve square across and free from inequalities, and make the entire set of ribs an equal thickness. After this has been nicely done, scrape them over, and give three or four courses of sand-paper, the last one very fine,

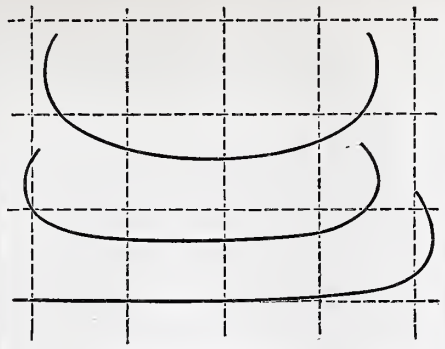


Fig. 6.—Stages of bending Waist Ribs (half size).

back, and trace around it with lead pencil; turn the pattern over, and complete the outline. Next place the model, back downwards, exactly true to centre joint, and an equal distance all round from the pencil outline already traced, and fasten it in that position with an iron cramp at each end. Now correctly trace on the back the outline of the ribs with a fine pointed marker, and then remove the model, and mark out the belly in the same way as the back; but as the "tab" or "button" on the latter will not be required on the belly, the outline must therefore be continued across the top.

*Sawing out Back and Belly.*—Your next business is to saw these two shapes out with the bow or a fret-saw, keeping just outside the pencil mark. With the compasses draw a line all round the upper or bevelled sides of both back and belly, $\frac{3}{8}$ of an inch from the edge. Now set your cutting gauge to $\frac{3}{16}$ in. and cut a strong line that distance from the flat side, all round both back and belly. With a dovetail or fine tenon-saw, and gouges, cut away the rectangular piece thus described, and afterwards level it with a flat oval plane (J, Fig. 5) and files, finishing it $\frac{5}{32}$ in. thick. The model, with the ribs on, should again be placed in the position marked from them on the back, cramped as before, and fixed in the vice, thus fastening securely the back and the ribs together. The edges should now be reduced with files

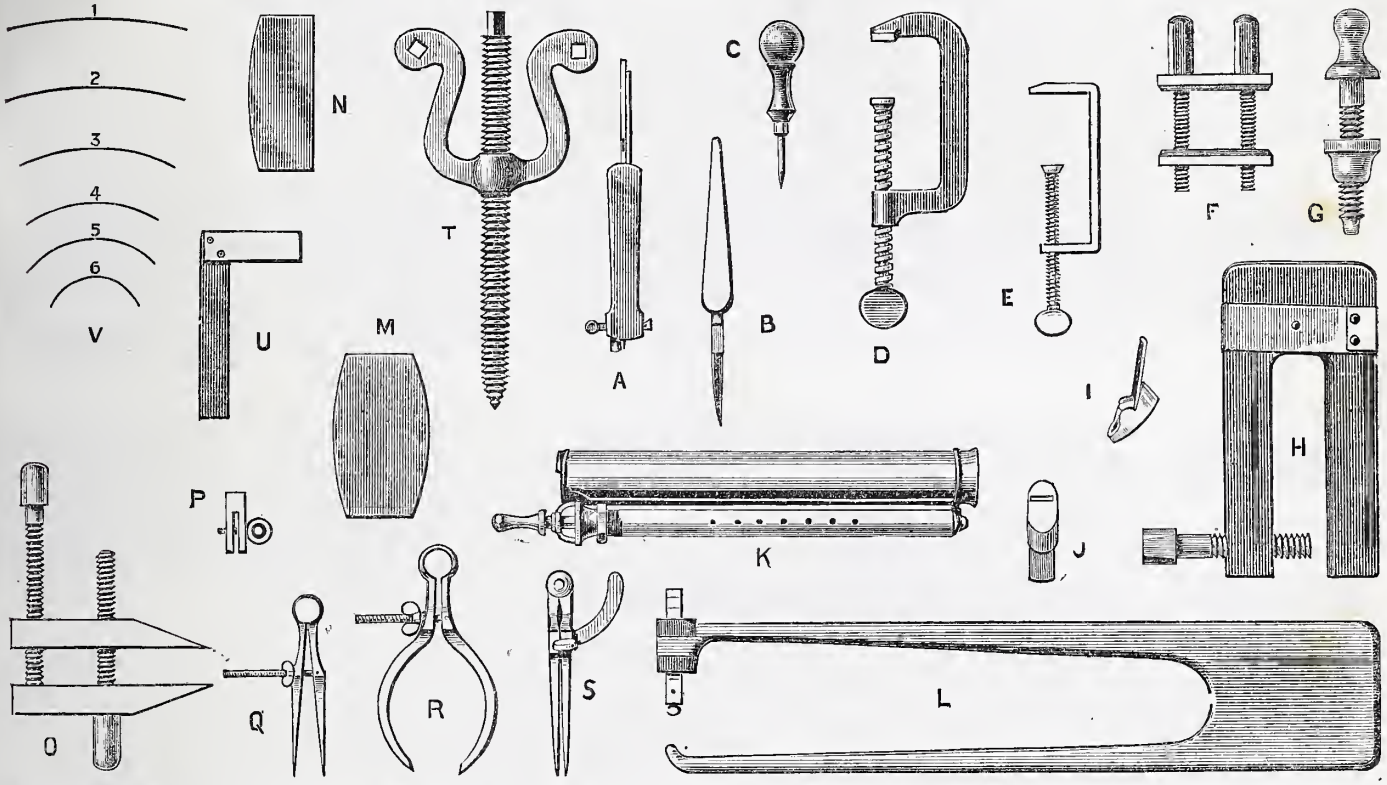



Fig. 5.—Some Special Tools used in Violin Making—A, Purfling Gauge or Cutter; B, Knife; C, Router; D, E, Iron Cramps; F, Cramp for fixing Back and Belly to Ribs; G, Cramp of Writer's Design; H, Wood Cramp; I, J, Small Iron Planes; K, Apparatus for bending Ribs; L, Thicknessing Gauge; M, N, Steel Scrapers; O, Hand Screws; P, Small Cramp; Q, Spring Dividers; R, Spring Callipers; S, Steel Compasses; T, Carver's Screw; U, Small Square; V, Sweeps or Curves of necessary Gouges.

and each one must be used on a cork rubber; work lengthways of the ribs, and preserve the edges absolutely square and sharp. Now square a light centre line down the bottom of the ribs, and midway of this line make a puncture which will show the position of end pin, the hole for which should then be bored with a $\frac{1}{4}$ in. bit.

*Marking Back and Belly from Ribs.*—The ribs are now ready, and the back and belly can be marked out from them, but first place (Fig. 2, p. 5) the outside pattern to the joint of the

until there is a perfectly even projection over the ribs of $\frac{1}{8}$th of an inch. Be particular to make the corners match in direction as shown in Fig. 7. Remove the model from the vice, and take the cramps off; now open the compasses to $\frac{7}{16}$ in., place one point on the joint of the tab $\frac{1}{8}$ in. from the rib line, and describe a semicircle: this gives the form the tab will bear, or nearly so. In Fig. 8 will be given a back with edge reduced and ready for purfling, of which operation I shall give an account in my next paper on violin making.

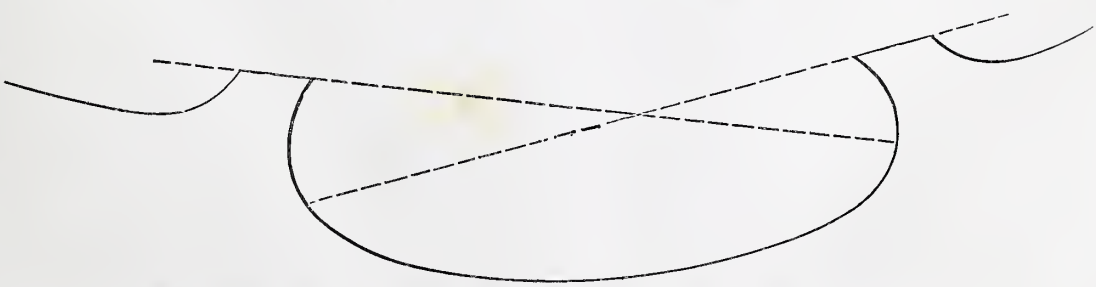


Fig. 7.—Diagram showing by Dotted Lines the Directions in which Corners should be cut.

# VENETIAN BLINDS.

BY B. A. BAXTER.

PROCEDURE—MATERIAL—METHOD OF CUTTING—CONTENTS OF A BUNDLE OF 100 FT. SUPER.—LONG LATHS CANNOT BE PLANED USING AN ORDINARY BENCH STOP, BUT BY TENSION, HELD BY HOOKS—HOLES ABOUT ONE-FIFTH FROM ENDS OF LATH—NUMBER OF TAPES MUST BE TWO OR MORE FOR OVER 4 FT.—LAP OF LATHS—TAPES OR LADDERS—HOW SET OUT—STUFF FOR HEADS AND THICK LATHS—ADJUSTABLE ANGLE—HOW SECURED—PULLEYS AND CORDS—ROLLERS AND WEBS—PAINTING AND VARNISHING.

THESE blinds, once so popular, and likely again to become so, are of very simple construction, though the opportunity of making mistakes is greater than in almost any other work with which I am acquainted. Like all other work where there is a constant recurrence of the same forms or the same operations, it is necessary to observe routine methods, and to divide the work up into as many separate portions as possible, each portion requiring but few tools, and each also being easily mastered. It is not necessary to give these varied operations to separate workers, though in shops where boys are employed, they, of course, do the simplest portions of the work; but it is necessary to divide the work up into parts, and do each part before another is begun, or confusion will result from the want of method.

The wood of which Venetian blinds are made is American pine—that variety which, when exposed to the air, takes a pinkish tinge being preferable; and it should be free of knots, shakes, sap, or resin—resin, that is, that looks as if a knife had been inserted into the wood, and the opening made thereby filled with a glutinous stopping.

The qualifications of pine for this work are its lightness, straightness of grain, and ease of working, and its standing the heat of the sun, which, behind glass, is often considerable.

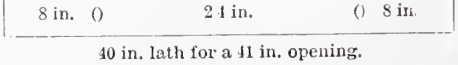
Pine, as most of our readers know, is usually in planks 11 in. by 3 in.; for blinds, however, the saw-mills proprietor is more concerned about quality than dimensions—smaller timber will do, if good. Supposing, however, the stuff is 11 in. by 3 in., it is first reduced to 2½ in. (this is the usual width for blind laths, for reasons which will be explained presently); then it is cut down the centre, and then cut after cut is made, so as to remove pieces 2½ in. wide and ⅛ in. thick. This is the ordinary thickness, and the saw used is a circular saw, ground so that it is thin at the edge; the teeth are small and the set slight, so as to leave the wood as smooth as possible, and not to make deep furrows, to need much planing out. A thin saw wastes less wood than a thick one, which is an additional reason for its adoption.

The laths thus cut are sold in bundles of 100 ft. superficial, or 480 ft. run, which is the same; 12 ft. long and 2½ in. wide being equal to 2½ ft. superficial; forty of such pieces, therefore, are equal to 100 ft. superficial.

The saw-mills people now usually also sell the laths planed and the edges rounded. This formerly, and not so long ago, added 3s. 6d. to the cost per 100 ft.; competition and machinery have reduced this of late years, but the laths are still advertised as "hand-planed"; and sometimes they are.

When planed in long lengths, blind laths are too thin to resist the strain of planing, so they are held by two or three brads or wire nails driven into the rear end of the bench nearly as far as the heads, which are cut off, and the remainder filed to the necessary shape. The laths pressed down on these hooks will hold well enough for a finely-set plane to work well upon them. The edges are rounded with a plane made for the purpose, but failing the special tool, an ordinary ¼ bead plane will do well.

If the laths are bought unplaned, the workman may plane them first, as above, or he may cut the laths to the appropriate lengths and then plane them; it is scarcely needful to remark that in that case the filed hooks are not used. It is optional to round the edges before or after the flats are planed, but very often the laths are cut to the proper lengths, then the edges planed with a jack-plane in groups of about twenty-five at a time in a trough made for the purpose; then the flat surfaces planed and the edges rounded. The holes for the passage of the cord used to be made with a gouge, preferably one ground inside; but for those who mean to make any considerable number of blinds, a punching press, of which many suitable patterns are made, is a necessary investment. When the gouge is used, a bradawl is put through the laths at the proper distance from each end, thereby holding the group of about six laths in position while they are being sawn, as well as marking the place for the hole. In deciding the place for cutting these cord holes, it may help to advise the usual allowance of ½ in. for freedom of the lath at each end, and one-fifth of the length of the lath for the distance of the holes from each end: thus—




40 in. lath for a 41 in. opening.

It is customary to have three tapes, and consequently three holes and cords, to all blinds over 4 ft. wide; and Venetian blinds for shop windows may well have four, or even more, tapes and cords, according to their size.

As a Venetian blind must be fixed together in such a way that it can be drawn up, and so that the laths lap or cover each other, laths 2½ in. wide are usually placed 2 in. apart—six to the foot. Tapes or webs, with cross-pieces sewn at intervals, are needed.

These tapes, or ladders, as they are sometimes called, are made of a webbing intended for the purpose; and before Carr's patent woven web appeared in the market, the making of the tapes was the great difficulty in the way of beginner or amateur, but now the patent woven ladder webs make blind making possible to anyone who can use wood-working tools and a paint-brush.

To those who wish to know how the blind makers of a former time managed, I may say that the tapes were tacked temporarily on a board, to the edge of which a strip of wood was affixed. This strip we divided carefully with compasses into parts 2 in. between the lines, and other distances on other sides of the strip, or on other strips which did duty upon occasion when other distances were needed. Having the tapes on the board, and the divided strip visible on its further edge, the operator transferred the marks with a T-square and pencil; only a little care to stretch the web equally tight was needed to ensure a satisfactory result. It is evident that the worker could allow the proper distance for the lowest and thicker lath by this way of marking the tapes, in which respect only the old way was superior; but the woven web may be recommended to all amateurs and beginners, notwithstanding that the folding of the cut ends of the web are a slight difficulty.

The narrow tapes, about ⅜ in. wide, are usually set out by winding the material round a piece of wood 2½ in. wide and ¾ in. thick; this may be of any convenient length, and when the tape is neatly wound, red chalk or black lead is slightly rubbed along each corner or arris of the covered strip of wood. A sharp knife or chisel is then used to cut along the centre of the ¾ in. edge of the wood, thus dividing each strap from its neighbour, and leaving each with marks indicating the place to sew on to the wider web.

I mentioned the lowest and thicker lath just now: anyone who has seen a Venetian blind knows that it contains thin laths,

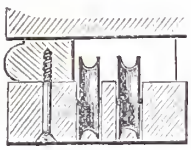


Fig. 1.

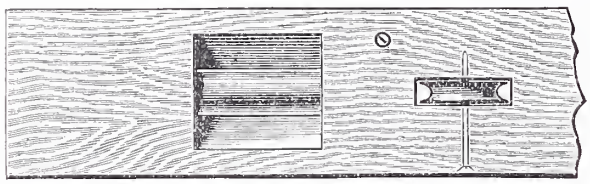


Fig. 2.

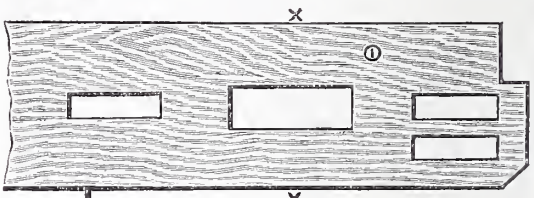



Fig. 5.

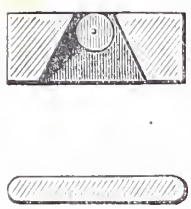


Fig. 3.

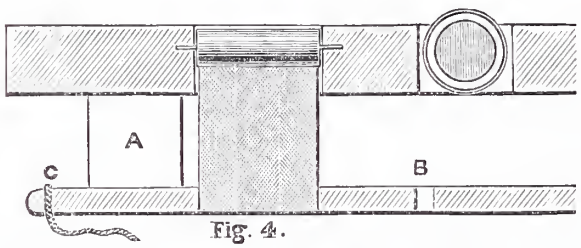



Fig. 4.

Fig. 1.—Section of Pulley Lath through Pulleys. Fig. 2.—Underside of Pulley Lath, showing Pulley and Roller. Fig. 3.—Section of Pulley Lath through Roller. Fig. 4.—Section through both Pulley and Roller, showing Position of Cord (B) and Spacing Block (A), and Cord (C) to alter Angle of Lath. Fig. 5.—Right-Hand End of Lath, showing Relative Positions and Sizes of Mortises—B, Centre Line of Cord; X, Front; Y, Back.

varying in number according to its length, and two stouter laths, one at the bottom and one at the top, to which the tapes are affixed, the whole being suspended to the head or pulley lath, as it is variously termed; 4 cut stuff is about right for these thicker laths, and 1 in. or 2 cut for the head or pulley lath. "4 cut stuff" is a technical term. It means that the plank has four cuts in it, thus making five boards about $\frac{5}{8}$ in. thick.

In order to give adjustment of angle to every lath in the blind, there are rollers let into the pulley lath, the axes of which are parallel to the edge of the lath. The movable laths rest in the tapes affixed to the stout lath at the top, which is fixed to the pulley lath by webs passing over the aforesaid rollers, and parallelism of the whole (which is important) is secured by using a spacing block, or a pair, between thick lath and pulley lath, while the web is drawn over roller and lath and tacked in its place.

Before we proceed to paint our thin laths, we must take off with some glass-paper the fibre or rough edge left at the ends of the laths by the saw. This is usually done a number at a time, and the group of thin laths can be held in various ways so as to secure contact with the glass-paper on each edge of the ends in turn.

The probable reason why $2\frac{1}{2}$ in. has been universally chosen as the ordinary width for Venetian blind laths is because that is the widest that could go between the beads in $1\frac{1}{2}$ in. sashes, and that width of lath has become universal, because variations in width would be inconvenient.

The blinds are drawn up by cords passing over pulleys; the axes of the pulleys are at right angles to those of the rollers just mentioned, and by a simple method the cords are made to draw up—in most cases at the right-hand of the window—while the cord that slopes the laths at pleasure is usually at the left hand.

In the diagrams that accompany this description this will be seen, and the arrangement of pulleys and rollers made clear.

The pulley laths serve the double purpose of fixing the blind, and also form the place of attachment for the pulleys and rollers. Reference to Fig. 1 will show how these pulleys are arranged so as to escape contact with the sash beads. The outer beads are usually $\frac{5}{8}$ in. by $\frac{3}{4}$ in., therefore the foremost of the two pulleys should be quite that distance from the front. The pulleys are made of various sizes, but 1 in. diameter is the most useful size for all but the smallest blinds. The mortises for the pulleys are generally cut with a $\frac{3}{4}$ in. chisel.

The rollers are seen in Figs. 2, 3, and 4, and are cut with a $\frac{5}{8}$ in. or $\frac{3}{4}$ in. chisel; the length is abont $1\frac{3}{4}$ in. The lower side of these mortises must be enlarged, as shown in Figs. 3 and 4, because the web which passes over the roller also passes over the lath, which is $2\frac{1}{2}$ in. wide.

The figures also show how the pulleys and rollers are centred, the latter needing the wire to be let into a mortise cut for its reception. This is shown in Fig. 4. The holes for screws for fixing must not be forgotten, as it is most inconvenient to find no screw-holes when you have the blind put together and are about to fix it. Figs. 2 and 5 show suitable places for screws.

The stout laths which form the top and bottom laths, and to which the tapes are secured, have cord-holes corresponding to those in the thin laths, but those in the top are larger than those in the bottom, which are small enough to retain the knot in the cord, neatly covered by the tape, and resting in a countersink made in the bottom of the bottom lath.

We have now our blinds cut to size, and the cord-holes cut or punched; they are, of course, planed, rounded, and the edges of the ends and corners rubbed with glass-paper. We will now paint or varnish them.

In painting blinds we must guard against the use of too much oil; no boiled oil must be used at all, on any account, and the first coat of colour the laths receive is very frequently composed of size and whiting. This should have no water added to the size, which should not, in melting, be allowed to boil. When well melted, the whiting should be crushed and stirred in gradually; and not a great deal is needed, or the mixture will be too thick to put on easily, and will dry with coarse brush-marks. The painting of blind laths needs a quick and light touch, or some of the laths will be broken. A 000 or 0000 brush is suitable—oval brushes are preferred by many—and the lath, while being painted, is held by the left first finger and thumb at the hole in the lath, the other end resting on the board fixed on the painting bench. The paint which follows the size colour may be ordinary *raw* oil colour, rather sharp, and still more turps for the finishing coat.

For varnishing, two coats of patent size of best quality—vellum size for choice—the first coat of which may have some water added, and the second some, but less. The varnish may be best church oak, and blinds should have two coats of varnish, pure as received from the maker.

The arrangements for drying the laths differ, but the general plan is to fix a piece of quartering, in which is driven pieces of the stoutest iron wire (about $\frac{1}{4}$ in. diameter), about 15 in. or 16 in. long and about $4\frac{1}{2}$ in. apart. Each of these will hold about ten laths, and the whole arrangement of quartering and wires is fixed on the wall horizontally, and higher than the eyes of the workmen.

I need say nothing about the putting together and fixing, because anyone who can do the preceding work can easily overcome the remaining difficulties, but one word of warning must be uttered: do not, in putting in the cords, allow the cord to depart from its true course, which is down the centre of the wide tapes, and therefore alternately to the right and left of the short tapes on which the laths rest. If you make any mistake, rectify it at once; do not treat it as a matter of indifference, for a cord inserted in the wrong way will do mischief to itself and the tapes until it is put right.

Lastly, as the parallel position and equal spacing of the thin laths depend on the accuracy of the tapes, so the spacing and parallelism of the lowest lath depend on the care with which it is tacked in its place. The absence of attention to this trifle makes a great difference in the appearance of the finished work.

After a trial or two the making and finishing a Venetian blind will not be found so difficult as it may seem at first sight. It will be good practice for anyone who has in his possession, or can become possessed of, an old blind to take it to pieces and put it together again. From this point of view it follows as a matter of course that any paper will prove useful to those who merely wish to clean the blinds or even to furnish them with new tapes. In taking a blind to pieces for the first time, due regard should be paid to the construction and arrangement of the cords.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### Theory and Action of the Slide-Valve.

Engines not made Self-Acting at First—The Plain Slide-Valve without Lap—Slide-Valve with Lap for Expansive Working—Stroke of the Eccentric—Lead of the Valve—Angle of Advance, of Admission, of Expansion and Release, of Exhaust and Compression — Inside Lap — Use of Lead—Lineal Admission and Expansion in Parts of the Stroke—How to Arrange for more Expansive Working—High Rate of no use in Unjacketed Cylinders — List of Castings and Tools required for making the Engine.

*The Slide-Valve.*—It would be quite possible to put together the engine we have in hand without any directions beyond those which accompany the drawings; but no amateur engine-maker will be content to be ignorant of the action of so vital a part of the machine as the slide-valve, nor of so beautiful and ingenious an adaptation of means to an end—a problem which may well be considered as a kind of *pons asinorum* in steam engineering. Besides, if we do not master the slide-valve, we cannot certainly go on to deal with link motion or expansion gear.

It may not be generally known that the first steam engines required a man, or boy, constantly beside them, to turn on and off at every stroke the cocks which directed the steam into and out of the cylinder. We can hardly imagine such a state of things in these days; but it continued until a boy, who wished to exchange work for play, had ingenuity enough to connect by strings the handles of the cocks with some of the moving parts of the engine, in such a way that the engine did for him the work he was set to do—a real invention, for he had made the steam engine *self-acting*.

The distribution of steam in the modern engine is controlled by the eccentric and slide-valve — a beautiful and smoothly working arrangement, almost perfect in its action. The eccentric is keyed upon the shaft and gives motion to the slide-valve, so that, no matter what may be the position of the piston in the cylinder, the slide-valve will always be, of necessity, in the correctly corresponding position. The steam is led from the boiler into a steam-chest, or valve-box, upon the side of the cylinder, and the duty of the valve is to direct the steam upon the back of the piston to drive it up the cylinder for three-quarters of the stroke; then to stop the supply till the piston reaches the end, and then to bring the steam upon the front face of the piston to drive it back, whilst it allows the first cylinderful of steam to escape by the exhaust pipe.

Looking at Fig. 1, the valve v and the ports or steam-ways P, P,' will be seen in section, leading the one to the top and the other to the bottom of the cylinder (called top and bottom merely for convenience of description). There is a third port between the other two called the exhaust port, E, which is *always covered* by the slide-valve, and through this the steam makes its escape; the pressure under the valve, therefore, will be the same as that in the exhaust pipe which opens into the air, whilst the pressure upon the outside of the valve is 50 lb. per square inch, or whatever may be the pressure in the steam pipe which supplies steam to the box in which the slide-valve works. The valve fits so perfectly upon the face that only the merest whiff of steam—a hardly

perceptible quantity—can pass between the surfaces, and the same is true of the fit of the piston in the cylinder. All that escapes in either of these places is loss, and, if well and carefully fitted, there need be no loss. The difference of the pressure outside and inside the valve causes it to be held up firmly against the valve-face on the side of the cylinder. The figure also shows the eccentric which moves the valve, but this is drawn as if it were turned a quarter round, so as to show its flat side instead of its edge.

We may now pass on to Fig. 2 and investigate the action of the plain slide-valve without lap. At Fig. 2*a* will be seen the valve which belongs to Fig. 2. Lay a piece of tracing paper over Fig. 2*a*, and trace the valve with the base line to *h*, and the verticals *g*, *h*, and *k*. Lay this tracing on Fig. 2 and see that these vertical lines correspond with those of the figure beneath, whilst the edges of the valves *a b*, *c d*, coincide with the edges of the ports A B, C D; thus the valve will be in the middle of its course, whilst the point *g* on the tracing will coincide with *z*, the centre of the circle representing the movement of the eccentric. Evidently the ports are all closed and no steam can pass anywhere; the piston then must be at one end of its course. Let us place the crank upon the line *z r*, and suppose the piston to be at the top end of the cylinder. Looking at the valve, we see that whether the crank moves upwards or downwards from *r*, the valve must move to the left so as to uncover port P to the steam and port P′ to the exhaust; if then the crank is to go round *upwards* from *r*, the eccentric must be fixed at *s*, but if the crank is to go *downwards*, and go round as a watch does (forwards), then the eccentric must be placed at *t* to make the valve move to the left. *Fix the eccentric at t, and the engine will run forwards; fix it at s, and it will run backwards.*

Thus we arrive at this conclusion: that when the edges *a b*, *c d*, of the valve are the same width as the ports, the eccentric must be keyed at an angle of 90 degrees *in front* of the crank.

Let us now suppose we determine that the engine shall go forwards and the crank go downwards from *r*. Suppose it to move one-quarter round from *r z* to *y z*, then the eccentric will have moved from *t* to *v*, and the valve will move to the left while the eccentric passes round the quarter circle till the point *g* coincides with *v*, *d* with C, and *b* with A. The piston is now in the middle of its course, moving at its greatest velocity, and the valve has been opening both steam and exhaust openings wider and wider till they are now opened to their widest extent. Continuing the movement through another quarter circle, the crank continues its course till it arrives at R *z*, bringing the piston to the bottom end of the cylinder, whilst as the eccentric passes over the arc *v s*, the valve returns again to its former central position, gradually closing the steam and exhaust openings as the piston comes gradually to rest. Now, however, though the valve is in its first position, the crank is at R and the eccentric at *s*, and therefore the further movement of the crank and eccentric will cause the valve to move to the right of its central position, opening port P′ to the steam and port P to the exhaust, so that now the direction of the steam is reversed, it flows into the back end of the cylinder, and the steam which did the work during the last stroke escapes under the valve to the exhaust.

Fig. 2, with the tracing of Fig. 2*a*, will enable the student to find the corresponding position of the valve for any position of the crank. It simplifies the problem by getting rid of the eccentric rod, the angularity of which is so slight that the error thus introduced is unapprcciable.

Having now studied what may be called the rudimentary slide-valve, which would only be suitable for a water engine, we will proceed to show how by altering its dimensions its working may be greatly improved.

A great fault in the arrangement of the valve of Fig. 2 is that it does not allow the steam to be used expansively. Without going deeply into the subject, it must be evident that, with the valve just considered, the steam will continue to enter the cylinder and drive forward the piston to the very end of its stroke, and that then the exhaust valve will allow the whole cylinderful of high pressure steam to escape, though it has in it power enough to do a great deal more work. Suppose, instead of this, we had arrested the flow of steam into the cylinder when the piston had only travelled through half its stroke, the half cylinderful of steam, say at 40 lb. pressure per square inch, would have begun to expand, and would have continued to press forward the piston until it arrived at the end of its stroke, when, having doubled its volume, its pressure would have fallen to one-half (reckoning from vacuum) what it was at first. By this means half as much steam would have been made to do almost as much work as the whole cylinderful.

There are, however, practical reasons why it is not well to carry the system of expansion very far in a small unjacketed cylinder like the one we have before us, and the limit has been fixed at three-quarters—that is, the proportions of the slide-valve have been arranged in such a way that when the piston shall have travelled over three-quarters of its stroke, the ingress of more steam shall cease, and the remainder of the stroke be completed whilst that steam expands. The arrangement saves at every stroke one quarter of a cylinderful of steam, and the average pressure is reduced about 2 lb., whilst the terminal pressure falls to three-quarters of the initial. How this is done can be seen by referring to Fig. 3, which, with its valve, represents the arrangement and proportions actually adopted. The letters of reference are the same as in the former example, and the tracing of the valve, Fig. 3*a*, should be made as before. Laying this second valve tracing on Fig. 3 in its middle position, we notice that whilst the points *b* and *c* on the valve coincide as before with edges B and C of the ports, edges *a* and *d* of the valve *overlap* the port opening by a distance D *d*, A *a*, equal to the width of the port opening; this distance of overlap is an important dimension, and it is called *the lap* of the valve; in this case we should say we have one port of lap.

Let it be noticed that the valve is not, when in its middle position, properly placed to begin to admit steam through port P so that the piston may begin its "in" stroke; it will not do this till the valve has moved to the left, until edge *d* reaches edge D. Moreover, it will not have opened the port fully till edge *d* reaches edge C. Supposing we wish to arrange the valve to open this port fully, we must make the radius of the circle of the eccentric equal to the distance *c* to *d*, or *a* to *b*; and since in our case we have made the ports $\frac{1}{4}$ in. wide, this radius will be $\frac{1}{2}$ in., and the eccentric will have an eccentricity of $\frac{1}{2}$ in., and the stroke of the eccentric and valve will be 1 in., which is the way the size of the eccentric circle on Fig. 3 was determined. To find the proper angular position for the centre of the eccentric upon this circle, move the valve to the left till edge *d* has just passed edge D by the thickness of a visiting-card, say $\frac{1}{64}$ in.; this distance is called *the lead* of the valve. Now observe where the line *g h* on the tracing cuts the eccentric circle at *t*, join *t z*, and produce the line to *s*; *t* is the position the centre of the eccentric must occupy when the crank is at *r* ready to begin the "in" stroke, and the angle *r z t* is called *the angle of advance*. It is the angular distance by which the eccentric precedes the crank; in this case, were it not for the slight addition made to it by the lead, this angle would be 120 degrees. We may now, by the help of our diagram, watch the action of the valve, and determine at what points in the revolution of the eccentric the inlet and outlet of the steam occurs. Beginning at *t*, the valve edge *d* having just passed D let the eccentric move on to *v*, and *d* to C; here the valve is fully open; pass on from *v* to *p* (determined by the edge *d* reaching D), and the valve closes and stops the admission of more steam; *t z p* is *the angle of admission*. By dropping from *p* the perpendicular *p p′* upon the diameter *t s*, we find that if the distance *t s* represents the length of the stroke, then distance *t p′* represents that part of it during which steam is admitted. Let the eccentric continue its course from *p* to *o*, and the valve will reach its middle position; but here another event occurs. Edge *c* of the valve passes edge C of port P, which opens it to the exhaust; the steam that was expanding in the cylinder will therefore escape when the eccentric reaches the angular position *o*, and the piston the position corresponding to *o′*, whilst the stroke does not end till the point *s* is reached at 180 degrees from *t*; angle *p z o* then is *the angle of expansion*, angle *o z s the angle of release*; if *t s* represent the length of the stroke, then *t p′* is the admission, *p′ o′* the expansion, and *o′ s* the release. Following the eccentric round from *s* through *w* to *n*, we note that at *s* the piston begins its return stroke, which ends when the eccentric reaches *t*; but that, just as the exhaust begins at angle of *o z s* before the completion of the stroke, so in like manner the exhaust ends at *n* before the exhaust steam has been completely expelled. Dropping a perpendicular from *n* to *n′*, we find that if *t s* represent the length of the stroke of the piston, then, when it shall have returned from *s* to *n′*, the port P will be closed to the exhaust, and during its remaining course from *n′* to *t* it will *compress* the exhaust steam remaining in the cylinder, which will have the effect of raising its pressure; so that when, just before the next stroke begins, the port P opens to the steam again, this high pressure steam will not have to fill a port-way and cylinder-end at atmospheric pressure, but will find there already a pressure of some 15 or 20 lb. The angle *n z t* then is called *the angle of compression*; it is a decided advantage to the engine. Moreover, the angles of release and of compression can be varied: we can take from one and add it to the other by simply adding to or reducing the distance *b* to *c*. Suppose a little piece *m* (Fig. 3*a*) to be fitted inside the valve, and watch its effect; it will move the points *o* and *n* on the eccentric circle a little further to the right; it will take a little from the release and add it to the expansion, and,

by the same amount, it will increase the compression. Such a piece added as at *m* would be called *inside lap*; it is sometimes used, but the more usual practice is to make *b c* equal to B C.

The use of the lead is to take up the looseness of the joints of the connecting-rod ends, and so to prevent any knock on the dead points. It will be understood that as the force of the steam urges the piston first in one direction and then in another, if there were the slightest amount of play anywhere in the joints, between the piston and crank, the pins would be forced first to one side and then to the other of each joint, causing a disagreeable thump at the beginning of each new stroke, at the moment the steam came on to the piston. By means of the lap, and also with the help of the compression, the motion of the piston is retarded at the end of each stroke, so that the momentum of the fly-wheel takes up all looseness in the joints, in such a way that the pressure of the fresh steam is transmitted solidly to the crank-pin. When this is properly done in every respect, not the slightest knock or thump will be heard as the engine piston reverses its movement in the cylinder.

If it be required to find at what parts of the stroke in inches the various incidents take place, the eccentric circle in Fig. 3 can be surrounded by another circle, as seen dotted in the figure, having a radius equal to that of the crank—$2\frac{1}{8}$ in.—and the various angles of the eccentric positions can be produced to the circumference of the larger circle, and perpendiculars let fall upon its diameter; these perpendiculars will now mark off the different parts of the stroke in inches. By this method it was found that, the stroke being $4\frac{1}{4}$ in., the admission occupied $3\frac{3}{16}$ in., the expansion $\frac{3}{4}$ in., and the release $\frac{5}{16}$ in.

It may now be said, that as the ports are, of necessity, made large enough to give free exit to the exhaust steam at atmospheric pressure, it is not necessary that they should be fully opened to admit the high-pressed steam; we can, therefore, if we like, employ an eccentric with only $\frac{3}{8}$ in. eccentricity. We shall leave it to our readers to work out the full results of this change, only stating that the angle of advance will be increased by about 8 degrees. The cut off will occur soon after the half stroke has been passed, and the ports will never open more than $\frac{1}{8}$ in.—one-half their width. The arrangement would be a good one; it would use less steam and give out but little less power than the one already examined. Economy in so small an engine is not of much consequence. Possibly it might amount to a saving of a penny a day, and readers might do well to adopt it if they can afford to sacrifice a little power, or if their boiler is deficient in steaming capacity. An expansion of one-half is about the limit of what can be obtained by the single slide-valve. Even with that amount the release and the compression grow to rather formidable proportions. If we wished to work still more expansively, we should have to employ a second eccentric to work a second slide-valve, moving upon the back of the first, and by this means the expansion might be carried to any degree desired. It is, however, no advantage to use a high degree of expansion in a cylinder not provided with a steam jacket; and the very small amount we might hope to save in so small an engine does not make it worth while to incur so much extra expense and complication.

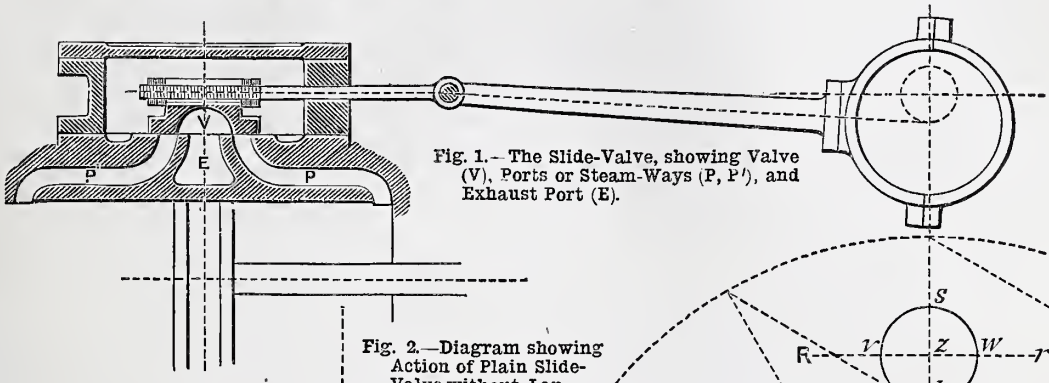



Fig. 1.—The Slide-Valve, showing Valve (V), Ports or Steam-Ways (P, P'), and Exhaust Port (E).

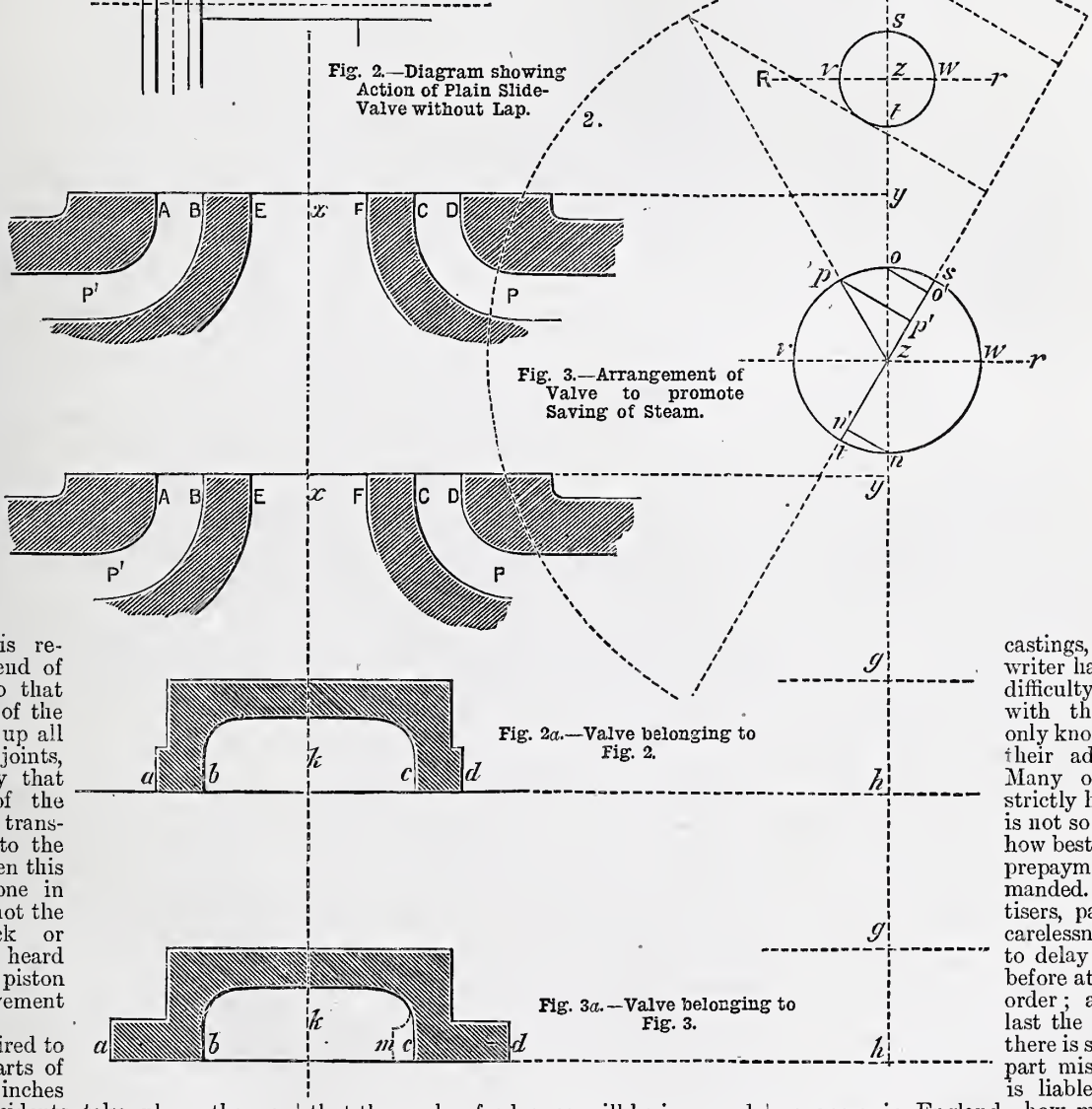



Fig. 2.—Diagram showing Action of Plain Slide-Valve without Lap.

Fig. 3.—Arrangement of Valve to promote Saving of Steam.

Fig. 2*a*.—Valve belonging to Fig. 2.

Fig. 3*a*.—Valve belonging to Fig. 3.

*List of Castings supplied, and of Tools required, for making the $\frac{1}{4}$ H.P. Engine.*

In buying castings, the present writer has found some difficulty in dealing with those who are only known to him by their advertisements. Many of these are strictly honest, but it is not so easy to know how best to deal when prepayment is demanded. Some advertisers, partly through carelessness, are apt to delay a long while before attending to an order; and, when at last the goods arrive, there is some essential part missing. If one is liable to such annoyances in England, how much more so in the Colonies! It is with a view of preventing such annoyance to those readers of these papers who might wish to obtain a set of castings, that a set of excellent patterns have been made. From these, as soon as it is practicable, castings will be made by a man on whom some of us think we can depend. So that it is hoped that the owners of the patterns will soon be in a position to execute orders for them from all parts of the United Kingdom, the Colonies, or anywhere else, and to forward the cast-

ings complete, without unreasonable delay. Of this, however, due notice will be given by advertisement in Work.

Another great annoyance to a would-be engine builder is to find himself suddenly pulled up by the want of some little forging it was supposed he would be able to make, or of a bit of brass rod to make some small part for which no casting has been supplied. To avoid this, castings are provided of many very small parts which might have been made of a bit of brass rod, if the workman happened to have a suitable piece, but, for want of which, he might have had to wait. Our readers' patience will be sufficiently tried if they undertake this piece of work without any disappointment of such a kind, and an attempt has been made to save them all unnecessary trouble.

The first list, here following, is that of all castings and materials required to *make the engine alone*, without either pump or governor.

List of Castings and Materials for Making Engine Alone, without Pump or Governor.

| *No. of Pattern.* | *Description of Casting.* | *No. of Castings.* |
|---|---|---|
| 1 | Bedplate | 1 |
| 2 | Cylinder | 1 |
| 3 | Top Cover | 1 |
| 5 | Bottom Cover | 1 |
| 6 | Piston | 1 |
| 7 | Piston Bottom | 1 |
| 10 | Steam Chest | 1 |
| 12 | Steam Chest Cover | 1 |
| 15 | Crosshead | 1 |
| 17 | Fly-wheel | 1 |
| 18 | Crosshead Guides | 2 |
| 28 | Angle Bearings | 2 |
| 29 | Caps for do. | 2 |
| 34 | Eccentric | 1 |
| 35 | Ecc. Half Strap (rod end) | 1 |
| 36 | do. do. do. (outer end) | 1 |

All the above in Cast Iron.

| | | |
|---|---|---|
| 4 | Gland for Cylinder Cover | 1 |
| 8 | Piston Rings | 1 |
| 9 | Piston-rod Nut | 1 |
| 11 | Gland for Steam Chest | 1 |
| 13 | Slide-valve | 1 |
| 14 | Valve-rod Nuts | 4 |
| 30 | Bearing Brass (bottom) | 2 |
| 31 | do. do. (top) | 2 |
| 32 | Con.-rod Brasses (small) | 4 |
| 33 | do. do. (large) | 2 |

All the above in Gun Metal.

| | | |
|---|---|---|
| 16 | Connecting-rod | 1 |
| 38 | Valve-rod | 1 |
| 39 | Eccentric-rod | 1 |

These three in Malleable Cast Iron.

1 Crank Shaft in Wrought Iron.

With the above, 5 Stauffer lubricators, smallest size; one ½ in. brass screw stop valve with nipples to fit.

Castings Required for Feed Pump.

| *No. of Pattern.* | *Description of Casting.* | *No. of Castings.* |
|---|---|---|
| 19 | Pump Body | 1 |
| 20 | Pump Cover | 1 |
| 21 | do. Gland | 1 |
| 22 | do. Union Nut | 1 |
| 23 | ¼ in. Spindle-valve | 1 |
| 24 | $\frac{5}{16}$ in. do. do. | 1 |
| 25 | Pump Plunger | 1 |
| 26 | Liner for do. | 1 |

All the above in Gun Metal.

| | | |
|---|---|---|
| 27 | Pump Eccentric Rod | 1 |

Of Malleable Cast Iron.

| | | |
|---|---|---|
| 35 | Half Strap of Eccentric for Pump | 1 |
| 36 | Other half of do. for do. | 1 |
| 37 | Pump Eccentric | 1 |

Of Cast Iron.

Castings, etc., Required for Governor.

| | | |
|---|---|---|
| 40 | Governor Bracket | 1 |
| 43 | do. Balls | 2 |

Of Cast Iron.

| | | |
|---|---|---|
| 41 | Governor Sleeve or Body | 1 |
| 42 | Do. Pivot Pin | 1 |
| 44 | Driving Pulley | 1 |
| 45 | Throttle-Valve | 1 |
| 46 | Do. do. Case | 1 |
| 47 | Do. do. do. Gland | 1 |

Of Gun Metal.

Other Materials: Four inches of ¼ in. steel tube $\frac{3}{8}$ in. bore. One pair of 1 in. brass mitre wheels.

Tools Required to Make the ¼ H.P. Engine.

1. A metal turning lathe, with slide-rest, is necessary; if the fly-wheel is to be bored, it must have a gap capable of taking in a diameter of 16 in. If it is not a self-acting lathe the cylinder had better be ordered ready bored. The lathe should not be less than 5 in., or at least 4½ in., centres.
2. A universal chuck three or four inches in diameter is desirable.
3. A face-plate chuck 8 in. to 10 in. diameter is necessary. It must have dogs and bolts.
4. An angle-plate chuck to bolt on the face-plate.
5. A vice. A 10s. 6d. parallel vice might do, but a larger one would be better.
6. A set of flat and round files and some cold chisels.
7. Screwing tackle, a screw plate and taps up to ½ in. or $\frac{7}{16}$ in., a stock, and dies for brass gas-threads.
8. A set of straight flute or Morse twist drills up to ⅜ in. with drill chuck.
9. A drill gauge is very useful; it costs 12s. 6d. from Churchill's, and contains a number of holes from $\frac{1}{16}$ in., up to ⅜ in. rising by $\frac{1}{64}$ in.
10. A surface-plate and scribing block.
11. Squares and callipers.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* Work *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* Work *without charge, the notices given partake in no way of the nature of advertisements.*

### 9.—Black's Patent Fastener.

Mr. Alexander Black, High Street, Cowdenbeath, N.B., has produced a new kind of fastener for shirt studs, a specimen of which he has sent for inspection, and which seems likely to be useful to those who wear shirt-studs, solitaires, etc., as the patent fastener enables the wearer to insert and remove them with the greatest ease, and absolutely without injury to the linen. The fastener can be fitted to any size or form of stud; and Mr. Black claims for his invention that it is more secure when inserted than any other, and forms, with the top, one piece only; thus overcoming a difficulty never successfully met hitherto. In Fig. 1 is shown a representation of the stud when about to be inserted in the hole or holes made for its reception; Fig. 2 shows a side or sectional view of the appliance. It is used by inserting the ribbed end A of the fastener under one lip of the button-hole (as in Fig. 1), and then pushing it first to the right as far as it will go, and then to the left under the other lip of the hole, or in other words, to the left in order to bring B under the other lip. When it is desired to remove the stud, the movement is simply reversed. The spring clips the linen firmly in inserting and removing, and closes or locks when the stud is in position. There is no wear to the linen from the stud revolving in the hole. The neck being flat, it cannot turn, and always lies in position to be readily removed. The more stiffly starched the linen is, the better the working of the stud.

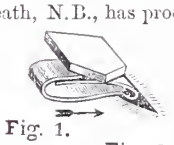


Fig. 1.

Fig. 2.

Fig. 1.—Black's Fastener. Fig. 2.—Ditto, side view.

### 10.—"The Art of Graining and Imitating Woods."

I have received from Mr. W. G. Sutherland, the managing director of the Decorative Art Journals Company, Limited, Parts 1, 2, and 3 of a superb work entitled, "The Art of Graining and Imitating Woods." Mr. Sutherland's name is so well known in the decorative world in connection with that kind of art-work of which he is so able a master and exponent, that it is enough for me to say that anything he produces is well worthy the attention of all professional painters and decorators who desire to attain excellence in their craft, and of all amateurs who are interested in the subject, and who wish not only to try their hand themselves at the imitation of woods by brush-comb and the requisite pigments, but also to possess safe and sure guidance in the art and the means of discriminating between good and bad imitations of the original woods, both in colour and veinings. I am sorry that I am unable to state at the present moment the price of the parts of this magnificent contribution to the literature of decoration, but I can put my readers on the right track for learning this for themselves by saying that the Company's address is 15, St. Ann Street, Manchester, and that Mr. Sutherland will undoubtedly be pleased to answer any inquiries. Further, the London publisher is Mr. Henry Vickers, 12, Catherine Street, Strand, W.C., where anyone resident in the metropolis and its vicinity might see the work, if he was so minded. To give those who cannot do so some idea of it, I may say that the size of the page is 18½ in. by 13½ in., and that there are eight of these large pages in each part, and four examples of the graining of different kinds of wood, beautifully and artistically rendered in colour, and representing the work as it should look when brought to completion. A chapter is devoted to the treatment of each kind of wood, and the letterpress is enriched with characteristic initial letters and tail-pieces, and in some cases with illustrations of the appliances used, of the modes by which some of the desired effects must be produced, and of examples of veining in black and white when it is helpful to show the peculiarities of the natural wood otherwise than by colour. To give some idea of the method of treatment adopted for the text, I will take Chapter VIII., on bastard mahogany or baywood—the kind of mahogany that is brought from Honduras, in Central America. In this we have first some mention of the history of the wood, especially as regards its use in this country and its rise and declension in popular favour. Then we are told in separate sections, each under its own heading, the "colours required;" the "grounding," how it is to be made; and "how to grain it," describing clearly the manipulation that is necessary. We are then introduced to "another method" of arriving at a similar result by "flogging in the ground," "pencilling," and "glazing." The value of the directions is further enhanced by side-notes in small type, which enable readers or those who use the book as a work of reference to gather the nature of the text without wading through it from beginning to end, by merely running the eye down the side of the column until the position of the information required has been found and noted.

### 11.—"Photography in a Nutshell."

Not long ago I called attention to a manual of photography entitled "Photography in a Nutshell," which was sent by the publishers, Messrs. Iliffe & Son, 3, St. Bride Street, London, E.C. It was in a paper wrapper, and its price was 1s. I have now received another copy from Mr. William Tylar, 57, High Street, Aston, Birmingham, which I am bound to notice on account of its marked peculiarity in having every right-hand page blank for notes. Mr. Tylar says: "I have much pleasure in sending for review *my* latest edition of 'Photography in a Nutshell.' I am sure that practical workers will welcome the combination of a practical book of reference with a note-book, especially as the interleaf is so arranged that the printed index refers to the written notes as well as to the corresponding printed paragraphs. It is an entirely new departure in photo literature." That it indeed is, and a departure that might be adopted with advantage in other books—especially books for use in schools and colleges. The new edition is bound in cloth, and its price is 2s. 6d. Whether or not Mr. Tylar is the "Kernel," the *nom de plume* of the writer of the volume, is a matter for speculation into which I do not attempt to enter, but with this, the entire absence of title page from the copy in my hands—another new departure in literature generally—has probably something to do.

The Editor.

## SHOP:

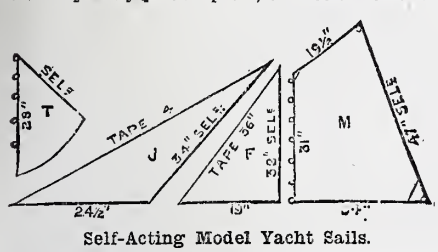
### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Self-Acting Model Yacht.**—T. H. C. writes:—"I enclose particulars of a self-acting model yacht I have made. She is 40 in. overall—*i.e.*, from stem to stern—13 in. wide, and 8 in. deep, with a false wooden keel 1 in. wide by ⅝ in. at stern, tapering down to ½ in. by ¼ in. at prow, and below this is a




Self-Acting Model Yacht Sails.

leaden keel of 22 lbs. weight, ⅞ in. by ⅝ in., tapering down to 1⅛ in. by ¼ in. at prow. Spars—Mainmast, above deck, 37½ in.; topmast, outside the head of mainmast, 26½ in.; boom, 37 in.; gaff, 23½ in.; jibboom, 25½ in.; fore staysail boom, 20 in.; bowsprit, outside stem head, 35½ in."

**Rate for Circular Saws.**—A Wood-Worker writes:—"*Do we drive our circular saws too fast?* This is the gist of a question put by F. A. M. on page 12, Vol. III. I am aware of the fact that machine saws driven by steam are driven very fast indeed, the limit being in the stability of the machinery—that is, its smoothness of running and absence of vibration. It is this last desirable quality that prompts makers to adopt the box pattern now so general, in preference to the older plan of several frames bolted together. But it may be that such velocity is not absolutely necessary, except as an essential to rapid sawing. Could we then saw at half the pace with a saw velocity reduced in proportion, and the motive power equally diminished? I believe we could. But it would be necessary to abolish *slip*, which is the bane of belt driven machinery. We are between two difficulties—a slack belt means slip, and a tight belt means waste of power, while all the applications of resin, etc., which may prevent slip, involve the loss of some power by the parting of belt and pulley, which is as inevitable as the movement. What is to be done, then, to secure the desired result at the least cost? Gearing is noisy, and not to be thought of; but it may be that we can learn a lesson from the cyclist. We know that if his rear-driving safety was connected with pedal by means of a very tight belt, he could not perform the great distances at the great speeds now so often accomplished. And if it were known to me how to alter a treadle machine in my possession, which now drives the saw by a leather belt, into a machine which drives with a chain, which need not be tight, but fits each wheel, I would experiment, and make the result known in Work. For some time past there has been an advertisement of a hand circular saw in Work (which was in the late Exhibition), and I believe it works well, although the saw revolves but slowly; the feed is in proper proportion, and there is no slip. Probably the teeth of the saw might need adapting to the speed, making the angle of clearance less, and making the tooth more a cutting tool and less a scraper; but if the space between the teeth is sufficient to contain the waste of the stoutest stuff it is used to cut, I think such a modification could but be of benefit."

### II.—Questions Answered by Editor and Staff.

**American Organ Coupler.**—Coupler.—The sketches given on page 633, No. 91, are correct, and do not require reversing as you suggest. Fig. 1 shows the bass coupler, which acts on the octave below the note touched; and Fig. 2 is the treble coupler, which acts on the octave above. The "A" end of the wires is pressed down by the button on the forepart of the key, and the "B" end presses on the collar or button on the plunger of the key an octave above or below, as the case may be. You ought to have no difficulty in arranging the wires and bending the flattened ends so that they will work without catching against each other, as the amount of movement is very slight. The platform need not be as much as 2 in. wide, and the wires need only overhang sufficiently to work. But the sizes of the various parts depend entirely on the amount of space available, and are not arbitrary. You appear from your sketch to have room for the coupler described without shifting the register or lath through which the plungers pass. As regards the broken screw in the reed plate, you may perhaps be able to move it by applying the edge of a small cold chisel to the head of the screw and gently tapping it with a hammer so as to cause the screw to be gradually moved round. After two or three turns, you would be able to get hold of it with the pliers and screw it out easily. If you cannot manage this, you might drill the screw out, but the first method is preferable. A hot wire held on the top of the screw and a drop of oil placed on it will facilitate the turning of the screw.—M. W.

**Coach-Painter's Outfit.**—Apprentice.—You want to know "where to get good pencils and varnish brushes," etc. There should be no difficulty in a town like Leicester to get all that you require. I purposely avoid saying, "Go to a good shop and pay a fair price"—advice often given in journals to inquirers. At the outset, the inquiry is for a good shop and about a fair price. Such a reply assumes that the querist will know a good shop when he sees it, and what is a fair price when the price is stated. A few questions to an old workman about paint-brushes and pencils will win you more information than any stranger's answer will help you to. But, in utilising your question for the benefit of others as well as yourself, it suggests a few remarks. It is nearly everywhere the rule for employers to find varnish brushes for workmen. All they are expected to find are the pencils for fine lines, stripes, or bands, a putty-knife, a stopping-knife, and a chisel-knife. The pencils are camel-hair, sable (red and brown), and ox-hair from the ear of the ox—nearly white hair—for some purposes. The ox-hair and camel-hair are mixed in pencils for striping. Coach-painters' pencils are known as "liners," as they are used for the lines on carriages, the hair being from 2 in. to 2½ in. long. The terms for sizes are by the quills in which they are held, the hand pencils being in goose-quills, stripe pencils in duck and crow-quills, and fine-line pencils in lark-quills. The short-haired pencils are known as the same, with the addition of the swan's-quill, for spot-work or carriage gear painting. These last an employer finds for his men. The prices of the "liners" are from 3d. to 1s. 10d. each. To try their quality, there is nothing better than drawing from the wet tongue over the lips, so as to saturate them with wet, and then spread them flat on a piece of glass with the fingers. They should feel free of knots, and, when flat, should be parallel-edged and square-pointed. In use they are not square-pointed by finely tapering; the flatting out on the glass makes them square-ended, where the separate hairs may be counted, so fine is the spread of the hairs under the fingers of the fine-liners. It is said of steel watch-springs, that they are dearer by weight than gold. These fine hairs of the Russian ox, sable, or camel are dearer than either by weight when mounted as pencils, and it may not be amiss to remark that gold intrinsically is a worthless metal compared to many others, or with such humble materials as hair, drugs, etc. Having bought your pencils—dearer than gold, some of them—you have to handle them with wood to suit the size of the quills. Soft cedar is a good wood for the purpose, as it is soft enough not to burst the quill when pressing it in. Be sure to file the part you poeket into the quill with a fine file; by holding the quill part in the mouth, or putting in warm water, it saves from splitting the quill; a little varnish on the dry point of the handle and in the quill cements them together. The putty and other knives are from 9d. to 1s. 6d. each. Just a word about taking care of pencils: you must not leave them in the paint-dipper for the paint to dry on the hairs; some paints are like glue, some corrosive. Wash them out with turpentine, wipe them dry, and draw the hair between the fingers as they hold a clean piece of hard tallow; spread the hair out flat and straight with tallow, enough just to make them stick to a bit of clean panel or glass, and put them thus into a small box or tray-draw. This tallow is easily washed off before using again. A good plan to compare prices is to get a price list from two or three makers. They will not vary much: the most intelligently written and illustrated one will doubtless commend itself to you. J. B. Smith, 117, Hampstead Road, London, N.W., issues a 42-page catalogue, fully illustrated, as do many other firms whose names I forget.—J. C. K.

**Book Sewing.**—One in Trouble.—Read the articles upon "Bookbinding" in Vol. II. of Work, where all instructions are given for sewing books. If you follow the details there given, you may be able to sew your volume.—G. C.

**Phonograph.**—The article on the above, with working drawings, will be published when space can be spared for it. I hope you will find them answer your purpose, and that you will be able to make the instrument.—W. D.

**Telephone.**—R. A. D. (*Forest Hill*).—From the meagre description you give it is impossible to tell what is the matter with your telephones. Your magnets may not be strong enough, or too near to, or too far away from, the diaphragm. Or the diaphragm itself may not be tightly clamped. You want a transmitter and battery to get good speaking results.—W. D.

**Enlarging Photographs.**—Nil Desperandum does not say if the photographs are paper prints or transparencies; in any case there is no necessity to injure them. If on paper, they must be fixed on a flat surface in a good light, avoiding reflections, and a negative made of them in the usual manner. If on glass—that is, glass transparencies—they must be placed so that a strong light is reflected *through them*. A large sheet of white cardboard is the best reflector, set at an angle of 45° behind the transparency—all other light except that passing through the transparency carefully shielded from the lens. A negative is now taken in the ordinary manner.—D.

**Whole-Plate Camera.**—H. B. (*Hammersmith*).—If you refer to the first volume of Work, you will find full instructions for making a whole-plate camera. The size you want is for plates, 6½ in. by 4¾ in. You can easily reduce that given to suit this measurement; you may make it somewhat lighter all through. If you can grasp the principle of the thing, you will have little difficulty. To give drawings, measurements, and text, would occupy too much space in these columns. You can get the metal and other fittings of Parks, 1, Orchard Buildings, Kingsland Road, N., and the lenses of any photographic material dealer; there are scores in London. The kind of lens depends very much on the kind of work required. The best kind of lens for general work would be either of the rapid rectilinear or symmetrical type. The portrait form is not suitable for anything else but portraiture, the field being too round. The size of the stand is very much a matter of taste—about 5 foot is an average height. You will find diagrams and descriptions of this also on referring to the back numbers of Work.—D.

**Roller Model.**—J. G. (*Aberdeen*).—The necessity for rollers or castors under heavy drawers is by no means so great as you seem to suppose, and to have them under drawers no larger than those in an ordinary dressing chest would be quite superfluous. As a matter of fact, your idea is by no means a new one, for I have known of similar contrivances being used for many years whenever required. The ordinary sash roller is far better for the purpose than the model you send, which, from a practical tradesman's point of view, is defective in many respects for general purposes. You will thus see that I cannot hold out any hope of your making a success with the article if you were to incur the expense of patenting it. In case you wish to try what chance you have with your roller in the open market, submit your idea to any of the Birmingham cabinet brass founders.—D. A.

**Water in Gas-Pipes.**—S. M. (*Kidderminster*).—From the fact that where dry gas meters are used there is seldom, if any, trouble about water in the pipes, I conclude that it is caused by a certain amount of water being brought into the pipes from the water that is used in a wet meter. Put a syphon in the lowest part of your pipes with a small tap, which, if turned off now and then, will remedy the defect.—R. A.

**Incubator.**—Chicks.—An article on "How to Make an Incubator" appeared in No. 89 of Work.

**Home-Made Furniture.**—S. C. (*Ashton-under-Lyne*).—You may send photographs of any of your home-made articles, together with descriptions of how you made the same. If suitable, publicity shall be given them.

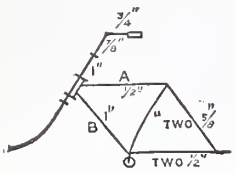
**Japanning Oven.**—E. H. (*King's Cross*).—The temperature of your oven should range from 260° to 300°. It is advisable to stove the ground colour first, and then put on the decoration, and stove again at a little less heat. For paints, japans, and medium for applying gold-leaf or bronze-powder, apply to Mander Brothers, Varnish Manufacturers, Wolverhampton; or to Wilkinson, Heywood, and Clark, Caledonian Road, N. Works: West Drayton, Middlesex. Either of these firms will supply your needs.—R. A.

**Ice-Cream Freezer.**—J. C. (*Belfast*).—It is a very simple affair, and consists, as you are perhaps aware, of a pewter cylinder with a bottom, and with a well-fitting cover. You do not state what size you require it to be, and not knowing your trade or what tools you have, it is rather a difficult matter to advise you upon; but, however, here goes. To make one 15 in. deep and 6 in. diameter, get a piece of pewter ½ in. thick (or a shade less will do), 18¾ in. by 15 in. If you can get a tinsmith to turn it round for you in his rollers, it will save you a lot of trouble; if this is out of your power, you can bend it round on a piece of iron pipe, 4 in. or 5 in. in diameter, or on a round piece of wood. Let the edges "butt" together—not "lap" them—and solder down the seam with a hatchet, soldering-iron, or a blow-pipe. Cut a circular piece, and solder in one end for the bottom; file off all superfluous solder, and scrape smooth. For the lid, cut out a rim 2 in. in depth, and long enough to go round the outside of the vessel just described; solder as before, and solder a similar circular piece to the one in the bottom; if you can hollow it up, it will look all the better. Then bend a piece of tin or lead pipe to form a handle, and solder it on to the lid, and the affair is completed. Finish up with glass-paper and a burnisher if you want it to look anything.—R. A.

**Telegraph Wires.**—Ned.—Lay the line wire in the groove of the insulator on one side. Pass one end of the binding wire over the line wire to the left of the insulator; form this part of the binding wire into a loop, and hold this in the left hand. Then pass the other end of the binding wire over the line wire to the right of the insulator, draw it tight, and then bring the line into the insulator groove on one side, whilst the binding wire is pulled tight into the groove on the opposite side. Pass the right-hand end over the line to the left,

and the left-hand end over the line to the right; pull both well into the groove, then twist the two ends together with a pair of stout pliers, and cut off the surplus ends. Each wire end in the $\frac{7}{64}$ cable must be separated and cleaned with emery cloth to the length of 2 in.; these cleaned ends must be spliced or twisted together, moistened with soldering fluid, and soldered in the ordinary way. Wipe clean with a rag, and bind the joint with tarred tape. After this is done, restore the outside insulating and protecting covering.—G. E. B.

**Light Roadster Bicycle.**—A WELL-WISHER OF "WORK."—The weight of tubing for a light roadster or racing machine would be all over 15 in. B.W.G., the thickest tubes would be 1 in., and smallest $\frac{1}{2}$ in. The spoke wire, if for direct spokes, would be No. 10, 11, or 12; if for laced or tangent wheels, No. 15 is heavy enough. Handle bar may be bent by heating to a bright red the part you wish to bend; grip the straight part in a vice—that is, the end part where the handle will be placed—and use the remainder for a lever; it will thus be readily bent. If the bend is somewhat quick, the part bent will incline to oval: this may be cured by hammering carefully on a smooth anvil. The only other bent tube is the seat tube, and it may be bent in the same way. See that as much of the tube as you wish to bend is heated at once, and equally. The sketch given above has marked on it the thickness of the various tubes composing the frame. Some diamond frames—such as the "Referee" and "Swift"—have the tubes A and B both $\frac{5}{8}$ in.; so it is a matter of choice. For an ordinary heavy roadster all the tubes would be $\frac{1}{2}$ in. heavier than indicated in the diagram.—A. S. P.



Bicycle Frame.

**Amateur Printing.**—ELEVEN.—Information as to the cost of requisites for this work may be had from the Model Printing Press Co., 3, Ludgate Circus Buildings, London, E.C.; or from the Birmingham Machinists' Co., Parade Iron Works, Birmingham. As he is something of an amateur workman, ELEVEN thinks that if he knew how to set about it, he might make a press for himself. I think so too, and will, if he wishes it, help him to full directions for constructing a small press.—S. W.

**Home-Made Camera.**—W. J. U. (*Leytonstone*).—An article on the above appeared in WORK, No. 70. It will probably suit you.

**Oilstone.**—RISHTON.—You would be able to procure the stone you require from Mr. R. Hickman, Worcester Street, Wolverhampton. I do not know of any book on the subject of cutlery.—T. W.

**Hinge and Catch.**—J. E. W. (*Camberwell*).—I have seen such spring hinges and catches as you refer to, but they are by no means common, and at the time of receipt of your letter I was unable to say where they could be obtained. However, as the result of inquiries among the cabinet brass-founders in Birmingham, I find that Messrs. R. Gardner & Co., 66, Granville Street, Birmingham, can supply you with them.—D. A.

**Medical Coil.**—A. B. (*Accrington*).—A series of articles on "Coils" is now in course of preparation. In these a medical coil will be fully described and illustrated.—G. E. B.

**Pipe Mounts and Ferrules.**—J. D. (*Dundee*).—To make an ordinary pipe mount, a plate of silver has to be prepared exactly the size, or perhaps a shade smaller than will fit tight round the two pieces that are to be joined by its means. The easiest way to obtain a pattern of suitable size and shape for this plate is by wrapping a piece of smooth paper round the place where the mount is to go, and very carefully cutting all the surplus away with a pair of scissors until one thickness of the paper is all round the pipe. If this is well done, due attention being paid to the straightness of the soldering seam and of the ends, then the silver can be cut to it exactly. The next thing to do is to get the plate flat, and then proceed to turn it up into a tube quite free from bruises or kinks. For this a "triblet" is required. It is nothing but a piece of smooth, round, tapering piece of iron or steel and a bending block, such as is figured in No. 41, page 648, Vol. I. of WORK. A mallet also may be necessary if the silver is thick; if it is not, then it will come up by the pressure of the hand almost; or, in place of block and mallet, a pair of half-round pliers will do if the silver be rather thin. For mounts of less than an inch in length, I should say size 6 Shakespear gauge would be plenty stout enough. The next step is to fit the soldering seam so that the two edges are quite level and true with each other; see also that no burr from the file is left before tying with wire. A scraper, made from a three-square file, is usually the tool used, but a knife will do as well. Should the mount be long, it would be well to file small nicks in the edges that form the seam (as shown in Fig. 1, *a a*), for the solder then holds better, and will not be so likely to open during the later operations it has to undergo. When fitted, it has to be tied with iron binding wire in such a manner that the edges of the seam are retained in their places during the operation of soldering. Wire should not be used too thick, as in cooling it will shrink, and may bruise the work. In most cases the tying of the wire will not be difficult, but it will be so when the mount is very taper (as in Fig. 1). Here there are means taken to prevent the binding wire slipping down, which, I think, needs no further explanation than the sketch. Many of the details of soldering are given in No. 37, page 588, and No. 46, page 732, of Vol. I. of WORK, so that can be passed over here, and we can proceed with the mount after it has been soldered and "pickled," and all pieces of unflushed solder filed away. The mount is sure to be more or less out of shape now, so we have first of all to get it true and smooth; this can be done pretty well on the triblet, previously spoken of, with a smooth-faced mallet. A lathe would be useful at this and at the polishing stages, but we are to do without it. So if the triblet and mallet or hammer will not get the mount smooth (and it will not if very thin metal is in use), then it will be worth while to get made a kind of ribbed burnisher (as shown in Fig. 2). I do not know that this is made and used generally, but with it it is quite possible to rub the thinnest of collars true and smooth. The size of it would be from 7 in. to 10 in. long, and about 1 in. wide; the thickness will be $\frac{1}{16}$ in, or thereabouts. An old flat file can be made to do capitally. The ribs or ridges should be quite smooth, and the size shown in sketch will do for their average size. The sketch shows only part of this tool, for I have not the presumption to ask for space to illustrate it at its full dimensions. Somehow or other we will suppose now that the mount is in shape, and fits the pipe; therefore we have but to smooth it up and polish it. It may need filing to remove hammer marks, etc.; if so, then get them out at once with the file. Do not depend on glass-paper or emery-cloth. These two

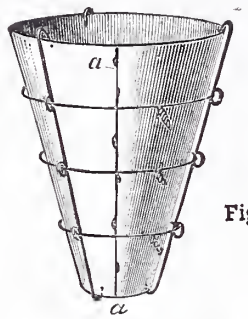
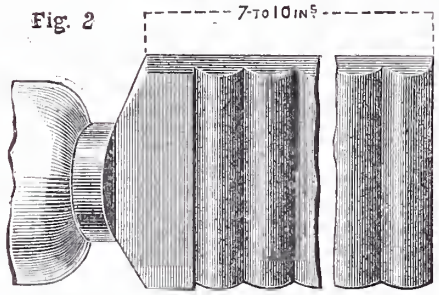


Fig. 1.

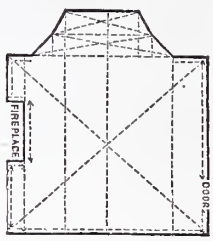
Fig. 2



Pipe Mounts and Ferrules. Fig. 1.—Mount. Fig. 2.—Ribbed Burnisher.

articles are very useful in their way, but they tend to make the corners rounding when they should be sharp. Either can be used after filing, but use the smoothest quality. The next thing is to polish the mount. The theory of polishing is a simple one. It is the application by friction of abrasive materials in stages of gradually increasing fineness. If that theory is understood, it will be easy for this correspondent or anyone else to make shift with materials to hand. Those I now speak of are the proper articles, a lathe not being allowed. As the mount we are to polish may be thin, and therefore likely to get out of shape, it will be best and easiest to fit a piece of wood to it, which will serve the double purpose of supporting it and of allowing it to be handled with comfort. The first thing used is a stick of water of Ayr stone; this is used with water, a damp sponge being employed to remove the mud-like stonings as they are produced. The next polishing material is powdered pumice-stone and oil; after that, crocus and oil (or rotten-stone or Tripoli powder and oil). Any or all of these are to be applied by means of buffs charged with them. A buff is merely a strip of buff leather (soldiers' belts), glued to a piece of wood. With these and plenty of elbow grease the mount will soon become bright and smooth. Next brush it with damp whiting (not too hard a brush, please), and then wash it in hot soda and water to remove every atom of grease and other polishing material. In rouging—tools, rouge, hands, all must be clean and free from grit. Use a buff at first; then charge the palm of the hand or ball of the thumb for finishing, thus using the skin as a finer kind of buff. After washing once more to remove any rouge there may be, the mount is ready for fixing on. Each material used must be entirely removed from the work before the next finest is used, and for that reason separate buffs are to be obtained. They only cost about 3d. each; and as for the other polishing materials, the water of Ayr stone, the crocus, and rouge can be obtained in three-pennyworths or thereabouts at any jewellers' material shop. Powdered pumice and whiting can be got at any oil-shop, for they are used in the household. There are other materials used, but these are sufficient for the present jobs. With reference to ferrules for the ends of sticks, the same set of processes has to be gone through; they are, however, less carefully finished. With reference to the plate at the end, which is to stand the wear—What is to be put in? Steel, iron, or only a thick metal plate? Whatever it is, pewter solder seems good enough to hold it. These ordinary ferrules can be bought so cheap that, except for practice, nobody would make them.—H. S. G.

**Carpet.**—WEST KENSINGTON.—Had you stated exactly where your difficulty lies, I could no doubt have done something towards removing it, but apparently you want to be told all about carpet planning, which really cannot be done in "Shop." It may be that you want to have a definite rule to go upon in all cases, a sort of "guide to carpet planning in a nutshell," and, to accommodate you as far as possible, the best advice I can give you is to use your common sense, and not to be afraid of taking all measurements with the greatest accuracy. Something near the mark will not do. Be careful to take not only the measurements along the walls, but take them from angle to angle wherever there is an opportunity of doing so. These will materially assist you when you proceed to set out the full-sized plan of the room—in fact, you cannot do without them. When measuring, take down on a sheet of paper a rough plan of the room, and mark in position the various dimensions. The carpet itself will be best fitted and made to a full-sized plan, which you can mark out on a large floor with chalk. To give you some idea of measurements, the small diagram which accompanies this will be useful. As it is necessarily on a small scale, the measurements are not stated. You will understand that the dotted lines must be measured, and, of course, round the walls. Experience only can teach a man to know exactly what cross measurements are absolutely necessary. As a beginner, you will find it better to take too many than too few. Act on the reverse of the saying, "When in doubt leave out," by putting in all that may assist you when planning the carpet, even though you find afterwards that some of it is superfluous. If you attend to this brief advice on a very wide subject, and use your brains, you will not make any very serious mistakes.—D. D.



Carpet Measure Plan.

**Potash Battery.**—VOLTAGE.—It is several years since I had anything to do with the battery made up of iron turnings and black potash, but I have some remembrance of its voltage being slightly less than the Leclanché—say, about 1·2 volts. The internal resistance of the quart size, when first made up, was a trifle less than that of the No. 2 Leclanché cell. It was simply a modification of the Bennett battery, black potash being substituted for caustic potash. Its chief merit lay in its low first cost, as it could be made up out of old tin pots, iron turnings, and scrap zinc.—G. E. B.

**Battery Carbons.**—OBLONG.—(1) Battery carbons may be made of very finely powdered gas carbon and wood charcoal sifted free from lumps and mixed in the proportion of four parts carbon to one part of charcoal. The mixture must be made into a stiff paste with a sufficient quantity of treacle, and pressed very tight into an iron mould, which must then be tightly closed, heated to a bright red, and allowed to cool slowly. When the mould is cool, take out the carbon plate or bar, soak it well in the treacle, place again in the mould, and again heat the mould to a bright red. Repeat this treatment until the carbon has been rendered sufficiently dense and hard. (2) Before attempting to cap the plates, see that the carbon is quite dry. Let the heads stand well above the tops of the cells, and paint them whilst still hot with a sufficient quantity of Brunswick black to soak well into every crevice beneath the head and down the plate to the depth of $\frac{1}{2}$ in. below the head. If you do this well, I think you will not be troubled with corroded heads. (3) I have not had any experience with baked manganese, but should think the process doubtful as a means of restoring oxygen to the partly exhausted manganese.—G. E. B.

**Water Power.**—A. B. (*London*).—Three gallons of water weigh 30 lbs., therefore the gross power at your disposal is 40 ft. × 30 lbs. = 1,200 ft.-lbs. per minute. As one horse power is 33,000 ft.-lbs. per minute, your gross power is equal to about one twenty-eighth of one horse power—rather less than half a man power. A small turbine will be the best motor for you to use; a good one will utilise about 75 per cent. of the total power, and so give 900 ft.-lbs. per minute, or one-third of a man power. The Index to Vol. II. is published and can be had, price 1d.—F. C.

**Solder for Albo-Silver and Aluminium Gold.**—V. T. (*Galley Hill*).—This correspondent says he cannot obtain satisfactory results with spelter solder. Now, in very many cases it is the lack of scrupulous cleanliness that causes difficulty with the proper fusing of solders. Is the borax clean, the water clean, the spelter clean, and the work well scraped?

Is the flame used to solder with a clear and not a smoky one? If all of these are answered Yes, then it will be the spelter solder that is in fault; so when next either alho-silver or aluminium gold is hought, the proper solder should be asked for. I have not had occasion to work the albo-silver, but the makers of that alloy (Messrs. Reading & Co., of Warstone Lane, Birmingham) tell me that they have a special solder for it, which is sold at 4s. per lb. For both of these alloys the ordinary silver solder that can be hought at jewellers' material shops will do all right—that is, if the aluminium gold which I have worked is the same as that you have. The proportions of aluminium and copper will very probably vary with every maker, so it is quite prohable that I may be wrong in your special case; hence it will he best to do as I say above—obtain the solder from the same place where the metal is bought.—H. S. G.

**To Clean Silver Filigree Work.**—E. B. (*London, E.*).—The only ways to restore the dead white surface to silver filigree are:—First, by having it put in the plating solution, when a fresh coat of fine silver can be deposited on the surface; or, secondly, hy annealing and pickling it. Tbis last process will hardly do with stock work, as in time the article would be destroyed through the gradual removal of the outer layers of silver, for it is hy refining the surface (taking all the alloy out, that is) that the pure silver coating is obtained. The means I take to make silver presentable is as follows:—Make whiting into a paste with a solution of half water and half liquid ammonia; then, for this class of work, I cover it completely with the paste, and leave it for a quarter of an hour or so; then wash thoroughly in boiling hot water, well rinse it also in boiling water, and then, without any exposure to the air, it is next to he covered up with hot clean hoxwood dust, until it is thoroughly dry, when a soft brush can be used to remove the sawdust. This diluted ammonia with whiting is a good thing to use with ordinary hright silver work, where a brush can be used to apply it. Of course, a hrush is hardly suitable here, as the work must be kept as dead as possible. If the filigree is made of really fine silver, then it might be worth while to try the Indian method, as described hy G. E. Gee, on page 142 of his "Silversmith's Handbook," as follows:—"Some juicy lemons are cut into slices; the silver articles are briskly ruhhed witb theso for a short time, and subsequeutly covered with them, being placed in a suitable vessel for a few hours for the completion of the process. For very delicate articles of jewellery, the natives cut a large lime nearly in two halves, into which they insert the work; the halves are then tightly closed up again, and placed aside for a few hours. When the article is removed, it is well rinsed in clean water, and consigned to a vessel of nearly hoiling soap-suds, wbere it is well brushed, again rinsed in fresh hot water, and finally dried on a metal plate placed over hot water; the process is rendered complete by a little gentle rubbing if the work be of a plain nature. Green tamarind pods are also employed hy them for the purpose of whitening silver, in the same manner as just described; they are great detergents of both gold and silver manufactures, and are largely employed by artisans in the East for the removal of oxides and fire-marks." In the above quotation, the drying of the articles does not seem to be so thorough as it will be if the hox sawdust is used, and is heated in a basin or other receptacle surrounded by hot water. The sort of thing best to use is something on the principle of a "Bain-marie pan," used in cooking, or else that of a glue-pot. Dry heat is too risky, for one can say good-bye to nice white work, if ever so small a portion of the boxdust gets burned. If the Indian method is tried, all metal tongues or joint pins will have to be taken out.—H. S. G.

**Geneva Watch.**—AMATEUR.—It is impossible to help you, as you give no particulars. Take it hack to the watchmaker who did it, and do not pay for doing it till it goes.—A. B. C.

**Current from Battery.**—A. M. (*Rochdale*).—If you have not a galvanometer to detect the current, you may still tell whether current is passing or not by the following simple device:—Connect two wires to the battery, one to each pole; clean the two free ends, and place them on your tongue; then bring the ends together on the tongue. If current is being given off from the battery, a sharp acid flavour will be tasted at the moment of crossing the wires, and this flavour will be sharper when the current is vigorous than when it is sluggish. You cannot feel the current in your hands. After mixing the acid with water, allow it to cool before placing it in the cells, then it will not "hurn away the zinc." Of course you know that the zinc must he coated with mercury before using it in a chromic acid battery. I do not know the depolarising liquid used by Dr. Gassner. Try soaking in Condy's fluid disinfectant. The copper wire is soldered to the top of the zinc cylinder. It is merely in place of a binding screw, but I prefer the screw.—G. E. B.

**Clock Designs.**—AN APPRENTICE MASON.—If you wait patiently, some designs for clock cases will be given. Freestone is scarcely to be recommended as a material for clock cases.

**Wire for Electric Bell.**—A. P. S. (*Heaton Chapel*).—The two bobhins 2 in. by ¾ in. will take about 92 yds., or about 9 ozs. of No. 24 silk-covered copper wire, and this will cost somewhere between 1s. 3d. and 1s. 6d. A papier-mâehé tube will do very well for the body of the bobbins when fitted with hard wood collars for the ends. Be sure to glue these on firmly, or the wire will push them off. Also have the tubes thin, so as to get the wire coils as closely as possible to the cores.—G. E. B.

**Sanitary Rail.**—MEDICUS.—A simple and effectual method of admitting fresh air into ordinary dwelling-rooms is shown in Fig. 1. It consists of a piece of wood fitted tightly in between the sash heads on top of the inside of window-sill, and secured hy small dowels at bottom and two blind holts on top, so that it can be removed for the purpose of cleaning windows, and that on raising the bottom sash 2 in. or 3 in., a current of fresh air is admitted between the meeting bars in the direction shown by arrows. The meeting bars of an ordinary

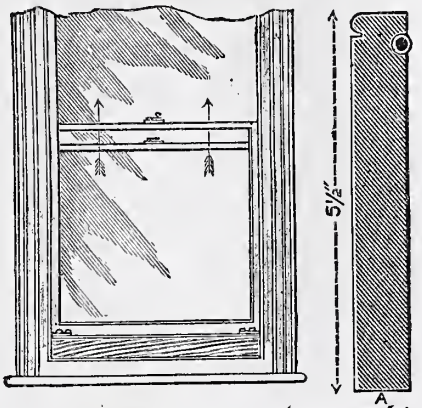
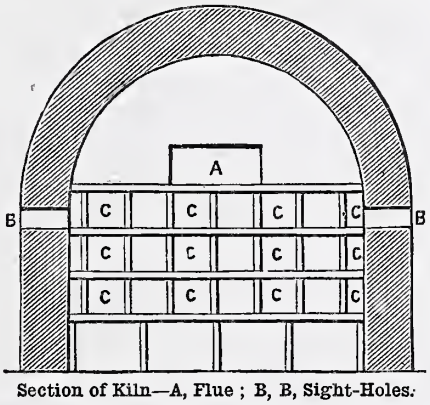



Fig. 1. Fig. 2.

Sanitary Rail.

hung sash being above 6 ft. high from the floor, and the current of air directed upwards, persons in the room feel no inconvenience. Fig. 2 shows the end view of rail with a piece of indiarubber piping inserted and glued in a hollow groove, against which the face of the hottom rail of hottom sash slides, and thus prevents a draught at this point. I generally put a similar piece of piping along the hottom of rail to make a good joint down on the bead at A. The ventilation of a room would be very much more complete with the addition of an outlet ventilator into the chimney, or any other convenient point as near the ceiling as possible, to ensure a thorough change of air by continuous circulation.—E. D.

**Kiln.**—ANTONIO.—The simplest method of building a kiln is to form a square or ohlong chamber, arched at the top; it should be lined with fire-hricks set in fire-clay, and backed up outside, or hooped with iron, to prevent it giving way from the heat. At one end a furnace with grate bars is formed, and having a vent over the door for the admission of air, with a sliding fire-brick lump to regulate it. Inside the chamber a number of spaces are formed




Section of Kiln—A, Flue; B, B, Sight-Holes.

of fire-brick, and covered with fire-brick lumps set in fire-clay. The figures are placed in each alternate space, and the flame and heated air from the furnace are arranged to pass through between each space occupied by the articles to be fired. The sketch above is a section of the chamber, the spaces marked C,C,C, containing the articles; and the flame passing through the remaining spaces, and escaping at A into the chimney. The chimney should he 20 ft. or more in height, so as to have a good draught. The fire is put away slowly at first, till the kiln is heated throughout; it is then urged to the requisite heat for burning the articles, which is tested by having pieces of clay put in at the sight-holes, B, B, at each side: these are examined from time to time till of the required degree of hardness. The sight-holes are covered by fire-brick lumps, and the draught is regulated by admitting more or less air over the furnace door. As soon as the articles are sufficiently hurnt, all the openings are closed up, and the kiln allowed to cool gradually. If you only have a few articles to burn, you will find it more economical to send them to some works to be burnt than to do it yourself.—M.

**Lacquering.**—A. B. (*London, N.E.*).—Lacquering can scarcely he called a "trade hy itself." I should think it might be more correctly called a hranch of the hrass-finishing trade, though there is this to he said ahout it: that in large establishments there are persons employed solely in lacquering. I am not aware of any classes for practising lacquering, nor of any hooks bearing specially on the subject. There is some information on the subject in Spon's "Workshop Receipts" (First Scries), which would be of use to you. With regard to the latter portion of your letter, where you ask, "Has one a chance of a job who has had some practice at filing and finishing and lacquering" hrass?—to this I can answer, Yes; such persons are frequently advertised for in the *Daily Chronicle* and other papers. My advice to you is to get into a good shop as improver, at whatever salary you can get, and make the hest use of your eyes and ears. You would then, if diligent, soon be capable of taking a hetter job.—R. A.

**Microscope: Where to Buy It.**—W. W. (*Wensley*).—See reply to B. G. F. (*Bristol*), and for trade catalogues, with prices of microscopes of every description, write to either of the following firms for catalogues:—Mr. E. G. Wood, 74, Cheapside, E.C.; Messrs. Watson & Sons, 313, High Holhorn, W.C.; Mr. J. H. Steward, 406, Strand, W.C.; Mr. J. Browning, 63, Strand, W.C.; or Messrs. Sands & Hunter, 20, Cranbourne Street, W.C. If you only require a very cheap microscope, I may tell you that Messrs. Lancaster & Son, Colmore Row, Birmingham, used to make up a cheap botanical microscope—one power, 1s.; two powers, 2s. 3d.; three powers, 3s. 6d.; table microscopes, mounted on three feet, from 2s. 6d. The same firm used to supply amateurs with a set of lenses for making a compound microscope with a power of 200 diameters, and a lithograph and instructions, 3s. 6d.; or the same with a power of 400 diameters, 5s. 6d., and power of 600, 7s. 6d. Set of achromatic lenses as above, with a power of 200 to 400, 10s. 6d.; or power of 600, 21s.—C. A. P.

**Books on the Microscope.**—B. G. F. (*Bristol*).—A cheap manual dealing with the microscope is published hy Mr. E. G. Wood, 74, Cheapside, E.C., under the title of "The Microscope: How Made and How Used," price 6d., post free, with a trade catalogue. If you require a more advanced work, you should get "Lancaster's Half-Hours with the Microscope," 2s. 6d.; "How to Choose a Microscope," by a Demonstrator, 1s.; "Objects for the Microscope," Lane Clarke, 3s. 6d.; "Handbook of the Microscope," Griffiths, 7s. 6d.; "Practical Microscopy," G. R. Davis, 7s. 6d.; "Hogg on the Microscope," 7s. 6d.; "Carpenter on the Microscope," 15s.; "How to Work the Microscope," Beale, 21s.; "Tuckett on the Microscope," 22s. If you want a trade catalogue, see above reply to W. W. (*Wensley*).—C. A. P.

**Filling Lamps.**—S. B. (*Upper Holloway*).—We have examined and considered sketch and description sent, and are of opinion that it is ingenious, practical, and likely to be useful if properly put on the market, but we cannot see our way to introduce it to the notice of anyone likely to join the inventor, as he would have to trust entirely to the *bonâ fides* and honesty of those treated with, who, when they know as much as the inventor, are too apt to think they can do without him, and in far too many cases take an unfair advantage of the information they have obtained. The only safe course we could advise would be to make a careful search at the Patents Office to see if there is anything of the kind recorded, and if not, then to lodge the provisional specimen, and so soon as it is accepted, he will then he perfectly safe in treating with anyone who may be disposed to join. We should hesitate to incur the responsibility of advising any person to treat for capital for an unprotected invention with anyone he does not know, and know well.—C. E.

**Electro-Motor.**—MAC.—As you have Mr. Bottone's book on "Electro-Motors: How Made and How Used," I need only direct you to its pages. On pages 29 and 32 you will find illustrations of a compact form of motor. The "Simplex" motor, shown on page 59, is also a compact form. If you wish to know how to make a small motor to run with current from one chromic acid cell, consult section 34 of the book, on pages 60 to 63. You will get very poor results, however, from a motor worked with currents from only one pint chromic acid cell. The zinc in a cell for driving a motor should have a surface area of not less than 16 sq. in., and three such cells should be provided. The poor results complained of are, I fear, due more to the workmanship than the design. I have described and illustrated in WORK a very neat and compact form of motor introduced hy Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham, who will supply the castings for 3s. 6d. Perhaps this may suit you, but it will not do any useful work—or, in fact, any work at all—with only one pint chromic acid cell.—G. E. B.

**Pocket Battery.**—J. K. (*Bury*).—When lead plates are used in making a pocket battery, the cells are charged with a mixture of sulphuric acid and water. There are pockct batteries that are not charged with liquid, such as the silver chloride and mercury chloride series of batteries, in which the negative element of silver, platinum, or carhon, and the positive element of zinc, is coated with a paste of the exciting salt. The Gassner is also a dry battery. Some of these are regenerative, and therefore may he classed among secondary batteries, but they are not furnished with lead plates. You will find an account of a pocket battery in the eighth of the series of papers on "Model Electric Lights"

published on pages 790 to 792, Vol. II. of WORK. —G. E. B.

**Fishing Rods.**—J. N. B. (*Liverpool*).—If you will look on page 802, No. 102, Vol. II. of WORK, you will see that the subject has already had attention. —D. D.

**Sideboard.**—E. A. P. (*Beckenham*).—For the purpose of selling the job, you might estimate the cost of material and the value of the time. Even though you have not kept an account of this, you have probably some idea, and it will be much fairer to base your charge on this than on an idea of the value from anyone who has not seen the job. If you and your customer cannot agree as to value, get a valuer to assess it.—D. D.

**Polish.**—J. T. (*Merthyr Tydfil*).—The simplest and best way of making French polish is, as has been several times stated in these columns, by simply dissolving shellac in methylated spirit in the proportion of about 6 oz. or 8 oz. to the pint. The cause of your dissatisfaction with the result of the polish you are at present using probably arises not so much from the resin it contains as from want of skill in applying it. The resin should not prevent a good gloss being obtained; and I take it that this is where your difficulty lies. You may use a filling if you like, but you will find it a very difficult and tedious matter to clean it out from corners. On this account fretwork is seldom filled by polishers. If you have not already fretted the wood, polish in the usual way as far as bodying in before cutting, and afterwards finish by spiriting off. If you do not care to take the trouble of polishing, go over the work with spirit varnish.—D. D.

**Improving One's Position.**—H. B. (*Dudley*).—Have your past services been of such a character to your employers that they may be induced to remove you into the main works as a reward for past services faithfully and intelligently rendered? If so, they may entertain a request from you, although it would best suit them to allow you to remain where you are. Could you do better by obtaining work in a small country wheelwright's shop, where you may gain a more general insight into a greater variety of work? I do not recommend you to try model making; but if you have made any articles worth showing them, it may help you by calling your employers' attention to them. There are other roads open to you. I have a young fellow near me who has been doing the rough woodwork in a brickfield for years, but has also learnt himself wood carving at home. Another one especially, who, until he was twenty-eight years old, worked as striker at a forge, and at forty was in charge of one of the best and most complicated machines in a large engineering shop; he, like all the others, was steady, clever, obliging, and would never be beaten.—WORKER BEE.

**How to Clean Brain Coral.**—W. A. P. (*Hackney*).—For a piece of rough coral with very delicate portions like this, the easiest way to clean it will be by using an acid, and dissolving away the present dirty surface—that is, if merely washing in hot water will not obtain the desired result. Either nitric, sulphuric, or hydrochloric acid (spirits of salts) can be used; but as I know the last is best, I advise using that. It does well with ordinary branch coral in the proportion of $\frac{1}{16}$ to $\frac{1}{20}$ acid to water. A minute or so of immersion should be sufficient to remove the very small depth of outside surface that is necessary. Unfortunately, I have no specimen of this coral by me to experiment with, but I should proceed as follows:—Make the mixture as given above, and dip an unimportant lower part or end, and see what the result is. Whether trying the whole piece or only a portion, be sure to have plenty of warm water ready for rinsing the whole piece, and so stop the action of the acid. It is easy to see if the acid in the water is present in sufficient quantity, for if it acts it shows that it is acting by giving off a stream of bubbles. The stronger the acid, the greater rapidity the bubbles are given off. In order not to complicate matters, see that there is no grease on the piece of coral. Washing in hot water will get rid of grease, particularly if a little soda be mixed with it. It must be well rinsed in hot water, with no soda, and shaken nearly dry before placing in the acid bath.—H. S. G.

**Tools and Machines.**—W. T. R. (*St. John's, Newfoundland*).—Section I. of "Shop" is specially designed for the expression of ideas interesting to readers of WORK. If, therefore, you have any tools or machines of novel character likely to be interesting to workers, by all means send us on sketches of them, with particulars of what they will do. All other readers are invited to note this.

**Rabbit Skins.**—W. B. W. (*Wolverhampton*).—Whatever you have to say to E. H. H. upon this subject you should say through the pages of "Shop," for the benefit of all readers.

**Wax-Polishing.**—BEACON.—If, as you say, you have tried wax-polishing and cannot do it, I am afraid you must give up all hope of ever being able to polish anything by any method, for it is the simplest there is. I am inclined to think you have omitted to use elbow grease with the wax and turpentine. As you say you cannot find anything about wax-polishing in WORK, let me refer you to page 826, No. 52, Vol. I., where you will find the subject has been fully treated by Mr. Denning. —D. A.

**Incubator.**—JAMES.—It is clear that your lamp-flame is insufficient. Try a circular burner: the kind known as "Kosmos" is the best, and is obtainable at any dealer's. Should you find the chimney too long for the case you have already made, you can easily shorten it by filing a "nick" all round at the required length, and then gently knock it off. It will not materially affect the burning of the lamp.—C. M. W.

**Bell Fittings.**—ANXIOUS H. F.—If you send four stamps to Messrs. Baughan & Co., Charlbury, Oxford, they will send you an illustrated list of electric bells and fittings, which also contains a short description of how to fix them. Perhaps you could obtain a list of cranks, etc., from an ironmonger in Sheffield. I do not know of any list out of the trade.—T. W.

**Fret Machine.**—SAWYER.—The "Companion" lathe and fret saw is a good one so far as value for money is concerned, but you must understand that from its small size its turning powers are limited. If you only want to turn small articles, it may suit your purpose. The fret-sawing attachment is useful, and is a good arrangement of its class of machine—viz., that with movable arms. If you contemplate doing anything but small work, I should recommend you to lay out a little more money than the figure you name, and buy a really good fret machine and lathe separately, as the ordinary combined lathes and saws are naturally only suitable for small light things. The fret machine I recommend to you is the Britannia Company's "Improved No. 8," and you could have a lathe attachment to it, though it is not usually sold with it. I am told that the Britannia Company are devising a special lathe attachment for the No. 8, so by the time you see this answer to your inquiry they may be able to give you all particulars if you write to them direct. Their endeavour is to supply a serviceable attachment for somewhere about a sovereign. Their fret machine having a heavy wheel, naturally there will be a proportionate increase in power for turning. If you prefer the "Companion" style of machine, I think you will find the "Goodell" worth the extra amount charged for it. It is in all essential features the same as the others. The cutting of wood you send is too small to tell the kind of timber, but it seems to be sycamore, though, as your local dealer did not know, it may possibly be some other kind. Perhaps the colour misled him. Any way, it is simply a piece of white or light-coloured wood dyed grey, and can easily be got from fancy wood dealers and fret supply stores. Ask for grey wood or silver wood. Yes, it can be French polished.—D. A.

**Bicycle Enamel.**—J. P. (*Bethnal Green*).—You should rub down the parts of bicycle to be painted with emery-cloth or glass-paper, then wipe clean with a cloth; then procure Club hard drying black enamel, and apply it evenly with a flat brush about $\frac{3}{4}$ in. broad; cover as much as possible with each brushful, as it dries quickly, and, if possible, do not go over the same part twice. The enamel may be had in most cycle warehouses; bottle and brush, 1s. If you mean stone enamelling, you had better give it up, as the apparatus would cost you about £10, not to speak of considerable experience.—A. S. P.

## III.—QUESTION SUBMITTED TO CORRESPONDENTS.

**Hoop Rollers.**—A. L. (*London, W.C.*) would be obliged if some reader would give sketches and instructions to make rollers (about 12 in. long) suitable for bending hoops of tin or thin plate iron.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Violin Making.**—NO NAME (*Manchester*) writes, in reply to J. E. (*Chatham*) (see page 814, Vol. II.):—"For the *wood* required, get the best well-seasoned log pine and sycamore from any respectable dealer. All the *tools* required may be procured of George Buck, 242, Tottenham Court Road, London, W. For the *varnish*, he will get a good violin varnish by applying to James Whitelaw, chemist, 496, St. George's Road, Glasgow. Follow religiously the articles on 'How to Make a Violin,' which began in WORK, No. 105."

**Browning Gun Barrels.**—P. J. R. B. writes, in reply to C. B. F. (see page 734, Vol. II.):—"Try the following: Wet a rag with antimony chloride, dip it in olive-oil, and rub the barrel with it. In about forty-eight hours it will be covered with a kind of rust. Brush it with a scratch-brush, and polish with a little oil."

**Hand-Power Sawing Machine.**—M. (*Bishop Auckland*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"You can get a hand-power saw bench, with iron frame and table, 6 ft. by 2 ft., from Messrs. J. Carter & Co., New Bailey Street, Manchester, for £10 10s., to cut up to 3 in. thick; they also supply saw spindles, etc. If you write to them, they will most likely supply you with what you require."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. H. Y. (*Battersea, S.W.*); G. G. (*Portsmouth*); C. S. (*London, N.W.*); DERNAX; LEGHORN; ANXIOUS (*Shepherd's Bush*); F. W. M. (*Clerkenwell*); E. S. (*Liverpool*); H. A. K. (*Bedale*); MOTOR; W. B. (*Longton*); C. B. (*London, E.C.*); B. A. W (*Croydon*); CLARIONETTE PLAYER; G. J. F. (*Chiswick*); J. B.; BIRD FANCIER; J. D. (*Poplar, E.*); BOWTON LAD; E. G. (*London, N.*); F. F. (*Leeds*); A. R. (*Blairgowrie*); A. J. T. LE G. (*Guernsey*); A. E. (*Leeds*); N. M. (*Sheffield*); ENGINEER; J. J. W. (*Hartlepool*); J. W. M. (*Ashton-under-Lyne*); F. P. (*Leeds*); J. C. (*Halifax*); A READER; J. B. (*Durham*); T. H. (*Stafford*); G. A. (*Edinburgh*); H. R. P.; H. S. P. (*Nottingham*); READER; S. S. (*Salford*); I. H. T. (*London, S.E.*); W. B. (*U.S.A.*); F. W. M. (*Preston*); N. N. (*Lancaster*); J. W. M. (*Duffield*); J. S. O. (*Weston-Super-Mare*); ARSENAL; PRETORIA; W. I. (*Lawrencekirk*); J. N. (*Cork*); T. R. B. (*Wandsworth*); SINE CERA.

## Trade Note.

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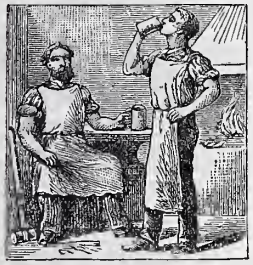

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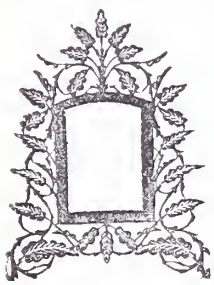

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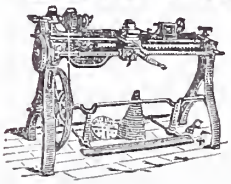

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# WORK

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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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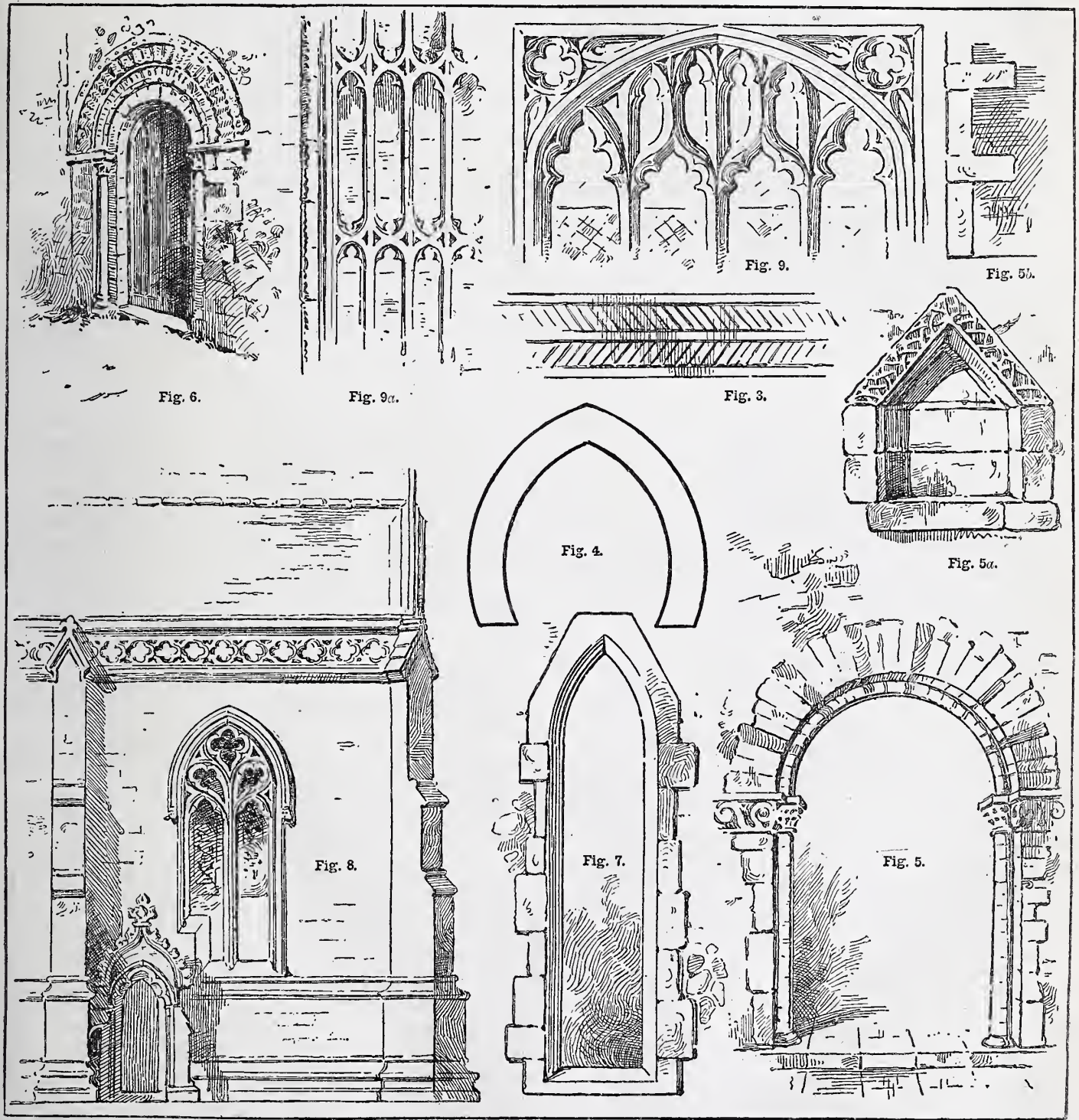



MASONS' WORK. Fig. 3.—Herring-Bone Work. Fig. 4.—Moorish Arch. Fig. 5.—Anglo-Saxon Style: Semicircular Arch. Fig. 5*a*.—Triangular-Headed Arch. Fig. 5*b*.—Long and Short Work. Fig. 6.—Norman Style: Doorway. Fig. 7.—Early English Style: Lancet Window. Fig. 8.—Decorated Style. Fig. 9.—Perpendicular Style: Window. Fig. 9*a*.—Wall Panelling.

# MASONS' WORK.

BY MUNIO.

ANCIENT MASONRY—COMPONENT PARTS OF FIVE ORDERS OF ARCHITECTURE—BASE—SHAFT—CAPITAL—ENTABLATURE—STYLOBATE—PEDIMENT—GREEK AND ROMAN MOULDINGS—BYZANTINE AND ROMANESQUE STYLES—MOORISH STYLE—ANGLO-SAXON—NORMAN—EARLY ENGLISH—DECORATED—PERPENDICULAR—DEBASED—GOTHIC—VARIOUS STONES USED IN MASONRY—WEIGHT AND CRUSHING STRESS OF STONES.

**Historical Styles and Stones in Masonry.**—Masons' work is the art of dressing or cutting stones, and of setting or fixing them together in masses to form various kinds of buildings.

The art must have attained to great perfection at a very early period, as evidenced by the remains of cities, temples, etc., built by the ancient Egyptians, Assyrians, Persians, and other nations of antiquity.

The masonry of these nations was characterised more by gigantic proportions and profuse decoration than by what we term elegance of design. Immense blocks of stone were used. The obelisk now standing on the Thames Embankment, and known as Cleopatra's Needle, is an Egyptian stone.

The Greeks passed from these gigantic forms, and built their temples with great elegance and dignity. We are indebted to them for three of what are now known as the five orders of architecture—the Doric, the Ionic, and the Corinthian.

The following terms are used to denote the component parts of the five orders:—The lower part of a column is the base, the middle part the shaft, and the upper or ornamental part the capital. The entablature is the horizontal portion resting on the top of a range of columns. Its lowest portion is called the architrave, the middle portion the frieze, and the upper or projecting portion the cornice. The lower portion of a base or pedestal of a column is called the plinth, the middle portion the die, and the upper portion the surbase.

The stylobate is either a platform with steps, or a continuous pedestal supporting a range of columns. A pilaster is half a column attached to a wall, and is sometimes rectangular.

A pediment is a triangular gable over a range of columns, with a cornice; the portion under the cornice is called the tympanum.

The mouldings used by the Greeks are shown in Fig. 1. A is the fillet, B the astragal or bead, C the cyma-recta, D the cyma-reversa or ogee, E the echinus or ovolo, F the cavetto or hollow, G the scotia, H the torus.

The Greeks called their random walling opus incertum; walls formed in regular courses were called isodomum; and walls faced with regular courses, but filled with rubble, were called emplectum. They also used a kind of walling called reticulatum, formed with square stones laid diagonally.

The Romans absorbed the three Greek orders, and added two more—the Tuscan and Composite. The Roman mouldings are shown in Fig. 2, and are named the same as the Greek. The Romans used courses of thin tiles in some of their walls, and in others the stones were laid in a sloping form, called herring-bone work (Fig. 3). The Romans were the first who made use of the arch to any extent; as, although arches have been found at Nineveh and Thebes, these nations did not make much use of it in construction—they usually covered their openings with large stones.

A curious dome-shaped building was found at Mycenæ, in Greece, in which the stones forming the arch have level beds, the ends being projected, and cut to the curve on the under side. It is most probable that we are indebted to the Romans for the introduction into this country of what may be termed scientific masonry.

After the time of Hadrian, the art began to decline among the Romans. When the Empire was divided, the art which was practised at Constantinople was called the Byzantine style, while that practised in the

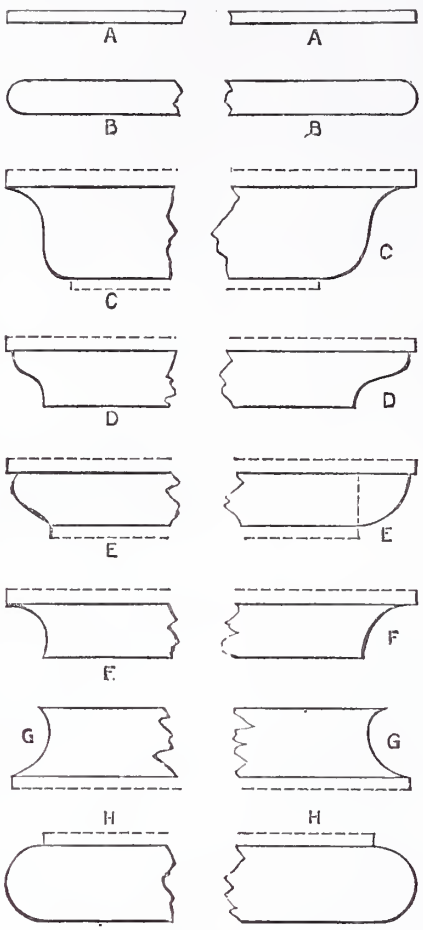



Fig. 1.—Greek Mouldings.




Fig. 2.—Roman Mouldings.

Western Empire was called the Romanesque style.

The Moorish style was that adopted in Spain by the Moors and Saracens. It is known by the peculiar shape of the arch (Fig. 4), by the slender spires or minarets, and by the flowery decoration termed arabesque work.

After the Romans had left this country, and it had been subdued by the Saxons, the style of building which prevailed from the close of the sixth to the middle of the eleventh century was called the Anglo-Saxon style. The semicircular and triangular-headed arches were used, also the peculiar arrangement at the quoins called "long and short work"; the windows and doorways were very low and narrow, and the walls very thick (see Fig. 5).

From the middle of the eleventh to the latter part of the twelfth century, the Norman style prevailed. This is known by the massive pillars and semicircular arches. The doorways were large, and deeply recessed, the arches in the latter period being carved with zigzag and other mouldings (Fig. 6).

Succeeding this style, and extending to the end of the thirteenth century, was the Early English style. This is known by the pointed arch. The piers were formed of numerous slender shafts clustered together, the capitals being carved with foliage. The windows were arched with pointed arches, single ones being termed "lancets." Sometimes three or more were grouped together, gradually rising to the centre. The doorways had moulded arches with a projecting hood mould or dripstone (Fig. 7).

At the end of the thirteenth century, by a gradual and imperceptible progression, the Early English merged into the Decorated style, which existed to the end of the fourteenth century. In this style a greater profusion of ornament was introduced. The windows were large, and divided by slender shafts of stone called "mullions," which in the heads were formed into geometrical or flowing figures called "tracery." The doorways were more ornamented, and pediments and pinnacles with projecting ornaments called "crockets" were used. It is generally considered to be the most beautiful style (Fig. 8).

During the fifteenth century a more elaborate style, called the Perpendicular style, prevailed. The windows were large, and the geometrical tracery was superseded by vertical mullions in the heads. The doorways were covered with low, pointed arches, with a square hood moulding over them. The walls, both on the interior and exterior, were covered with panelling in stone. Elaborate roofs of what is termed "fan vaulting" were used, as at Henry VII.'s Chapel, Westminster, and King's College, Cambridge (Fig. 9). During the latter period of this style, the Elizabethan or Tudor style and the Jacobean style were used in domestic buildings.

Succeeding this was the Debased style, which existed till the beginning of the seventeenth century. This style shows a gradual decline, and was much inferior to those preceding it. At the beginning of the seventeenth century pointed architecture appears to have died out, and was replaced by Italian or classical architecture, as practised by Sir Christopher Wren and others.

The term "Gothic" was applied about the end of the seventeenth century to the mediæval architecture as a term of contempt, by Wren and others.

In the early part of the present century, what is known as the Gothic revival set in, since which time some excellent works in masonry have been executed.

**Stones Used in Masonry.**—The stones used by masons are the freestones, which are obtained from the coal measures in various parts of the country. These stones vary in colour from nearly white to dark brown; in texture from the finest and close-grained to very coarse or open-grained. Some are very soft, but harden by exposure, while others are very hard when quarried. Some are laminated, and are made into landings, flags, etc.; while in others the beds are hardly distinguishable. The following are some of the principal quarries:—Craigleith, near Edinburgh; Prudhoe and Benton, in Northumberland; Pensher and Dunhouse, in Durham; Park Spring and Bramley Fall, in Yorkshire; Hollington, in Derbyshire; Mansfield, in Notts; Forest of Dean and Painswick, in Gloucestershire; Doulting in Somersetshire, etc.

Stones from the Lias formation are

quarried near Whitby and other parts of Yorkshire.

Limestones are quarried at Ham Hill, Chilmark in Wilts, and Barnack. Magnesian limestones are quarried at Park Nook, Roach Abbey, and Bolsover. The new red sandstone is quarried at the Minera quarries in Denbighshire; the old red sandstone in Cumberland and Westmoreland.

From the upper Oolites are quarried Portland and Purbeck stone. There are two kinds of Portland stone—the brown, which is a weather stone, and the white, which is only suitable for interior work. The Ketton, Ancaster, Clipsham, and Casterton stones are also from the same formation.

From the lower Oolite is obtained the Bath stone. The numerous quarries of this stone are now worked by one company, called the Bath Stone Firms. There are eight different varieties of this stone: the Corsham Down, used for sculpture and mouldings; Box Ground, for exterior work of all kinds; Farleigh Down, for partition walls and face work; Corngrit, suitable for weight-bearing purposes, as columns, also for landings and staircases. Stoke Ground, Winsley Ground, Westwood Ground, and Bethel, are suitable for general purposes not too much exposed, and for interior use.

Caen stone is imported from Normandy for interior use, but it is now nearly superseded by Bath stone.

Granite is obtained from Scotland, Cumberland, Wales, Devonshire, Cornwall, etc.

Kentish rag is a limestone, and is obtained from the Greensand.

A basaltic stone of blue colour is used in Cumberland and Westmoreland for walling, called "ragstone."

Freestone is generally composed of siliceous grains or quartz, cemented together by siliceous, argillaceous, or calcareous matter.

Limestones are composed of carbonates of lime and magnesia, mixed with silica and alumina.

Oolites are composed of oviform bodies, cemented by calcareous matter of various kinds. The granites are composed of quartz, felspar, and mica in various proportions.

The selection of stones for masons' work requires great care and consideration. They should be able to resist the action of a smoky atmosphere, of moisture, wind, rain, and frost. Stones used in the vicinity of where they are quarried often stand the weather better than when used in a large town.

It has been found, by experiment, that stones which have the greatest specific gravity possess the greatest cohesive strength, absorb the least quantity of water, and disintegrate the least by the action of the weather.

Freestones absorb less water, but disintegrate more than magnesian limestones.

The stones should always (except in certain cases) be set on their natural or quarry bed. Some stones also require to lay for a certain time to "weather" before being used, while others may be used direct from the quarry.

The weight of a cubic foot of freestone is from 130 lbs. to 160 lbs., and its crushing stress from 4,000 lbs. to 8,000 lbs. on the square inch. Portland stone weighs 147 lbs. per cubic foot, and its crushing stress is 3,200 lbs. per square inch. Limestone weighs 170 lbs. to 180 lbs. per cubic foot, and its crushing stress is from 3,000 lbs. to 8,000 lbs. per square inch. Bath stone weighs 123 lbs. per cubic foot, and its crushing stress is from 1,800 lbs. to 2,000 lbs. per square inch. Granite weighs 160 lbs. to 170 lbs. per cubic foot, and its crushing stress is from 5,000 lbs. to 12,000 lbs per square inch.

In some districts flints are used for walling. They are generally walled in frames fixed to the thickness of the wall, the angles being formed with stone or bricks; they are sometimes walled rough and plastered on the face, and sometimes split, squared, and jointed.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

Position of Rider in Relation to Handle Bar and Pedal Shaft—Steering—Relative Position of Saddle, Handles, and Pedal Shaft—Steering Line in Relation to Forks—Position of Saddle—Double Adjustment of Handle Bar—Pneumatic Tyres—Cushion Tyres.

There is great divergence of opinion among cyclists with regard to the proper position of the grip handles in relation to the saddle, and the position of both in relation to the pedal shaft. Controversial letters are continually cropping up in the cycling journals on this vexed question. If these wranglers would consider for a moment that what suits one does not suit another, they would speedily set the matter at rest. Build and adjust two machines exactly alike in every particular, and mount two riders of the same height and length of limb; as like as not, they will disagree as to the adjustment, simply because the two men are not built alike in every particular. The two men do not walk alike, neither can they be expected to ride alike, and each must adjust the machine (if it is capable of adjustment) to suit himself.

The forward point, or nose of the saddle, is usually the point from which all the positions are taken. Now, in the case of an ordinary bicycle the nose of the saddle is from 2 in. to 3 in. behind a line drawn through the grip handles; then the axle, with its cranks, may be 2 in. in advance of this line through the handles; consequently, the axle to be turned by the feet is from 4 in. to 5 in. in advance of the nose of the saddle. Now, this condition of things suits the majority of riders of the ordinary, but not all. Some would have their pedals vertically under the middle of their saddles, which would be some 9 in. behind the adjustment given above, and, of course, they cannot get it on an ordinary. They may get it on a "Facile," which is worked by levers projecting backwards; but it cannot be called an ordinary—it is a cross between the ordinary and the equal-wheeled safety.

Now, if a certain adjustment of saddle and handles in relation to the wheel centre in an ordinary is found to be good by the majority of riders, there is no reason why the same positions should not be good in a safety; but I have never yet seen a safety so adjusted. The saddle may be placed well enough in relation to the pedal shaft, but the grip handles, instead of being placed 2 in. in advance of the saddle nose, are from 8 in. to 12 in. in advance; consequently, the rider has to stoop forward in order to grasp his handles.

The leisurely rider of the ordinary sits bolt upright in his saddle, with his arms down by his sides, and grasping his handles comfortably and naturally, on a line passing across at the angle of his trunk with his legs.

The safety rider is debarred this easy, natural position, and sits—or rather, lies—with his back arched, as if he were searching for something over his front wheel. Natural bicycle riding should be assimilated to natural walking. Let anyone try how far he will walk comfortably leaning forward at an angle of 45 degrees.

Most safeties are constructed so that the nose of the saddle will touch a line rising vertically from the centre of the driving spindle, or bottom bracket, and the saddle and spring, being mounted on an L-pin, are capable of being adjusted several inches backwards or forwards. Now, suppose the saddle is as far forward as it will come, the rider mounts, and finds it is all right in relation to the grip handles, but it is too far forward in relation to his pedals. He sets the saddle back 3 in., and finds a great improvement in relation to his pedals. But what is the result in relation to the grip handles? Simply that he is 3 in. further away from them, and has no means of bringing them back, for no safety, so far as I am aware, has the means of adjusting the handle bar horizontally; the only adjustment being vertical, or rather in the direction of the steering post. Now this is where the difficulty of a careful adjustment all round exists in the safety, and until makers remedy this, the machine cannot be said to have arrived at what may be called perfection. To adjust the handle bar horizontally is by no means a difficulty, as I will have occasion to show by diagram a little further on.

Another vexed question is the steering of safeties. The ordinary may be steered by the feet alone, because the feet have control over the steering wheel; but in the safety the feet have no control over the steering wheel whatever. The safety is the most tricky machine of any to steer, being constantly liable to wobble; very few racers even can steer without wobbling in a manner never seen on an ordinary. But all safeties are not tricky alike, any more than all row boats are not crank alike, and this is by reason of their build. In the case of the safety, the set of the front fork and steering post have much to do with the steering, and when these are skilfully set, the difficulty of steering is much reduced, and riders with much practice can steer some makes of machines for considerable distances without touching the handle bar.

Accompanying this paper is a line diagram, intended to show the relative position of the saddle with handles and pedal shaft. It will also be a clear guide in making a full-size drawing of the machine, securing, as it will, the relative positions here indicated. A, A, Fig. 2, are two 30 in. wheels; their distance apart, or the space between their runs, is 12 in. In this space is the pedal shaft, B, 3 in. clear of the rear rim, and 12 in. above the ground line. Now, taking the fore, or steering, part of the machine, we draw the line C D, which is a vertical line, from the centre of the wheel to the ground line, the wheel having contact with the road at the point D. Now from the centre of the rear wheel we draw a line E F, and 4 in. above the periphery of the front wheel, at E. Next we draw a line at right angles to E F from C, passing through E; this latter will be the steering line if the forks are straight. Three inches further back is another line, G H, parallel to E C. This is the steering line if the forks are curved, and the amount of curve 3 in.; so that this diagram serves for

either straight or curved forks. It will be observed that the straight fork machine will have a backbone or frame that is 3in. longer than the other, with curved forks.

Now I have to call particular attention to the steering properties of these two forms of forks. It will be observed that the line of the curved fork, G H, falls on the ground line in advance of the vertical line C D, and that the line of the straight fork, C E, prolonged to J, falls in advance of H. H is $4\frac{1}{2}$ in. in advance of D; and J in advance of H 3 in., or $7\frac{1}{2}$ in. in advance of D. The point of resistance being at D, the machine will steer better if made with straight forks, the distance between the point of resistance and the line centres being greater by 3 in. than if built with curved forks.

Now, with regard to the position of the saddle, it will be seen that in the diagram the nose of the saddle touches a vertical line rising from the pedal axle centre. For a rider with a 32 in. leg, the saddle would be 36 in. high. The L-pin should have each arm 6 in. long, and the vertical arm being placed 3 in. behind the vertical line rising from B, the saddle would thus have a travel for adjustment of from 5 in. to 6 in. The nose of the saddle at its forward limit would be 3 in. in advance of the vertical line, and set back to its limit, would be about 3 in. behind said line, which adjustment would be found ample for all riders, unless those who, if they cannot find a fault, will make one. Of course, the saddle has the usual vertical adjustment, to suit different lengths of leg. The position of the handles is here shown 3 in. higher than the saddle, and their rear ends are brought back to a line with the saddle nose. This is about as they would be in an ordinary. The rider could sit upright, and manipulate the steering with grace and freedom, whereas he is usually condemned to sit with arched back and twisted neck, in anything but a graceful position, unless, perhaps, in a race, when it is "sit as you please."

Now, it will be noticed that while the saddle has both vertical and horizontal adjustments, the handle bar has adjustment in one direction only—that is, in the direction of the line G H. Makers should set about giving a double adjustment to the handle bar, when they would find the improvement much appreciated.

The diagram (Fig. 3) will show how I propose effecting this desirable end. The steering tube remains unaltered, but the part usually affixed to the handle bar is detached from it, and has, on its upper end, a boss, which is a steel casting made from a pattern. The tube *b* is brazed to this casting. This casting, *d*, has a hole through it to receive the T-piece, *c*, of the handle bar; this T-piece is $\frac{7}{8}$ in. thick, same as the tube *b*, which slides in the steering tube *a*. The hole through *d* is $1\frac{1}{2}$ in. long, and the part *c* is 6 in. long, so that it is capable of an adjustment of $4\frac{1}{2}$ in. The handle bar, with its T-piece, is fixed by a set screw through the side of *d*, similar to that fixing *b* in the steering tube. The casting *d* is made so that the hole for the T-piece will have an angle, in relation to the part *b*, the same as the angle of steering post or the line G H in Fig. 2; so that the handle bar, with its T-piece, will be level, as shown by the line in Fig. 2, so that in adjusting the handles horizontally the height will not be altered.

This double adjustment of the handle bar involves some alterations of the brake work, but that is a matter that is easily overcome by the clever mechanic.

By a reference to the machine illustrated in the first of these papers, it will be noticed that the handle bar has not this horizontal adjustment. I have shown it here because I consider it a desirable improvement. It is not a patent; and the mechanic who elects to build his own safety is free to adopt it in preference to the usual pattern, as in Fig. 1 (page 33). The same may be said with regard to the two styles of steering forks mentioned in this paper. The illustrated machine shows curved forks, and the line G H is the centre of said forks (see Fig. 2). So the mechanic, whether he chooses curved or straight forks, will find this diagram (Fig. 2) equally serviceable. In following papers, however, wherein the practical construction of the machine will be described, we will hold strictly by the pattern illustrated (Fig. 1), and let those who choose adopt any suggested improvement upon it.

It will be further noticed that the machine illustrated has the ordinary solid tyres, notwithstanding the present rage for pneumatic and cushion tyres. To believe the advocates of, and especially the dealers in, these tyres, one would imagine that a solid tyred machine would be unsaleable immediately.

The pneumatic tyre is made from thin rubber, and filled with compressed air. When blown up, it may be from 2 in. to $2\frac{1}{2}$ in. in diameter, and is certainly not elegant in appearance. It is, without doubt, better than the solid tyre for comfort and easy running, but it is so liable to accident that I cannot but think it will not hold the field for long. Cushion tyres are made from 1 in. to $1\frac{1}{2}$ in. diameter. They have a hole cored out throughout their whole length. This lightens them, and gives them greater elasticity. They are said to be a great improvement over the solid tyre. Personally, I have not tried them, and cannot speak with confidence of their advantages or otherwise. They have, at any rate, caused a revolution in the making of the materials for bicycle construction, as special rims have got to be made for them, wider fork crowns, and flatter and broader mud-guards. The brake spoon has also to be carefully made and adjusted, else it will cut the tyre, which is simply a hollow tube. They have to be made of the best rubber; hence the price is high, and a deterrent to those with a limited purse.

The cushion tyre may hold its own alongside of the solid, but I do not think it is

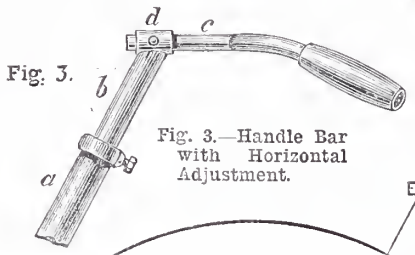



Fig. 3.—Handle Bar with Horizontal Adjustment.

Fig. 2.—Line Diagram showing Handle Bar and Pedal Shaft and Steering Line, with Straight and Curved Forks.

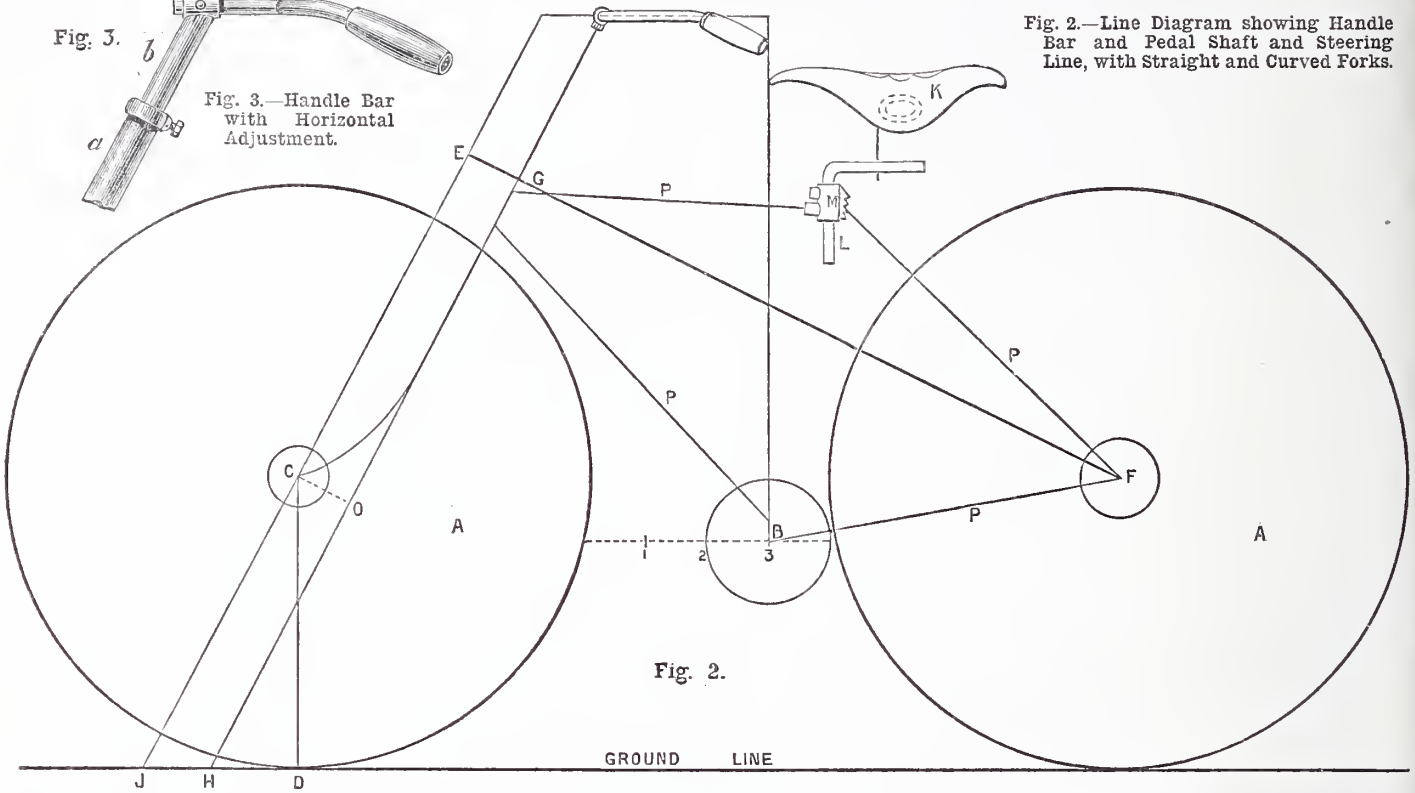



Fig. 2.

likely to supersede it, as a first-class safety, with, say, ⅞ in. solid tyres of best rubber, is about as good a machine as anybody could desire, and much less likely to get damaged and rendered unserviceable when, perhaps, hundreds of miles from home.

My next paper will deal with the materials required for the bicycle, such as stampings, castings, and patterns for castings, tubes, forks, etc., and where best to procure them, with their prices, according to present lists.

## EAR-RINGS AND OTHER ORNAMENTS FOR THE EAR.

### PRINCIPALLY WITH REFERENCE TO THEIR MODES OF ATTACHMENT.

BY H. S. GOLDSMITH.

EAR-WIRES OR SLEEPERS—ANCIENT EAR-WIRES—EAR-RING HOOKS—HOOKS AND CATCHES WITH AND WITHOUT JOINTS.

*Ear-Wires or Sleepers.*—These are the first and simplest form of ear-rings now in use. They are usually made of plain round or facetted—that is, lapped—wire. Fig. 10 B shows the details of the way they are made, although Fig. 10 A is about their usual size.

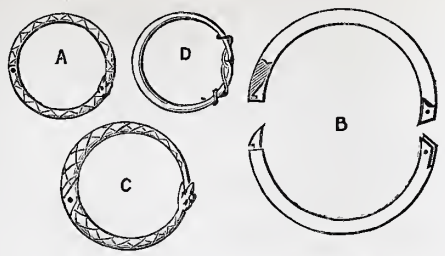



Fig. 10.—Ear-Wires—A, Ear-Wire or Sleeper, ordinary size; B, Details of same, enlarged; C, An improved shape of same in form of Serpent; D, Antique way of making an Ear-Wire.

In these the hardness of the gold itself acts as the spring to keep the catch in its place, and as a rule we find that they are very well and skilfully made, particularly when one considers the very low price they are sold at.

Fig. 10 C is exactly the same sort of thing, but here a more ornamental shape is given to it, and one that is very suitable too: as all our ornamental forms should be. You will notice that it is a serpent, with its tail in its mouth, and it will be, perhaps, just as well if mention is made of the mechanical advantages this shape puts us in possession of.

First, the head is broader and deeper, therefore stronger, and better suited to take the catch. The catch which is rightly formed out of the tapering tail gives us the chance to make it just as thin as we like to have it, for it has to pass through the ear. Now for the joints, which are generally the weakest part of these "sleepers." What have we to say here? Why, that as the body thickens the part where the joint is, we, of course, get greater strength.

Taken as a whole, Fig. 10 C shows thought, and is an excellent example of obtaining all mechanical requirements in a high degree, combined with the other quality that jewellery should possess: namely, be ornamental.

Our friends the ancients managed this class of ear-ring very easily, and strictly correct from an artistic standpoint: at least, so we are taught, for the very merit the material (fine gold) possesses most of—namely, ductility—is here used, as we shall see.

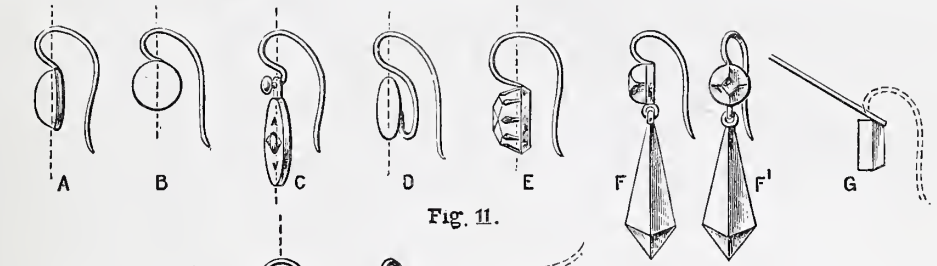



Fig. 11.

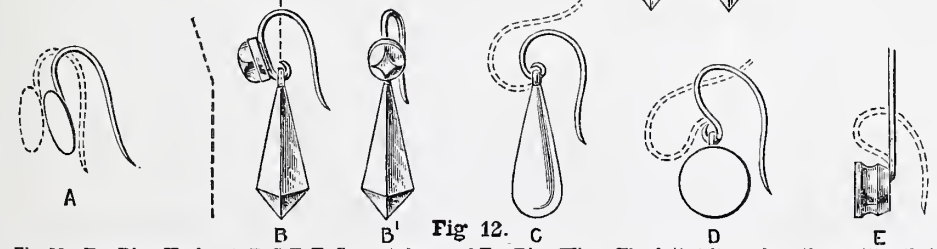



Fig. 12.

Fig. 11.—Ear-Ring Hooks—A, B, C, E, F, Correct shapes of Ear-Ring Wire. The dotted lines show the position that the highest part of Wire is to be, and where a line drawn through the Ear-Ring should come. D, Form of Hook to allow of Attachment of Pendant or Drop—at pleasure; G, Correct direction to solder an Ear-Wire to the Ear-top, to be bent as shown by the dotted lines.

Fig. 12.—Ear-Ring Hooks—A, B, B', Incorrect shapes of Ear-Ring Wire, and the results from such shapes; C, D, Ear-Ring Wires without Stops, liable to turn as shown by dotted lines; E, General way of soldering the Wire to an Ear-top, causing the ungraceful bend, as shown by dotted lines.

They are fashioned thus—a plain piece of wire is taken, and both ends are made to taper. Then some sort of a loop is made out of one end, the other end is passed through the ear, then through the loop, and coiled round itself, as shown in Fig. 10 D.

Of course this is the way to employ fine gold, but it would be a clear case of foolishness were we to attempt to make a pair of jointed sleepers in such soft metal.

Such contrasts as these will, it is to be hoped, give rise in my readers' minds, while they are at work, to just this passing thought: "Am I using a suitable quality or suitable alloy of gold for the result I have to obtain?"

Now we know that different qualities of gold are a necessity in our time, each being suitable for some particular purpose. Therefore, will it not be as well to take note of the modification that different alloys bring about—both for their advantages and defects?

There is but little doubt these will be treated on in WORK some day. But meanwhile, take note of all you can in this way, for "notions" picked up and thought out by one's self are the best, for then they do not get forgotten, as facts that are merely read of generally do.

*Ear-Ring Hooks.*—These, as you see by Fig. 11 A, B, C, D, E, F, G, are simply plain pieces of wire bent up somewhat in a hook-like form. There is some reason in their forms, however, and it is the why and wherefore of the shape that the apprentice should take note of, for on the shape of the wire depends the position of the top of the ear-ring, and may be its safety as well.

Perhaps you have noticed already—or you will after reading this—that nearly all the ear-ring-tops (not ear-studs) worn with and without pendants hang like Fig. 12 A and 12 B—that is, they look downwards, and consequently show a good share of their edges. Now, ear-rings are not generally designed with the idea of showing their edges, but their fronts; and the fronts are made the most ornamental part, in order that they may be seen—at least, that is the way they are fitted into cases; but thanks to the wrong shape of the hook generally, we get the bad result spoken of.

I should often like to take the ear-rings from the ladies' ears and alter them, for it is easy enough. All we have to do to get them to hang properly, is *to make the highest part of the hook in line with the centre or heaviest part of the ear-ring top.*

Dotted lines are in the diagram to show this, but in the workshop we just hang them on a needle-file or a piece of wire, when we see at once if they hang all right.

Even if a pendant is hung from the ear-top, there is not much improvement, for it will hang like Fig. 12 B and B', that

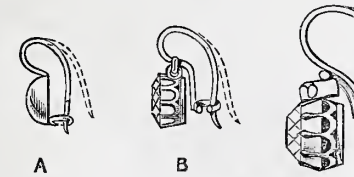



Fig. 13.

Fig. 14.

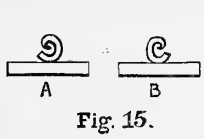



Fig. 15.

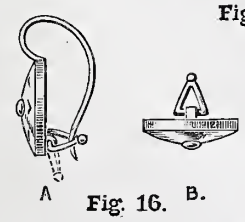



Fig. 16.

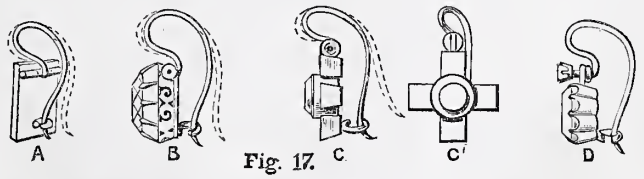



Fig. 17.

Fig. 13.—A, B, C, D, Fixed Ear-Ring Wires and Catches. The dotted lines give the position the Wire should spring to when released from the catch; B, C, Arranged to allow of a Swinging Collet; D, Simple piece of Wire, forming Ear-Ring Hook and Catch, Ring for a Collet to be attached to, and a loop for the attachment of a Pendant, at pleasure. Fig. 14.—Fixed Ear-Ring Hook with fall-down Catch, the dotted line showing position of Catch when raised. Fig. 15.—A, B, Catches as soldered on Ear-Rings, the opening being on different sides. Fig. 16.—A, Fall-down Loop Catch, the dotted line giving its position when released; B, End view or elevation of same. Fig. 17.—A, B, C, C', D, Different forms of Joints for Ear-Ring Hooks; A, B, Ordinary Chenier Joints; C, Side view of Ball Joint; C', Front view of same; D, Joint formed from Rings.

makes the whole affair just about as straight as a dog's hind leg: not at all like Fig. 11 F and F′, as it should be.

All this points to the necessity of hooks like Fig. 11 A, B, C, D, E, F, G, and it does not matter a little bit whether the hook swings like Fig. 11 C or is a fixed one; we *must* obtain the proper result in all cases, and then our work will look straight out at the world, and not hang its head down as though it were ashamed of the workmen that made it.

All the correct forms, Fig. 11, A to G, are taken from those used in the best work, and for proof of that, if in London, take a walk along Bond Street and Regent Street, where you will see in the best shops dozens of examples of what I am talking about—so it is not a new thing I am writing, but is one of the results obtained by experience, and by those who give thought to their work.

Fig. 11 D is one of the forms of hook that allows the pendant to be removed at pleasure.

Hooks like Fig. 12, C and D, should never be made, as they turn upside down, and if they do get in that position the ear-ring will drop out. They can be made all right by soldering something on them (a grain, or shot, or ring), to prevent them turning over, as shown by the dotted lines. Besides this tendency, there is another to guard against, and that is one in which the wire can get fixed in a reversed position: this is just as bad, to say nothing of having the pendant kinked up all askew.

Before finishing with simple wires, there is just a word to be said about soldering them on to the work. It is this: solder it on in the direction it has to take—that is, forward, like Fig. 11 G—then you will get a prettier curve to your wire than you could obtain by bending it sharp forward. This is only one of the little matters, but it tells in giving style to your work. Fig. 12 E is given to show the way that is *not* recommended. You see that the wire does not look as though it belonged to the top, like the other one, but appears to stand away, and besides, it has an ugly bend where the wire starts curving forward.

*Hooks and Catches* (with and without joints).—As these are, of course, for ear-rings, the wires must be of a proper shape, and in addition to that they have fittings similar to a brooch; therefore the same principles that apply to brooches must be considered here—at any rate, as far as they concern the soundness and strength of joint, the position of the catch, and the spring of the tongue. I mean, of course, the spring of the ear-wire. On this point the reader is referred to the papers on Brooches in Nos. 41, 46, 49, and 50, Vol. I. of Work.

Ear-rings with catches are sometimes made without a joint to either hook or catch, and as they are the simplest to look at we will dispose of them first, but they are the most difficult to make act properly.

Fig. 13 A, B, C, D, are all different in shape and arrangement, but all act upon the same principle, which is to get sufficient spring in the wire: first, to hold itself in the catch when it is placed there; second, to spring away far enough on being released from the catch to allow the ear to pass easily between it and the catch. For the latter purpose something over an eighth of an inch is wanted, and to get this distance is no easy matter. The dotted lines show how far the hook should spring back.

Fig. 13 A, being very short, is the most difficult of the four, and after all our hammering and twisting the hook generally has to be bent each time of removal.

Fig. 13 B, C, and D, having longer wires, give better results, and can be made to act fairly well.

For best work, where the cost of an extra hour's work is not of so much consideration, a fall-down catch or jointed hook is much to be preferred.

Before considering these, perhaps a word about Fig. 13 D will not be a waste of space, for out of one piece of wire is ingeniously formed—first, an ear-ring hook; second, a catch to retain it; third, a loop to swing a collet; and fourth, another loop for a pendant or pearl to hang on.

With fall-down catches we get an improvement, inasmuch as the great strain necessary to obtain so much spring is taken away from the wire, and we at once get the necessary space for the ear to pass by simply turning the catch down.

Fig 14 indicates how it is turned down out of the way, and the dotted lines show the position ready for fastening the hook.

The usual C-shape catch is the one most often employed, and on a pair of ear-rings they should be placed with their openings on different sides, like Fig. 15 A and B, the reason for this being that ladies find it easier to fix them from outwards towards the head.

Occasionally another form is used, and this is shown in Fig. 16 A and 16 B—these are the side and front views. This loop-catch is made out of a piece of tubing, which is soldered on to the ear-ring, and out of a piece of wire bent up in the form shown, this wire loop moving as shown by the dotted lines. This form of catch answers all right if the length of the ear-wire is properly adjusted to it. The small grain of gold you see soldered on the top is simply to give the nail something to catch hold of when the catch has to be moved.

In these the ear-wire is made to spring a little, just sufficient to hold in the catch, and that is about all the extra work the ear-ring wire is asked to do in this form of ear-ring, for the first and principal duty of the wire is to hang the ear-ring in the ear.

Now and then an obstinate customer will insist on a catch being added to the lower part of an ear-ring that swings loosely on the top part, and so depriving us of a fixed point for the wire to press against. In such a case we had better use the lyre-shape catch. The shape of this and the way it acts is shown in the paper on Catches of Brooches, and the diagram is Fig. 9 in Vol. I., page 772, of Work. These will not give you the size and thickness of wire, etc.: that you will have to judge for yourself; but they will appear rather weak of necessity, or else you will obtain no spring at all in them.

Hooks soldered on a joint are now in very general use, and there is but little to say about them except to speak about one or two points that have to be attended to:—First, enough action in the joint to allow of sufficient opening at the catch; second, strength of joint, combined with a workman-like neatness of fitting, and all is to be so arranged that there is something to prevent the wire coming too far back, for just as we used a fly-up plate in a brooch as a fixed point from which to obtain resistance, and so to enable us to get a spring in the brooch tongue, so in these we must obtain some corresponding fixed point for our ear-wire to spring from.

It is not a difficult matter, and there is no need to "lie awake o' nights" to think about it, for we generally carry the ear-wire right round the joint until it touches either the back or the inside of the ear-ring.

The simplest way is shown in Fig. 17 A, and you notice that this ear-wire and all the others are bent after the form previously spoken of, but with this slight difference—that it is just far enough away on the upper part to allow of sufficient opening at the other end, near the catch, when the wire is brought forward.

In the grain-collet ear-ring (Fig. 17 B) the joint is let into the collet; this is for neatness and strength.

If the very top of our ear-ring were of such small size as to reduce the length of our joint too much for a fair amount of strength, then we should use another form—most likely Fig. 17 C and C′, or some adaptation of it. It is, as you see, a ball joint, made as the ball joint for brooches are—out of three flat plates. It is narrow, but strong, and forms, when well made, a very neat and compact joint.

Hitherto we have said nothing of ear-rings formed from two ornaments or two settings—in fact, the last three diagrams show the whole of the fittings soldered on to one piece. If we have to swing a collet we must make a mount to carry the catch, something like the lower part of Fig. 13 B and C. In these, although more irregularly arranged, still we find all the same parts that we have in a brooch, but modified to suit the new conditions, and, as previously written, the arrangement of these joints and catches is subject to the same rules as for a brooch.

Yet another way is shown in Fig. 17 D. It is formed out of rings, with a collet or bead in front. The ear-wire plays through the ring soldered on the drop or pendant until it is to be fastened by the catch, when the two rings jamb, and so give the wire the necessary resistance.

These examples will probably suffice, for on these lines surely anybody will be able to devise something suitable for their requirements.

Pages of writing and dozens of diagrams might be given, but they would be but variations on those already given, so we will stop, and in the next paper we will talk about some other kind of fastening.

## A SIMPLE APPLIANCE FOR POLISHING TURNED METAL WORK.

BY OLLA PODRIDA.

The accompanying cuts illustrate a simple appliance whereby a good finish and high polish may be imparted to turned works between the lathe centres. Tapered or curved works, such as handles, pillars, stanchions, etc., can be treated with facility, and slight modifications in the form of the polishing clamps, or "sticks," as they are sometimes technically called, will enable surfaces of more complicated contour to be treated with ease.

These sticks are best made of the softer kinds of wood, such as pine, so as to avoid the danger of scratching or grooving the work which attends the use of harder kinds of wood. Fig. 1 shows a pair of these in profile, as they would appear all ready for use, and, as will readily be understood, adapted for three different sizes of work. Fig. 2 gives a plan of one-half, showing the grooves in which the work revolves, and the feeding channel at the front sides. The method of construction will be obvious, and detail of same unnecessary, further than that the hinge, although it may be made of metal, is best formed out of a strip of leather nailed over the ends, which must be rounded

as shown in sketch. The grooves for receiving the work must not, when closed together, wholly embrace the subject, but must be so arranged as to leave between the sticks a moderate space — sufficient to apply the polishing material. Fig. 3 will show at a glance what is meant by this, and how it is attained by cutting away the adjacent faces after marking, and cutting or boring the holes to form grooves, which, by the way, if not too large in diameter, may readily be accomplished by clamping the two parts together, and sending a sharp centre-bit through to the marks.

The detail of polishing is simple, and as follows:—After the work has been turned

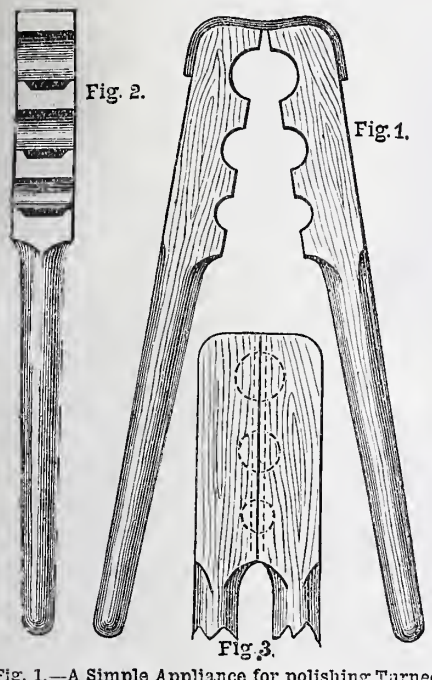



**Fig. 1.—A Simple Appliance for polishing Turned Work, shown in Profile as ready for Use. Fig. 2.—Plan of Half showing Grooves and Feeding Channel. Fig. 3.—Mode of cutting Grooves for receiving Work.**

and, where necessary, smooth-filed, it is revolved at a good speed in the embrace of the sticks, the feeding channel being kept supplied with emery and oil. If a high polish is desired, it is better to use a second pair, lined with leather in the groove, and kept for fine powder only. To facilitate the maintenance of an even pressure on the work, the handles may be tied together with a piece of cord, and the sticks pushed regularly from one end of the work to the other. This, with a little practice, can easily be accomplished by giving a slight angular movement or advance to the handles in the direction required. The waste emery and oil, or drippings, should be carefully saved for future use, and must not be allowed to accumulate amongst the working parts of the lathe.

## AN EASILY-MADE NEST OF PIGEON-HOLES.

BY C. E. MAES.

DESCRIPTION — CAREFULNESS — ARRANGEMENT OF HOLES—THE ORIGINAL MODEL—MATERIAL—TOOLS — SIZE — OUTER CASE — JOINT FOR SHELVES AND PARTITIONS—FORMING GROOVES —FITTING PARTS TOGETHER—SUGGESTIONS FOR ORNAMENTATION.

I SUPPOSE it is not necessary to tell any reader that the pigeon-holes referred to have no connection with Columbarian pursuits. If it is, let me say that the pigeon fancier will not find anything to interest him in this article. By telling him this at the outset he will not be disappointed when he finds, after having read it through, that pigeon-holes—or, to express the thing more correctly in technical parlance, a nest of pigeon-holes—are for keeping letters and other documents in. Of course, there are various kinds of contrivances for this purpose, and on looking at the illustration of the "nest"—strange how the idea of ornithology sticks to this little piece of furniture, is it not?—possibly some experienced wood workers may be inclined to turn up their noses at it. They will find this a more difficult operation than making the pigeon-holes; but if they will be kind enough to remember that a novice at wood working would find this latter equally difficult of accomplishment without directions, they will, if not inclined to welcome these, at least look on them with tolerance.

There is a beginning to everything, and the beginners at WORK must be helped forward as well as the more advanced. This remark, of course, is for the minority—doubtless a small one—of readers who are so unreasonable as to think or wish that their own requirements should be specially catered for in a magazine which caters for all.

Simple though the construction of these pigeon-holes may be, it will yet afford useful exercise to the tyro; and when it is made, no doubt he or some of his friends will be able to find a satisfactory use for it. If he succeeds in making it neatly and well, he may in time to come be able to regard it with pleasure as an early effort.

I may here say that, because it is simple, it will be a mistake for the beginner not to use as much care over its construction as he can. Careless work never achieved anything worth noticing, and the novice is too often discouraged by attempting to make something altogether beyond his powers. Let him proceed slowly and carefully from simple construction to more complicated contrivances, and he will find that his skill increases almost insensibly till, in the no distant future, he finds that he is able to accomplish anything in reason connected with the craft he has taken up, either for a pastime or as a business.

We all know Carlyle's definition of genius, and, without going too closely into it as of general application, there is no doubt that the cleverest and most skilful artisan—I won't call him a genius—is the one who takes the most pains with his work, whether it be great or small. He is, in fact, the one who obeys the injunction, "Whatsoever thy hand findeth to do, do it with thy might"—given, by the way, was it not, by a tradesman or artisan who might be supposed to know what is necessary in the way of good advice to hand as well as head workers?

Now, after these prefatory remarks, given by way of encouragement to beginners, and perhaps a little bit by way of apology to more advanced workers, let us see about making the nest.

In its primitive simplicity, it consists of an oblong box with an open front. It has two shelves, with a series of upright divisions, by which means the "pigeon-holes" are formed.

As the English alphabet consists of twenty-six letters, we may reasonably suppose that a nest containing about that number of holes will be the most generally convenient. The illustration shows the rows of holes, but it might as well have been four, or, in fact, any number; but as three into twenty-six won't go—I think that is the way that it was expressed when "we were boys together"—without leaving a hiatus somewhere, we just make three rows of nine holes each, being twenty-seven in all, or one more than the alphabet requires. It will come in handy for some purpose or other, so that we need not object to its existence. Special papers which it is desired to have separate may be kept in it, and, indeed, one or two more holes may be reserved for the same purpose; for it will be an unusual lot of correspondence which has many or an equal number of papers beginning with the same letters of the alphabet. As a suggestion, the X Y Z letters may be put in one pigeon-hole, without much difficulty arising when a particular document is wanted.

However, if the directions for making one set of pigeon-holes can be carried out, the veriest duffer can have no difficulty in making his own arrangement.

Perhaps it may lend additional interest to the nest, which forms the basis of this article, to say that it is in the editorial room of WORK, and that in it are accumulated the letters which are continually arriving for answer in "Shop," as well as others for the consideration of the Editor.

Of course, such a mass of correspondence requires a much larger nest than would be required for private purposes, and I have therefore taken the liberty of altering the dimensions of the original to those which are more likely to be generally useful. Those who do not like them can alter them to suit their own wishes.

What kind of wood are they made of? This is naturally a question which the beginner will ask, and very probably he takes sufficient interest in WORK, and all that pertains thereto, to wish to make his like the original one referred to, or, at any rate, of similar material. Now, from what I can gather, an editor's apartment is popularly supposed to be fitted up in a style of luxury and with a beauty of appointment which the humble reader cannot hope to aspire to; and of course, on this supposition, the editorial pigeon-holes are made of—well, let us say a choice and costly wood. I fancy I hear some one with the bump of curiosity largely developed say, "Why can't he tell us exactly what it is?" Well, my brethren—or, if you like it better, my fellow admirers of WORK—the reason is just this: On one occasion, shortly before I was asked to write on a particular subject, I was taught to be cautious. I was not sufficiently so when I got pen in hand and paper before me. That MS. was not published, and I got a "wigging" from the presiding genius. I do not wish to incur the mildest of mild rebukes from "our" Editor, so it must be sufficient to say that pine may be used instead of a choicer wood by the novice who essays to make the present pigeon-holes.

Although pine is a common wood, there is no reason why it should be bad of its kind. A nice clean piece—by which I mean that it should be free from knots and shakes or cracks—will work up admirably. It should also be dry, and in order to ensure its being so, it may as well be kept in the kitchen or a warm, dry room before it is used. Wood is often seasoned thoroughly, but not be quite so dry as it might be when it is first brought in from the timber yard, where it has very likely been exposed, more or less, to the changeable atmosphere of our climate. Do not, in any case, attempt to

dry it too quickly by the fire, or the results will not be satisfactory, and may possibly necessitate the expenditure of more money at the timber yard.

One of the first points to be decided on is the thickness of the material. The job will look better if the outer case is thicker than the shelves and partitions, but this is not a matter of importance. As very thin wood is not as easy to work up as comparatively thick stuff, we may take it as being about $\frac{3}{8}$ in. thick for all portions. If two thicknesses be decided on, let the case be, say, $\frac{1}{2}$ in. thick. Of course it may be much more, and may be less, if the maker has any wood lying by him that he can use for the purpose. Strength is, however, amply secured by the thickness named, and might be so even if it were less.

The depth from back to front being comparatively unimportant, let us assume that it is just the width of the board from which the job is to be made. As the wood will probably have an irregular edge, it must be set out from the narrowest part, and this, we may assume, will not be less than 9 in.

After the wood is planed smooth, the only tools absolutely necessary will be the square, a bradawl, a screwdriver or hammer (according to screws or plain nails being used), and a chisel of not greater width than the thickness of the wood forming the upright partitions. Even if the tools have to be bought specially, this will not involve a great outlay; it will be less than the cost of making the article, and, as the tools remain for future use, they may be considered, from a pecuniary point of view, a gain, or as representing profit—not in cash, of course, but in stock.

First of all, in making, with the aid of the square cut off two pieces of the board 27 in. long, and two pieces 1 ft. long each. These will form the top, bottom, and ends of case, and will be nailed together. The great consideration, of course, must be that opposite pieces are exactly of the same size, and that all the edges are square. If a piece is wider than the one opposite to it, or is wider at the front than at the back, or *vice versâ*, then a good square case is out of the question; for it is an impossibility to make a perfectly rectangular box if all the parts are not regular. With care, there will be no great difficulty in getting them so.

It is suggested that the top and bottom are to be nailed on to the ends, though whether this or the alternative of fastening the ends to the top and bottom be adopted is not a matter of vital importance. Those who can do so may prefer to fasten the parts together with dovetails, but as this presumes the maker to be possessed of more skill than those I am specially writing for, no detailed directions need be given.

The case being ready, the shelves will be cut to fit tightly within the ends. They will, of course, be the same width as the top and bottom, and should be cut with perfectly square corners. When they are cut, do not fasten them in at once, but wait till the partitions are ready and the grooves cut for their reception. The joint for the shelves and the partitions is shown on an enlarged scale in Fig. 2. From this it will be seen that the edge of the partition is sunk in a groove cut for it in the shelf.

This form of construction may not be the strongest possible, but as it is strong enough, nothing more can be required.

The width of the grooves is just enough to allow of the partitions fitting tightly into them, and their depth in proportion to the thickness of the shelves is sufficiently shown in Fig. 2.

To mark and cut these grooves is an easy matter, but it must not be done haphazard. At equal distances from each other, mark out the position for the divisions, either with compasses or by other convenient means, remembering that at the ends of the shelves the spaces must be shorter by half the thickness of the partitions than the others. The reason for this is so obvious that nothing need be said about it.

The places for the partitions being ascertained, with the square draw lines across, representing the width of the grooves; then cut these lines down to a uniform depth with the chisel, cutting downwards, or, guided by a straight-edge, draw it along so that it cuts into the wood. If the cut is not deep enough, it can easily be made so by repeating the operation as the waste wood is removed. This can be managed with the narrow chisel already referred to as one of the necessary tools for making the job with. The cuts at the sides of the grooves allow the wood between them to be removed without disturbing the surfaces of the shelves. The bottom of the grooves need not be made absolutely smooth, as they are not seen when the parts are fitted together, and a finicking amount of finish is not necessary, for the work will be just as strong and substantial without it.

All the grooves being ready, the shelves may be fitted in their places and the upright partitions be forced in. The grooves will hold those between the shelves, while those above the top and below the bottom shelf will be held partly by the grooves and partly by a few nails through the top and bottom. It only remains to fasten thin wood on the back, and our nest of pigeon-holes may be considered complete. It will naturally occur to the user to mark each hole with a letter of the alphabet, according to the documents it is intended to hold, but certain easily effected ornamental details may not so readily suggest themselves without a hint or two.

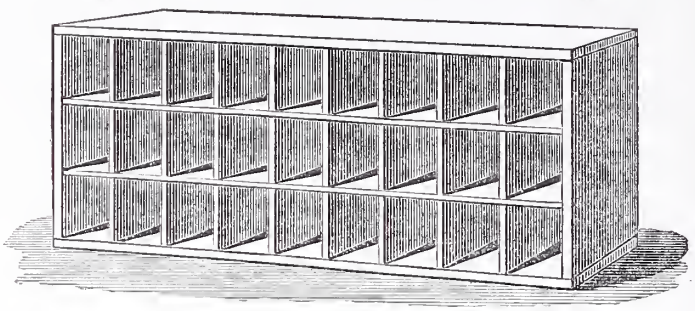


Fig. 1.—Nest of Pigeon-Holes: Plain.

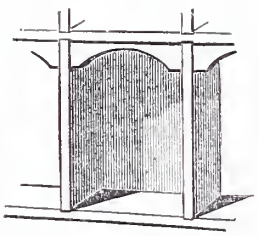


Fig. 3.—Bracket at Top of Pigeon-Holes.

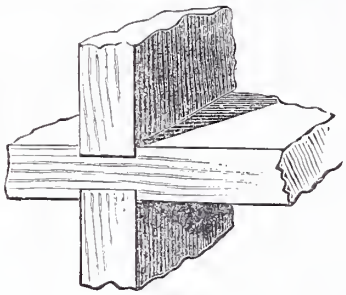


Fig. 2.—Connection of Partitions and Shelves.

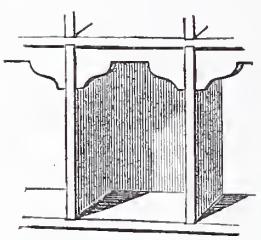


Fig. 4.—Alternative Form of Bracket.

An excellent finish, relieving the stiff, straight lines, may be easily formed by putting thin pieces of wood at the top of each hole. They are decidedly ornamental, and anyone who has a fret saw will have no difficulty in doing what is necessary. By way of suggestion, two appropriately shaped pieces are shown in position in Figs. 3 and 4. The pieces, of course, are fastened by small blocks of wood glued in behind them.

In Fig. 5 is shown a really handsome-looking nest of pigeon-holes, and yet it is virtually the same as the one which has been described.

The ends are thicker, and their front edges are beaded with the "scratch," a tool which has been so fully described in WORK already that further remarks about it would be out of place. The top edge is merely a piece of ordinary pine moulding, such as can be got in any large town from those who supply builders with them. The bottom is thickened up and the appearance of moulding given to it by three pieces of stuff, 1 in. thick and, say, 2 in. wide, being fastened on to the bottom board by means of screws driven through from below.

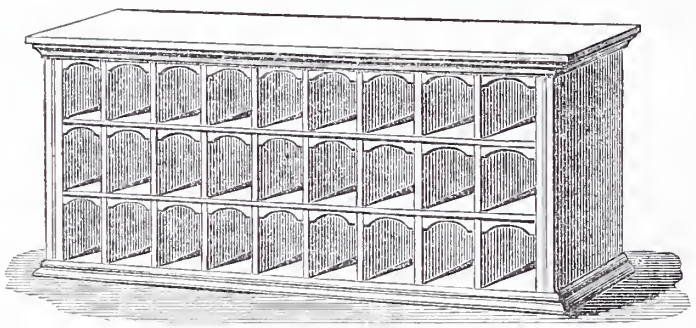


Fig. 5.—Nest of Pigeon-Holes: Ornamented.

The front piece should be the whole length of the job and the end pieces shouldered up behind it, so that they need not be mitred at the corners.

If these end pieces are cut off across the grain of the wood, instead of with it, they will be better; but on a job of this kind attention to this is not of the greatest importance.

The edges can easily be rounded off, as shown, with the plane, and finished with glass-paper.

With the remark that the job, when made, may be stained and polished or painted, according to fancy, these directions and suggestions must be brought to an end.

## HINTS ON MECHANICAL DRAWING FOR TEACHERS.

BY H. A. MILES.

Preparation of Wall Diagrams—Points to be Kept in View—Drawing-Board—Size Recommended — Method of Construction — Testing Accuracy—Arrangement for Taking Continuous Paper without Folding—T-Squares—Instruments—Ruling Pens Unsuitable—How they may be Adapted to Ruling Thick Lines — Most Suitable Breadth for Lines—Parts in Section—Colour *v.* Lines—Drawing Large Circles—Simple Beam Compasses—Shading Circles—Perry's Pen for Letters and Figures—Best Size for Same—Use of Stencil Plates—Inserting Dimensions—Wolff's Chinese Ink — How to Ink in Large Drawings—Cleaning Up—Mechanical Drawings and their Disadvantages—Should be Supplemented by Perspective or Isometrical Pictures.

How often has the reader wanted to make an illustration which has to be looked at from a distance? For example, a banner is required for the Sunday School, a large illuminated text for the walls, or, in the case of either a school or science teacher, a wall diagram is required to illustrate some portion of a lecture.

As a teacher of machine construction and drawing, etc., I have had to prepare a large number of such diagrams for class demonstration, and have at the present time over a hundred illustrations of machine and engine details, all prepared in the way I shall now describe.

To prepare a drawing, every detail of which must be perfectly distinct in the furthest corner of the class-room, requires, of course, a special method of treatment, and experience only can enable the draughtsman to judge what will be the best scale to draw to, so that while every portion shall be easily understood, no part is wastefully large. It is best, in some cases, to treat the very small details separately on a larger scale.

I do not in this paper propose to *teach* anyone mechanical drawing, but merely to explain the various methods by which I have overcome the many little difficulties continually cropping up, and assist others by bringing to their notice some of my own dodges for saving time or labour.

The drawing-board is, of course, the first consideration, and that which I have found best is a pine board 5 ft. by 3 ft., this size taking antiquarian or continuous paper.

It should be constructed as follows : The grain should run lengthways of the board, which should be of ¾ in. even-grained pine, entirely free from knots ; when glued and joined, the boards should be clamped up tight and left till dry—at least twelve hours. Both sides should then be evenly planed, and one edge shot up true and marked. The two ends and the other side may now be trued up from the first, and a final check on its accuracy taken by measuring it across diagonally from corner to corner, when, if both diagonals are equal, the board will be square. This test does not prove that the sides are straight, but the eye run along the edge will detect any inaccuracy. The best surface should be decided upon, and marked. The other must now be grooved with a plough plane at intervals of 3 in. or 4 in., the grooves being ¼ in. wide, and deep enough to leave a thickness of ¼ in. The warping and shrinking properties of the board are now practically reduced to one only ¼ in. thick, and made in widths of 3 in. or 4 in.

At least three battens, for the purpose of strengthening the board, will be required, and two of them must be about 6 in. longer than the narrow width of the board, for a purpose I shall presently explain. One of these must be fastened at each end, and the other in the middle of the board, as shown in Fig. 1. These battens must be fixed in a certain way, or the board will twist.

Each should be screwed in the centre, and all other screws necessary must be placed in longitudinal slots, as shown, thus allowing for expansion and contraction due to atmospheric influences. The board is now completed as far as ordinary work requires, but if continuous paper is to be used, a slight addition, designed by the author, will be required.

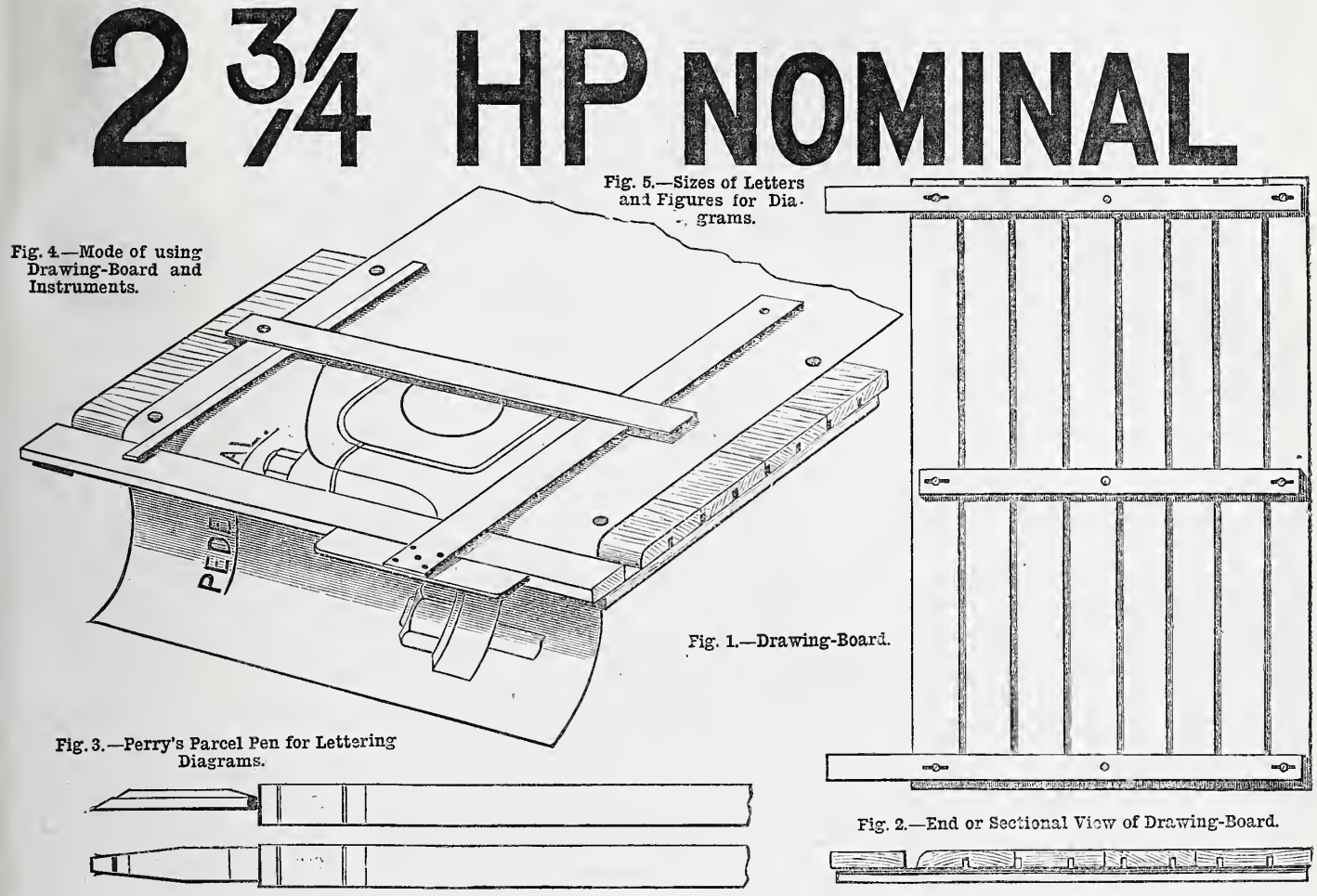



Fig. 5.—Sizes of Letters and Figures for Diagrams.

Fig. 4.—Mode of using Drawing-Board and Instruments.



Fig. 1.—Drawing-Board.



Fig. 3.—Perry's Parcel Pen for Lettering Diagrams.



Fig. 2.—End or Sectional View of Drawing-Board.



Take a strip of close, straight-grained mahogany, 5 ft. long, about 4 in. wide and ¾ in. thick, and plane it up accurately, with the sides perfectly parallel. This piece is now to be screwed to the two end battens in such a way that a gap about ½ in. wide is left between itself and the edge of the board, which is rounded off. The completed part of a drawing on continuous paper may be slipped down this opening, and a fresh surface exposed to the draughtsman, while the T-square always has a guide to work against, and no folds need be made in the paper, as shown in Fig. 4.

T-squares of pear wood are cheapest, and two will be required—one for each way of the board. The blades, which should be screwed to the stock, should be parallel, and not taper, as, owing to the size of the board, it is often necessary, especially when working at night, to use both sides of the blade in order to avoid shadows.

With regard to instruments, the ordinary

ruling pen will be found of but little use, the lines being almost invisible a few feet away, and much labour is entailed by ruling double lines and filling up the intervening space by a brush; while the brush alone is unsatisfactory in every way.

A simple yet wonderfully efficient dodge was thought of by the writer to surmount this difficulty.

A piece of fine linen is folded so as to present a nice blunt point, and is then placed between the jaws of the ruling pen, and the screw tightened, the waste material on either side being removed by a sharp knife. The pen may be supplied by means of an ordinary writing pen, or itself dipped into the ink direct. The first few strokes will be rather too fine, but the point rapidly widens to the full extent of the opening between the jaws, and a splendidly even line will then be obtained. The ink is held in reserve very effectively, only just sufficient being allowed to pass to the paper. The best thickness of the lines varies from $\frac{1}{100}$ in. for internal details to $\frac{1}{8}$ in. for outlines. Sectional shading may be done with this pen, but a darker wash of colour should be used in preference to lines, as the latter seriously interfere with the clearness of any dimensions which it may afterwards be necessary to insert. The pen joint of the ordinary compass may be treated in a precisely similar manner.

It frequently happens, however, that a circle is required which is too large to be described with these compasses, and the following plan may then be adopted as a cheap substitute for beam compasses—

Take a thin strip of wood, about $\frac{5}{8}$ in. by $\frac{1}{8}$ in., and fit the compass pen into a hole at one end. A pin passed through a fine hole and driven a short distance into the board will form the centre, and the circle can then be readily described, the bar being left long enough to accommodate itself to various-sized circles.

By the way, while speaking of circles, it sometimes happens that in a shaded drawing one side of a circle is required to be thicker than the other, and it is a very difficult operation to successfully accomplish. If, however, the centre be very slightly shifted towards the side in shadow, and the half circle again struck with the same radius, the effect will be perfect, the line gradually increasing in thickness, and as gradually merging again into the ordinary size.

For lettering, the best pen is Perry's parcel pen, shown in Fig. 3. It can be obtained in several widths, and engrossing or block lettering can be very effectively performed by its use. Some little practice is necessary, but if the pen be pointed outwards, as if writing with a "J" pen, very little difficulty will be experienced.

The most useful size for letters and figures is $\frac{3}{4}$ in. for important words and $\frac{5}{8}$ in. for ordinary lettering, such as names of engine or machine details. Figures should be $\frac{7}{8}$ in. for whole numbers, and $\frac{5}{8}$ in. for fractions.

For economy of space fractions are best inserted thus, $\frac{7}{8}$ in., rather than $\frac{7}{8}$ in.

Stencil plates are very useful, but require to be specially cut, as the ordinary Roman letters are unsuitable. The form most useful are oblong block letters, a specimen of which, with figures, is shown full size in Fig. 5.

All lettering and dimensions should, however, be left till the very last, after all colouring is perfectly dry.

The best ink to use is Wolff's liquid Chinese ink, which is of a dense black, and for ordinary work will bear 50% of water being added to it. This ink is especially suitable if the drawing is to be coloured, as when once dried, it is impossible to wash it up, even after prolonged saturation. For inking in, a flat ruler with a bevelled edge will be necessary, also a couple of strips of wood, about $\frac{5}{8}$ in. by $\frac{1}{8}$ in.; these and the straight-edge may be about 3 ft. long. The method of using them will appear further on.

It will now, perhaps, be advisable to follow the course of a drawing through all its stages before colouring is touched upon.

The board being placed at a height suitable to the draughtsman, the paper is placed on it, and fastened with a drawing-pin at each corner, first setting the paper square with the sides of the board. The usual method of procedure is then followed with regard to centre lines, etc., etc., until the drawing is completed in pencil.

All circles or arcs of circles must now be inked in, the pen being filled up as before described. The two thin strips of wood may now be placed across the drawing so as not to rest on any wet lines, and used as supports for the straight-edge. These strips may be shifted as necessity occurs, and the entire drawing inked in without any delays, while certain portions dry.

It will be found best to do all the thin lines first, and as the pen point widens with use, to insert the broader outlines. All lines in one direction should be done at once, as far as possible. The strips may then be placed parallel with them, the ruler laid across it, and those in the opposite direction filled in. Dimensions may now be inserted, the dotted lines being done in red, arrow-heads in black, and the whole drawing cleaned up with indiarubber.

If, however, the drawing is to be coloured, the paper must, previous to use, be damped and fastened by its edges to the board, narrow strips of gummed paper being useful for this purpose. Ordinary water colours are suitable, and brushes according to the fancy of the draughtsman.

All colouring should be as light as possible, the parts in section being slightly deeper in tone than the remainder; curved surfaces may be lightly shaded to assist the students in understanding their true shape.

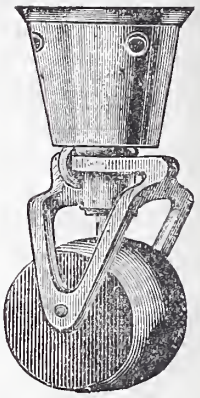
In concluding, the author advises all teachers of mechanical drawings to supplement their plans and elevations by models and perspective or isometrical drawings of the details illustrated; as every first year student experiences the greatest difficulty in understanding the construction of a piece of machinery until he has had a certain amount of practice in reading mechanical drawings. If this method is followed, the results will amply pay for the extra trouble involved.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

12.—Hart's Cantilever Bowl Castor.

I think all readers of Work will agree with me in condemning the old-fashioned ordinary form of castor—or easter, for both modes of spelling the word are used, and I venture to think the latter preferable—in which the axis on which the wheel of the castor worked went through the ends of a couple of pieces of brass, proceeding from a socket revolving on a pin issuing from the bottom of the cup of the castor; an arrangement which tended to throw the wheel right out of, and away from, the direct line of pressure, passing down the centre of any table leg or chair leg, which was perpendicular to the plane of the floor. It was a weak form of castor, liable, if badly made, to get quickly out of good working order, and many varieties have been introduced which have been, to a greater or less extent, improvements upon it. The latest with which I am acquainted is Hart's Cantilever Bowl Castor, figured in the accompanying illustration, a prospectus of which has been sent me by Mr. A. Marmaduke Hart, Vicarage Park, Plumstead Common, S.E. To judge from the illustration and description it seems to be an excellent form of castor, for the reason mentioned above; but I can say no more than this, as I have received no samples which I might put to a practical test. I append Mr. Hart's description of the castor, and from this and the illustration my readers will have as good means of forming their opinion of the article as I have as yet had.



**Hart's Cantilever Bowl Castor.**

Mr. Hart claims that the Cantilever Bowl Castor is "the most perfect castor for furniture, etc., ever invented, combining all the advantages of all other castors, equal to central action without the disadvantages, cannot get out of order, perfectly noiseless and free in action, no side strain. The principle briefly stated is, that the cradle, or holder, forms an unequal-sided triangle or pyramid, the base being divided into unequal lengths by the central pin, the bowl being at the apex slightly out of the centre. By means of the cantilevers the balance is readjusted, and makes the bowl equal to being in the centre of the castor; also the cantilevers overcome any resistance. The arrangement is so simple that it will be easily understood on reference to the drawing. The principle of construction is a sound one. For chair and couch work it is invaluable, entirely preventing fracture of the wood, straining the legs, or breaking out of the screws, which is constantly resulting from excessive leverage, and faulty construction of the ordinary castor; for this work I recommend the castor without a wheel. For tables and extra heavy work, the one as drawn with a wheel in the front, under the centre of action, is the best."

From this it is to be gathered that there are two varieties of the Cantilever Bowl Castor, one without roller, and the other with roller. Further, each variety, as castors generally are, is made in two forms, one as a socket castor and the other as a screw castor. Mr. Hart will make castors to suit any customer in strength and style from $\frac{3}{4}$ in. to 2 in. Those that are kept in stock, and which will meet all ordinary purposes, are made in four sizes, namely, $1\frac{1}{8}$ in., $1\frac{1}{4}$ in., $1\frac{3}{8}$ in., and $1\frac{1}{2}$ in. All are strong cast, and of brass, and are supplied in sets of four at the following prices: No. 1 Socket Castor, without Roller, from 3s. 8d. to 5s.; No. 2 Socket Castor, with Roller, from 4s. 2d. to 6s. 4d.; No. 3 Screw Castor, without Roller, from 3s. 2d. to 4s. 6d.; and No. 4 Screw Castor, with Roller, from 3s. 4d. to 4s. 10d. Plate castors, triangular, square, or round, are supplied at precisely the same prices as screw castors. In this form the castor is attached to the plate, and the plate is pierced with holes countersunk to receive the screws by which the plate is fastened to the wood.

The Editor.

# SHOP:

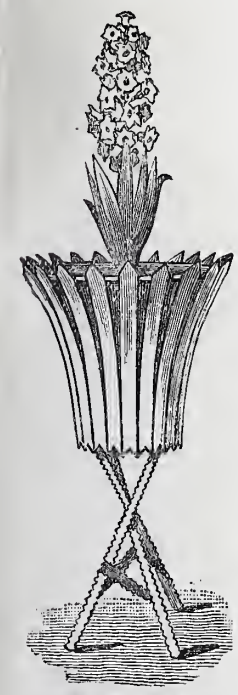
## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**A Cheap Flower Stand.**—J. L. (*Somerset*) writes:—"The original from which the accompanying sketch is taken is made from boxes in which cheese is sent to this country, and is quite within the capacity of any amateur who has the slightest knowledge of tools and wood. The way in which I made mine was as follows: I first cut the box into strips (following, of course, the circumference) about ¾ in. wide; these again I cut into lengths of about 8 in., shaped as shown in sketch. Next I got a piece of wood 1 in. thick, and cut out a circle 4½ in. diameter. To this I nailed the strips, letting the ends come about 1 in. below the piece of wood previously mentioned; this forms the bottom of the stand. For greater strength, I put a piece of wire about halfway up the strips inside, to which I fastened the strips with copper braeing wire. The legs are of small square pieces of oak, and are so fixed by boring holes in the bottom of the stand that they will cross each other about 2½ in. from the lower part of the stand. I notched mine with my pocket-knife. There are three other short pieces put on in the direction indicated in the sketch. When all was together, I stained the whole a dark brown, finishing off with a coat of varnish, thus making the whole thing look very pretty—prettier than my drawing, as I cannot draw very well now, having allowed my talent in that particular to rust. It is cheaply made, the whole costing not more than 6d., including stain and varnish."



A Cheap Flower Stand.

**Wood-Carving Prizes.**—Wood Carver writes:—"I think the matter of judges and the adjudicating generally in wood-carving competitions is a subject which should have more attentive consideration than it at present seems to receive in many places. It is not fair to encourage a number of workers to compete for prizes unless a *competent authority* is consulted on the merits of the exhibits. I have just heard of a case at Cheltenham, where the exhibits were large and important, and a village carpenter was called in to award the prizes."—[This is certainly a direction in which our correspondent's suggestion cannot be too promptly acted upon.]

### II.—Questions Answered by Editor and Staff.

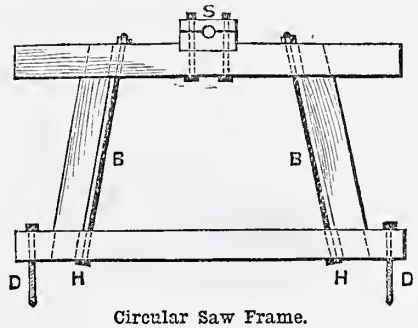
**Detective Camera.**—H. A. (*London, S.E.*).—The most simple kind workable is little more than a small box of the exact length to suit the focus of the lens used when focussed on objects about 10 ft. or 15 feet in front. Taylor, of Slate Street, Leicester, makes lenses especially suited for this work, about 6 in. focus. One of these lenses fitted into the front—which lens is flush with the front of the box, to allow the easy application of an up and down shutter—and the other end grooved to receive dark slides is practically all that is wanted with a lens of *fixed focus*. The whole may be covered in imitation of a brown-paper parcel. The slides may be changed in the ordinary way and carried in the pocket until required. A small finder may be fastened to the top of the box, easily taken on and off. Very good work has been done by a simple arrangement of this kind. H. A. will find that good work does not depend so much on the instrument as on the deftness with which it is used. Many of those in the market are needlessly elaborate. Anyone with a fair amount of constructive ability is able to make a good workable apparatus of this character. It is only when arrangements have to be made for *altering the focus* that fine and difficult work is necessary. Very good pictures have been taken by one made only of cardboard, dark slides included.—D.

**Poster Painting.**—W. H. (*St. Helen's*) and J. E. (*Skipton, Yorks.*).—Before this answer appears the Editor will have an article in his hands on Poster Painting.

**Pelican Writing Pencils.**—A. S. (*Newport, Mon.*)—Messrs. Brodie & Middleton, artists' colourmen, Long Acre, London, manufacture sable-hair pencils of the very finest description, and in all sizes. If you require an extra large size, and they have not got it in stock, they will make it to order in a few days. Of course the large size sable pencils are very expensive. The price of sable, too, has recently gone up, so you must get special quotations, and not depend on catalogues.—H. L. B.

**Gilding on Glass.**—Exile.—Burnished gilding on glass would unfortunately take up several columns of "Shop" if described fully enough to be of any use to you. Articles will, no doubt, appear in due course.—H. L. B.

**Hand Power Circular Saw.**—Compo.—Let me say that if you increase the speed of your saw, even then you will find it no easy work to drive through a piece of pine 2 in. or 3 in. deep. The fly-wheels generally fitted to such benches are too light to drive off from with belt or strap. I should advise you to go to a marine-stores, or some such place, and try to purchase a second-hand iron wheel about 5 ft. diameter, with a heavy rim; and at the same time look up a pair of stools and bearings and a piece of shafting about 3 ft. or 3 ft 6 in. long, that will fit hole in boss of the wheel. When these are obtained, then commence to make your wood frame out of 6 in. by 4 in. red or pitch pine. The frame should be 7 ft. or 8 ft. long, with four legs. At the bottom of legs there should be two pieces mortised lengthways of frame; as you wish the frame to be removable, the frame should be well mortised and bolted




Circular Saw Frame.

together. Then get four good wood screws, and if you are working on a wood floor screw the frame to the joists; if not on a wood floor, dig places for two sleepers in the ground and screw to them, fixing the frame from centre of it to centre of pulley on saw spindle; if you have room, from 12 ft. to 16 ft., as a long strap will drive with less tension and require less power to drive it. After the frame is fixed, bolt the stools on the frame; then lay the piece of shafting in the bearings, letting the end on which the driving wheel is to be keyed project the length of the boss of the wheel outside the bearing. On this end file a flat for keying the driving wheel; and on either side of the bearing farthest from wheel make a mark on the shaft, and close to the marks get two collars shrunk on to keep the shaft in place, and to prevent end play. This done, screw down top blocks, and then key on driving wheel. If there is not a hole in one of the arms of the wheel, drill one through to fix a handle to turn the wheel, and as far up as you can conveniently reach and turn the wheel. Now get a 6 in. pulley, and key on the end of saw spindle, seeing that both wheel and pulley are in line; then put on strap, crossing it if your bench is in position for crossing it. By crossing it will have greater grip on the pulley, and will not be so liable to slip. It will be seen by having 5 ft. wheel and a 6 in. pulley, that the saw will make ten revolutions to one of the driving wheel; and if you are driving a 12 in. circular saw, the traverse at point of teeth will be a little more than 31 ft. to one turn or revolution of driving wheel. Care should be taken in feeding the timber, which should be fed very slow. The annexed sketch is one side of the frame that is to carry the driving wheel, showing how it should be mortised and bolted together. B, B, are ¾ in. or ⅞ in. bolts; the heads H, H, should be let in level with the wood; D, D, are holding-down screws; S, stool and bearing.—A. R.

**Billiard-Ball Dye.**—Spot-Stroke asks for a good red dye for billiard balls. This should not be difficult, though it is a craft secret. Billiard-table makers and sellers do not dye their own balls, nor do they know how it is done. My experience with dyes is that cleanliness is one of the factors of success. The ivory must be cleansed of its acids and grease for some little distance into its surface, just as leather is, or it will not take dye or lacquer. The dye used is the result of boilings of red cloth that is left from the making up of soldiers' coats. This red is from the cochineal insect. Before putting the balls into the liquor, make a bran bath by boiling good bran for an hour; strain off the liquor, and let the balls soak in this liquor for half a day or more. Thoroughly dry the balls, avoiding the touch of the hands as much as possible; then put them in the hot red dye, and allow to remain till the proper colour. Another dye is common sumach. Boil or scald three pounds of sumach; put the prepared balls into this liquor after it has been decanted; let them be in it till it is cold. Much of the commercial dye is poor in penetrating quality, only suitable for wood or paper. If you can make your own magenta dye, here is a simple recipe. Heat commercial aniline with the tetrachloride of tin; or better, nitrate of mercury, or for cheapness, arsenic acid serves—twenty parts of the latter to twelve parts of commercial aniline, to be heated in a clean cast-iron still up to from 309° to 338° Fah. Water and aniline will pass over. After some hours, steam is blown through the mixture in the still, which brings over more aniline. The lid is removed, and the mixture allowed to cool sufficiently to be put into a large vessel, in which it is boiled with an excess of water. It is then filtered to remove insoluble matters. Common salt is added to the filtrate, which precipitates the colouring matter in a crude form. This is washed on a filter, and afterwards dissolved in boiling water. From this the magenta crystallises out in cooling, ready for use. To make the dye from the cochineal insect is a sure plan of obtaining a penetrating dye.—J. C. K.

**Looking Glass.**—S. H. (*Walsall*).—Receipes and directions for silvering glass by nitrate of silver have appeared in "Shop," and using those, it would take not quite an ounce and a quarter (1¼ oz.), or say 620 grains, to cover the quantity of glass you wish to do; but there may be something in your recipe to alter the quantities, that I cannot tell without seeing it; but, may I ask, are you going to try a new recipe upon six square feet? Would it not be better to use a small piece first? As regards the latter part of your letter, "Is it possible for an amateur to bevel the edges of glass?" I should say, Yes, it is *possible;* because, with money to buy tools, and time to gain experience, an amateur may be able to turn out as good work and do all that a professional can do.—W. E. D., Jr.

**Dulcimer Pins, etc.**—E. H. (*Bethnal Green*).—You can obtain these at almost any wholesale warehouse. My object in recommending Messrs. Chilvers & Co., of Norwich, was that, being wholesale dulcimer makers, they make a speciality of the fittings, and can be relied on to supply just what is required.—R. F.

**Bamboo.**—Victor.—Bamboos may be bent by heating them in a smokeless flame. The heat renders them pliable, so that they can be bent without much difficulty. When cold, the shape given is retained. Take care not to burn the bamboo; and to avoid this, as well as to prevent the bend being too sharp, keep it moving, and heat a length of some inches, according to the size of the work.—D. D.

**Bow Saw for Machine Saw.**—J. G. (*Nottingham*).—Half-inch is quite broad enough, if not too broad; mine is only ¼ in., and it acts well enough. The usual holes are right. I do not think that you could successfully fix a grindstone on it. I thought of doing so at one time, but abandoned the idea as not being practicable. Instead, I constructed a small compact treadle grindstone, with trough complete.—F. H. R.

**Model Wheels.**—Silicato.—As you seem to require felloes and spokes on rather a wholesale scale, you had better advertise in Work Sale and Exchange column for a band-saw man.

**Observatory Hive.**—J. J. (*Kidderminster*).—I will reply to any questions through "Shop."—Apis.

**Beehives.**—Ubique.—No instructions have been given as to the construction of the "Lanarkshire hive," nor do I know of the existence of such. There are the Stewarton, with octagonal boxes, and the Renfrewshire Stewarton, which has movable bar frames; either of which may be known locally under the term Lanarkshire. A paper on the construction of the Stewarton hive may appear later on, as it is in every respect an excellent hive.—Apis.

**Failure in Silvering Glasses.**—J. W. M. (*London*).—Your letter says that "You have followed the directions given in 'Shop' for silvering glasses, but have failed owing to holes in the foil when finished, and suggest that something else is mixed with the mercury by manufacturers, as you have seen some done, and it acted better than yours did." I think anyone of two or three things will account for your failure. Nothing is needed but mercury to pour on the foil; and part of your letter proves it when you say, "All the rest is right but these holes." But if you think differently, why did you not ask the workmen you saw what they were using? I think their reply would have convinced you. Now, in reading over your letter carefully, it strikes me that you have not used sufficient mercury, as you refer to laying it on with a hare's foot (I venture to say you did not see those workmen do that). Plenty of mercury must be used; a little will not do. It is nearly all pressed out again, and recovered when the glass is put on and weighted; but enough must be poured on at first to cover all the foil. If you only put a little in the middle and then try to spread it over the whole surface, it is sure to rot the part where it is first poured on, and holes are the result when finished, the thinnest places, of course, suffering most. For this reason, too, a stout piece of tinfoil should be chosen, as the thicker it is, the longer it will resist

the mercury; but above all, be quick in getting the glass on when once you have covered the foil. The last suggestion I make is that you get a fresh piece of foil, and at a different place, as I am told that you may sometimes happen to get hold of a piece of tinfoil which will not amalgamate with mercury because of its not being pure; I have not known it to occur, but I have it from one who has met with it, so if you still do not succeed with more mercury and stouter foil, try another shop for a better quality; but I think your mistake has been in letting the mercury remain on the foil too long before the glass is put on.—W. C. D., JR.

**Hall Lamp.**—W. H. T. (*Harringay, N.*)—We have not published working drawings of this; nor can we give you the addresses of our writers.

**Bracket.**—W. T. H. (*Wellington*).—Consult the Indexes of WORK, Vols. I. and II., for bracket designs and fret-wood dealers.

**Shooting Board.**—J. A. (*Gristhorpe*).—You should purchase the Indexes to Vols. I. and II. of WORK. Your difficulty in obtaining numbers of WORK would be obviated by subscribing for it through the publishers, Cassell & Co., Limited, London, E.C.

**Staircasing and Handrailing.**—M. A. P. (*Birmingham*) and M. T. O. (*Stockport*).—When I can meet with a man who is duly qualified in three important respects to handle this subject, it will be taken up and dealt with. Firstly, he must be thoroughly well acquainted with this branch of joinery; secondly, he must be a good draughtsman, able to put his work on paper in a clean and efficient manner; and thirdly, he must be able to write clearly and intelligibly, and capable of imparting instructions so fully and so plainly that no one may fail to understand his meaning. I have met one man, as I have said, who could satisfy the first two requirements, but he could not write. Had he remained within my reach, I would with my own hand have put his teaching, orally given to myself, into intelligible form. He did not do so, and so the thing fell through; and now I should decline altogether to undertake the task of licking crude thoughts and language into shape. Others have proposed to take up the subject; but when it has come to the scratch, they have proved unwilling—to speak in the mildest terms—to satisfy me as to their qualifications. Now you see the position, and are, I trust, satisfied with my assurance that when the right man turns up to undertake the work, the work will be done.—ED.

**Ancient Lights.**—LOTO.—This notice, which is sometimes met with on buildings, refers to lights which have become a rightful possession by the lapse of years, and which, therefore, cannot be encroached upon or impaired by any proposed new building, even though no plan or stipulation as to such lights may appear in the said light-holder's lease.

**WORK Registered.**—MEREDITH.—As WORK contains no matter which is essentially "news," it cannot be registered as a newspaper.

**Brass and Iron-Work.**—W. E. P. (*Ross, Herefordshire*).—I am unacquainted with any technical work on the subject, but you will find some useful and highly artistic designs for brass and iron in a work by A. W. N. Pugin, Esq. (1836). London: Ackerman & Co. There are examples of all kinds of ecclesiastical fittings and furniture in brass and iron-work, commencing with nail-heads, crosses, hinges, locks, bolts, knockers, chests, coffers, lamps, terminations for turrets and gables, railings, lecterns, branches for lights, windows, escutcheons, etc. As to the tools required, they may depend in a great measure upon what you want to make. The brass ornaments may be either stamped, pressed, or flied out in a press, and stamped into the required shape; or they may be spun into shape in the spinning lathe, and chased or engraved by way of ornamentation; or the brass ornaments may be *repoussé* work, entirely done by hand. By reference to Vols. I. and II. of WORK, something of all the above processes may be learned, and the suggestion of ornamental brass and iron-work has been noted; and instructions, with suitable designs, will be given in WORK as soon as arrangements can be made. Commercially, ornamental brass and iron-work is divided and sub-divided for economic reasons into many branches and processes, and can only be carried on with large capital and a thorough practical acquaintance with the business. I enumerate a few:—The designer, ornamental worker in iron, stamper, press-worker, chaser, engraver, spinner, buffer, and finisher. Then there are the maker-up or putter-together of the different parts, and the erector. A good firm for presses and American drawing machinery is Messrs. Taylor & Challen, Great Hampton Street, Birmingham; brass sheets and drawn tubes from Messrs. Tucker, York Street, Sheffield. Mr. A. Foster, Rockingham Street, Sheffield, makes and supplies tools for *repoussé* work, embossing, and chasing; and tools for engraving may be had from Messrs. John Sellers & Son, Arundel Street, Sheffield. As to your inquiry for black printed patterns, all patterns of any commercial value would be found in "The Manufacturer's Private Pattern Book," which might sometimes be picked up for a mere trifle at a dealer's in second-hand books.—N. M.

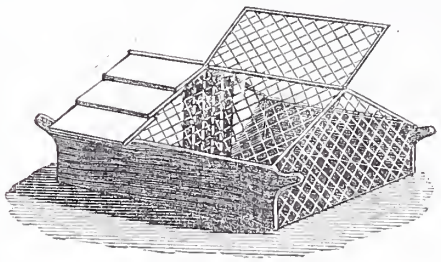
**Index.**—J. J. (*Birmingham*) and others.—The Index to Vol. II. of WORK is ready, and can be had from the publishers, Messrs. Cassell & Co., London, E.C., 1½d. post free.

**Wood Merchants.**—NO NAME.—You can get walnut at "Ware's," Kennington Lane, S.E. Consult Index to Vol. II., which is now ready, price 1d., and you will see several addresses of places you want.

**Æolian Harp.**—M. J. C. (*Glasgow*).—In Nos. 55 and 58 will be found information *re* the above. They can be had post free from the publishers, 1½d. each. The Index to Vol. II. is ready, and can be had of the publishers, post free for 1½d. It will be of great use to you for reference.

**Binding.**—BLOCKHEAD.—The four-page supplement of WORK should be pasted by "tacking" (as explained in the articles) it to the back of the section immediately preceding it. It is paged, so be careful to put it in its proper place. The fastening of the thread in sewing books is very simple. When you begin to sew, leave a long end where you started—that is, at the tail of the first section. Having passed the needle *up* the whole section, come *down* through the second; bring out the needle, and fasten the thread by tying it to the end which was left at the beginning. Now go on until you arrive at the head to the third sheet. Bring out the needle and pass it between the second and first sheets behind the thread, make a loop, and pass the needle through it and tighten up. When you come to the bottom of the fourth sheet do the same, and so on and on until the sewing is complete. I think this is simple enough without a diagram. The ends of the bands are first scraped thin; and after the end-papers have been placed upon the book, the slips, as they are called, are pasted and spread out flat upon the side of the book on the top of the end-paper. They should not be more than 1 in. long, and the reason of making them flat is to prevent them appearing like great lumps of rope when the book is opened.—G. C.

**Hen Coop.**—FACTS ON.—I give a sketch of above as supplied and manufactured by Messrs. Boulton & Paul, of Norwich. It is claimed for this coop that it is perfectly secure from inroads of vermin. The whole bottom of coop and run being



Hen Coop.

covered with 1 in. mesh wire netting, it is impossible for rats to get into it. The wire netting bottom lies flat on the ground, and can be covered with sand, or if on grass, the chicks run over it with perfect ease. When coop is shifted, all impurities fall through wire netting, and are readily swept away. Size, 5 ft. long, 2 ft. wide, 20 in. high; price, 15s.—E. D.

**Copying Printed Matter.**—W. O. J. (*Carnarvon*) will probably find photography the most satisfactory and simple way of reproducing printed matter.—S. W.

**Materials for Painting on Glass.**—G. C. (*Reading*).—Let G. C. try Messrs. Brodie & Middleton, Long Acre, W.C. They are, we believe, the London agents for the materials prepared by Mr. Hancock, of Worcester.—S. W.

**Firing Paintings on China.**—F. H. B. (*Barking*).—The home firing of painted china, as of painted glass, is generally done in what is called a "muffle"—a kind of box made either of iron or of a combination of iron and fire-brick; the "Automatic Kiln" is of this latter kind. It is said to be especially suited for amateurs. Purchasers are furnished with full instructions for fixing and using it.—S. W.

**House Painting.**—DECORATOR.—All the back numbers of WORK can be had through your bookseller or from the publishers. The Index to Vol. I., which can be had for 1d., will tell you the numbers.

**Scene-Painting Materials.**—W. P. (*Burton-in-Lonsdale*).—Any dealer in colours could supply you with paints. Consult the advertisements in WORK.

**Self-Centring Chuck.**—AMATEUR.—It is out of the power of an ordinary amateur to make a self-centring chuck. To be true to their name, the chucks must be exact in every part, and the most perfect of workshop appliances is needed to effect this. Even when a perfect chuck is made, having each of its jaws at an equal angle to each of its neighbours, and moving each jaw equally in obedience to the moving screws or spiral groove, a little variation of hardness in the jaws and some violence by the turner, and the accuracy is gone.—B. A. B.

**Soiled Book.**—J. B. (*London, W.C.*).—If the title-page of your book has only been soiled by "damp fingers," it could be cleaned by rubbing it carefully with bread-crumbs or indiarubber. If the latter is used, be careful not to rub too hard, or the cure may be worse than the disease. If there is any oil upon it, it should be washed with spirits of turpentine very carefully. The turpentine will run into the paper and turn it quite black-looking, and you will think it is completely spoiled; but it will all dry out, and the oil-stains will have disappeared.—G. C.

**Baking Bicycle Enamel.**—C. E. B. (*Poplar*).—The stove is heated up to 350° or 400°, using a thermometer. It is supplied with an arrangement of gas-pipes underneath; and a good supply of gas from the main is required. The work being first thoroughly cleaned from rust and grease, is coated with stoving enamel, called first coating, put in the stove for several hours. The first coat, when hard and cold, is smoothed with Tripoli powder, and another coat of finishing stoving enamel applied and baked as before. The stove has several angle iron ledges inside, on which various bars rest, on which to place or hang the work. The apparatus, including gas connection, would cost from £11 to £12; and unless your correspondent means to go into the thing on a large scale, he had better send out his bicycle or bicycles to a "baker."—A. S. P.

**Small Organ.**—GOOD TIPS.—It is possible to build a useful little pipe organ which will only occupy the same ground space as a moderate-sized American organ; but one must not expect too much from so small an instrument. The following specification is for an instrument which would be 4 ft. to 4 ft. 6 in. wide, and about 20 in. or 21 in. deep, exclusive of projection of keyboard, and 8 ft. to 9 ft. high—

| | | | | |
|---|---|---|---|---|
| 1. | Dulciana ... ... ... | 44 | pipes | 8 feet tone |
| 2. | Stopped Diapason (bass) ... | 12 | ,, | 8 ,, |
| 3. | Small Gamba, Keraulophon, or Vox Angelica ... | 44 | ,, | 8 ,, |
| 4. | Swabe flute, for principal.. | 56 | ,, | 4 ,, |
| | Total ... | 156 | | |

The sound-board for this would be about 4 ft. long and 18 in. wide if made singly; but it would be better to make it in two, and 3 in. or 4 in. in length might be saved, and more room gained for channels. Thus, make the front portion 3 ft. 9 in. long and 10 in. wide, with forty-four channels to accommodate the forty-four pipes in the treble of Nos. 1, 3, and 4. The back portion would be 3 ft. 9 in. long and about 6 in. wide, and would accommodate the twelve large pipes of Nos. 2 and 4, each standing in a single row. These two sound-boards would be united over a single wind-chest. The height of the instrument could be reduced, if required, by planting off a few of the largest pipes of each stop either at the front or ends. An octave coupler could be added if required, but would, of course, necessitate an extra octave of small pipes for each treble stop. The whole affair could also be enclosed so as to obtain a general swell. As regards a book on the subject, see replies in back numbers—*e.g.*, the last one mentioned in the answer by "K" (column 1, page 649, of No. 92) would just suit you, as it contains full and clear instructions for making every part of the instrument.—M. W.

**Writing Cabinet in Carved Work.**—X. L. U. MAY (*Hebdon Bridge, Yorkshire*).—I am obliged to you for your interesting communication respecting the construction of a writing cabinet from an old carved oak chest that belonged to your great-grandfather. It is most creditable to you that you should have evolved so good a piece of work from the materials at your command. I cannot, I regret to say, find room for its appearance in WORK; and your drawings shall be returned to you if you will favour me with your actual name, or certify me that the initials and name given above, which are open to suspicion, are those which really and truly belong to you.

**Artistic Lithography.**—H. G. (*Coventry*).—The above series is commenced in No. 106 of WORK.

**Screws.**—MECHANIC (*Leeds*).—An article on the above appeared in No. 109.

**Ladies' Writing Table and Escritoire.**—H. W. (*Rochester*) asks for a design for the above. The very thing he asks for he will find given in No. 56 of WORK.

**How to Net a Garden Hammock.**—F. W. P. (*London, W.*).—The article on the above appeared in WORK, No. 79. The Index to Vol. II. is now ready, and can be had from the publishers, post free 1½d.

**Clock Cleaning and Repairing.**—E. D. (*Deptford*).—The clock cleaning and repairing articles appeared in Vol. II. of WORK. You can get the Index to the volume and see what numbers you want. All the back numbers are in print, and can be ordered through your bookseller or from the publishers.

**Castings.**—B. (*Dundee*).—Having answered your questions as to castings, we can do no more.

**Bellows.**—E. A. and F. G. (*Bristol*).—Frame your reply so that it will be useful to all readers, and not to CARO only. All replies must go through "Shop."

**Brass Angle and Pieces.**—BERTIE.—Apply to any tool maker who supplies cabinet ironmongery. Many names have already been given in the pages of WORK.

**Dry Earth Closets.**—UBIQUE.—For the construction of an earth closet, sifted ashes mixed with fine dry mould would do excellently.—APIS.

**Colouring Clays.**—WORKITE.—Clay has many names. The chief one is "silicate of alumina" in one of its aspects of composition—the most general

one. Clay is the result of the decomposition by chemical and mechanical action of water and air on rock containing felspar, quartz, and mica; and by the action of water and air at certain temperatures it can be resolved into rock again. If for pottery, or extraction of metals or pigments, salts or acids, the processes are amply detailed in Roscoe's "Inorganic Chemistry" (Macmillan, 1880); and John Hunter's "Short Manual of Analytical Chemistry" (Simpkin and Marshall, 1887). W. A. Miller's "Text-Book of Chemistry" is a good book (Longman & Co., 1871); and a more extensive work, "Elements of Inorganic Chemistry," by the same author and publishers (1873); also Bloxam's "Chemistry" (Churchill & Co., 1890). In recommending these almost exhaustive treatises on earth clays, first, you will have a new vocabulary and a symbolisation of names demonstrated algebraically to learn; but that need not concern you much—it does not ninety-nine hundredths of the workers in clay, chalk, etc., for whom these are almost sealed books—and the formidable formulas you need not investigate for accuracy; every new decade modifies the past decade's assumptions and conclusions. One or two works have the word loam in the indices, and in the body of the work simply define it as "clay" or "impure clay," "clay from which bricks are made." It is an earth far too valuable for brickmaking, as well as often unfit. Some of it is worth 3s. 6d. per square yard, to be dug up by the buyer and carted several miles. It is the garden earth of these islands. The value of these books is in their chemical analysis of the earth's crust. They are beginning to learn about the fertilisation of earths. In following their guidance, you will find the track clear for you, and learn that, in operating chemically upon clays, you obtain aluminium and other metals; and learn also that there is about two pounds of aluminium and iron in every red brick that is used in buildings. The study of pigments in earths you will find interesting. What in wet weather we call mud is often paint, as umber, ochre, sienna, and various other clays that yield colour for the painter. Broadly defined, clay contains iron: ferro-oxide. Marl contains lime carbonates. Loam the chemists have not done justice to as the most fertile of earths. England now imports one-third of its food; without loam it would have to import two-thirds, and half its flowers also. The fossils, so valuable as manure, are well understood by farmers, even without chemical knowledge. Coprolites, which when ground to powder smelling and looking exactly like curry-powder, used to sell at £20 a ton. It is the remains of saurian animals, the teeth often found still perfect in shape. Pipe-clay, china-clay, chalk, etc., will yield new elements under the action of the blowpipe, pipe-clay becoming a colourless glass. The microscope will be essential for your studies. The clay—silicate of alumina—is mainly from granite. Its quartz is translucent, its felspar is cream-coloured, and its mica of glittering scales. In mixing clays you obtain porcelain. Thus: Kaolin or china-clay, 62 parts; Bougival chalk, 4 parts; Humont sand, 17 parts; felspar, 17 parts. This is the formula for the celebrated Sèvres porcelain. For pottery, clays need preparation and weathering, and have to be mixed with sand, chalk, ashes, etc., which prevent shrinking and warping under the action of heat. The clay worker puts back into the clay its rock-forming constituents, which the sun and rain had taken out. Glazes on pottery may be as simple as a dust over of sand, and kilning with salt in the furnace of kiln; or, for fine work, silicate of soda and lime, also silicate of potassium and lead. For colours from clays and earths you will have a vivid world of beauty open to you, and have to learn the new vocabulary of their names, which will mar your progress considerably if you wait to do that. You will be imperceptibly carried onwards in your studies to wider vistas of the unknown. The lapis lazuli is a silicate of alumina combined with lime, soda, sulphuric acid, and sulphur—the source of the once costly regal colour, ultramarine, now one of the medium-priced pigments made from clay: that is, kaolin, 100 parts; sodium carbonate, 100 parts; sulphur, 160 parts; and aluminium silicate, 17 parts, or also an addition of charcoal, 12 parts. In operating chemically upon clay you will soon find you have the metal aluminium. You will find you produce alum and iron, especially in the red clays. This alum, you will find, embodies as elements certain metals—but I must not detail the process of aluminium making, as it is now so well known. Perhaps you are near potteries, and can get to work in one to learn all about clay technically. China clay is called by chemists "hydrated aluminium silicate." Besides making hard china-ware, it is used as a dressing for paper, calico, and fustian. In this last form it is a source of permanent injury to health of wearers, by attracting damp to clothes worn by hard workers having fustian materials for make or linings; causing rheumatism to the wearers by the damp held by this clay. Its use thus ought to be penalised. Chalk—the remains, mostly, of marine shells—differs in density and fineness. The finest natural chalk is used for billiard chalks without preparation of any kind. England's manurial earths are but imperfectly studied by scientists, though known to farmers and old writers like Jethro Jull, who used common terms in speaking of them in his excellent writing on farming. Clay is the most valuable of manures for peat land, also with peat combined for light sandy land. Peat is excellent manure for stony land known as "stone brash." Chalk has general excellence to manure all soils. This interchange of soils serves another purpose; it eradicates and kills perennial weeds. Poppies cannot live in clay soils; chalk kills the heather; and many services to agriculture result from mingling of soils.—J. C. K.

**Druggists.**—F. L. W. (*Sandown*).—I do not know of any special firms who can be called "wholesale druggist to the cabinet and polishing trades;" but if you mean those who can supply lac, resin, methylated spirit, and such like used in making polish and varnish, you will find Burgoyne, Burbidge & Co., 16, Coleman Street, E.C., able to do the needful. Bottles can be got from Breffitts, 83, Upper Thames Street: or from Wright, Urmson & Wright, Southwark Street, London.—D. A.

**Jewel Cabinets.**—Z. L. R. (*Newhaven*).—I can hardly comprehend whether you want a swinging glass on top for toilet purposes or if I am to form my conclusions from the continuation of your letter, which says, "For a watch to hang on." At any rate, it matters little whether it be a swinging glass or a swinging lump of wood; in the former case, you must rebate it to admit the glass, and in the latter instance, hollow it slightly on the front for the watch's reception. A small peg inserted in the top of the stand will support the watch. The stand may be secured by thumb-screws between two brackets, the latter being further united by a cross-rail (as in Fig. 3), and the whole secured to the back of the cabinet. You ask for drawers and folding doors. As my suggestions may be of use to some who would not wish to repose the article in the company of a dressing-table, I have supposed

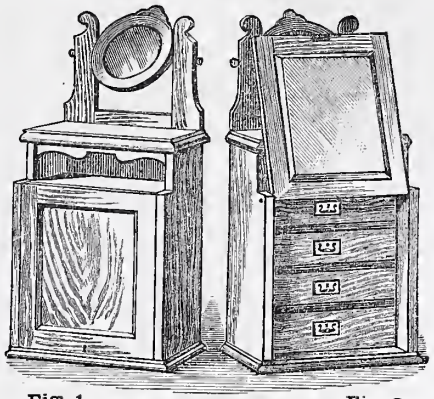


Fig. 1. Fig. 2.

Fig. 3.

**Jewel Cabinet. Fig. 1.—Jewel Cabinet. Fig. 2.—Cabinet with Flap Door opened (may be fitted with Mirror). Fig. 3.—Section of Back Uprights and Rail.**

that the door should open upwards, and be fitted on the inner side with a mirror. For appropriate remarks concerning this part, read through my article, "A Combination Bedroom Suite" (No. 26, Vol. I.). For the purpose of retaining the glass door in an elevated position, it is advisable to construct the cabinet in such a way that the front edge of the top board lays a short distance back from the front of the main portion of the article. The door will then lean against the top board. The former must be pivoted at the top between the sides of the cabinet. You might groove and tongue the sides and the top (dovetail form); but screwing will be sufficient for the back and bottom boards. Drawer runners, also, might be tongued to the sides. Have sunk handles to the drawers, that they may lay flush.—J. S.

**Chasing.**—MECHANIC.—In the first place, you must know that a knowledge of this trade is usually gained by apprenticeship, and that, although the process is fully described in the article in No. 92, Vol. II. of WORK, it is not to be expected that a person can at once jump into it and earn a living without much practice. The occupation is a very clean and pleasant one; and the remuneration depends on ability. An average workman can earn 50s. per week comfortably, and at present work is plentiful; but it is an occupation that depends largely upon fashion. Chased work is greatly in demand at present; and although a first-class workman can always depend upon employment, when the fashion changes some will have to go. However, if you are determined to go in for it, my advice is as follows: Keep to your present employment, if you have one: purchase the necessary tools for chasing, and work at home in your spare time until you are perfect. Then, when you think that you are competent, take a sample of your work round to the manufacturing silversmiths—you will get the names from the directory—and ask for a job; you will then see how you stand. London, Birmingham, and Sheffield are the three towns where this work is carried on. Most of the work is done in shops, not at home. I am not well acquainted with the London tool-makers, but write to Towneley, Bull Street, Birmingham, for their list. The snarling-iron is not usually quoted in the list, and would have to be ordered; it might cost about 10s.—F. R. H.

**Xylonite.**—J. W. P. (*London, E.C.*).—An article dealing with the use of xylonite for fretwork is in the Editor's hands, and you will find a great deal of information which will be useful to you and your chums who are fret-cutters. In the meantime, I may tell you that the best way to fasten sheets together for sawing several at a time depends on the thickness of the material. If this is less than about ⅛ in., I find it best to glue them together, with a piece of paper between; thicker stuff may be fastened with wire pins in the waste, but even for this glue is better. Certainly an ordinary drill will do. You could easily have ascertained this for yourself by experiment. I quite agree with you that there is a good deal of monotony in always using wood for fretwork, and that novelties should be welcome to the majority. Have you ever tried marquetry cutting? There is plenty of variety and interest in this work and its attendant operations. Please note that xylonite is spelt with an X, not with a Z, as you spell it.—D. D.

**Chessmen.**—W. E. H. (*Hebburn-on-Tyne*).—There is no reason why chessmen should not be made of imitation ivory. If you had taken the trouble to read WORK recently, you would have seen from the article on "Xylonite: its Nature and Use," on page 787, No. 101, Vol. II., that ample information is given about it. If you want your chessmen to resemble real ivory in appearance, get the "grained ivory" xylonite. You cannot make it. Buy the raw material, and do the carving, etc., yourself.—D. D.

**Tennis Shoes.**—H. B. W. (*Rugby*).—I cannot say whether the method of soling mentioned on p. 808 would do for tennis shoes, but I suppose so. The gutta-percha will not require stitching to them any more than to boots. If you follow the directions given, it ought to be sufficient. I am not acquainted with the tradespeople in Rugby, but if there is a dealer in indiarubber or waterproof goods, even if he does not keep gutta-percha in stock, he can get it for you in the ordinary course of his trade.—C. E. M.

**Table.**—W. E. (*Wimbledon*).—Undoubtedly the best way of finishing your table top will be by polishing it. If carefully done, no injury should arise to the painted decoration, which, I presume, is done with ordinary oil colours as prepared for artists' use. The enamelled part will probably not require anything doing to it. Probably you will get an equally satisfactory result by simply varnishing the decoration with a brush, using artists' copal varnish. I do not think it would be of any advantage for you to varnish first and then polish; but if varnish alone does not suit, there can be no harm in your trying.—D. A.

**Xylophone, Wood, etc.**—E. F. P. (*Leicester*).—The best wood for the notes is rosewood, but you may use oak or pine with very good results. Pieces with knots should be avoided; and a more even tone is said to be got if all the pieces are cut from one plank. The notes are 1½ in. wide and ⅝ in. thick, and rounded on the upper side. Holes are bored about 1½ in. from the ends, and a cord is put through, with a knot between each note. If you want semitones you must have three cords, and put the semitones in groups of two and three in one row, and the naturals in the other row, the middle cord passing through both naturals and semitones, and arranging them similar to the keys of a piano. To find the approximate length of the notes, mark thirteen lines at equal distances, and at right angles to a base line. Make the longest line 12 in. (which is E), and the shortest 8 in. (which is its octave), and draw a line between the points thus marked. The intermediate lines will give the length of all the notes between; and by drawing more perpendicular lines at either end, the same distance apart, and prolonging the line, you can get the length of the notes above and below. They are laid on three straw ropes about ¾ in. diameter, and played by two beaters of hard wood. You can tune the notes accurately to a piano by cutting a little off the ends to sharpen them. The Editor has an article and drawings on the subject, which will be printed as soon as space can be found for it, which will be of service to you. You can make one with brass tubes in the same manner, drilling holes through the tubes for the cords, and using tubes from 1 in. to ¾ in. diameter. You can get the lengths in the same manner, and tune them by filing a little off the ends till of the right tone.—M.

**Petroleum Engines.**—J. H. D. (*Halifax*).—The petroleum engine is very similar in character to the gas engine. In one form the oil is not vaporised, but is drawn into the cylinder in fine spray mixed with air. The action, or cycle, as it is termed, is as follows: an outward stroke of the piston draws in behind it a mixture of air and petroleum spray; the next inward stroke compresses the mixture to about three atmospheres; and at the commencement of the next outward stroke the mixture is fired by a gas jet in a suitable slide. This engine is single-acting, and makes one effective stroke in four. During the fourth stroke, which completes the cycle, the products of combustion are driven out at the exhaust. In another form of petroleum engine, the oil is forced by air pressure into a vaporiser appended to the cylinder, and there mixed with air under pressure as it is vaporised. The heat for vaporising is at the start furnished by a jet under the vaporising chamber, and afterwards maintained by the heat of the exhaust. One stroke in four is effective, and the mixture is fired by an electric spark from a coil excited by one large bichromate cell. The impulses occurring at such comparatively long intervals, these motors require

much heavier fly-wheels in proportion to their power than steam engines, to ensure steady running. The cylinder is surrounded by a water jacket, to prevent over-heating. It has been proposed to make the cylinder with external ribs to carry excessive heat off by air currents, and so dispense with the water tank; but I do not know if this has proved a success. It is said that these engines do not require cylinder lubrication.—F. C.

**Shoe Blacking.**—SHOEBLACK.—There are a great many recipes for making both liquid and paste blacking, all more or less good for the purpose. The great secret in successfully making all the various blackings is the proportions of the ingredients used, the quality of them, and the perfect and careful mixing, so as to get a smooth, even product. Unless this is done, no satisfactory result can be obtained. Blacking from the following recipes may be made in large or small quantities without the use of machinery; but where large quantities are to be produced, it would be madness to attempt it without its aid. The recipes given are known to be good; but unless it is intended to make it a business to manufacture and sell, it would be a great waste of time and trouble to attempt it, as it can be bought so cheaply and so good. Liquid blacking:—Take of bone-black—not lamp-black—16 parts; treacle, 12 parts: oil of vitriol, 3 parts; seal, cod, or sperm oil, 2 parts; gum arabic, 1 part; strong vinegar or sour beer, 48 to 50 parts—all by weight. The first step is to place the bone-black in a large wooden, stoneware, or enamelled iron vessel, to which add the oil, and rub and stir them well together; when this has become a smooth, even mass, gradually add the treacle, still rubbing or grinding the whole together all the time each ingredient is being, and also after each is, added, until the oil is thoroughly amalgamated or "killed," and continue to grind or rub the mixture for some considerable time. Now dilute the oil of vitriol with about three times its bulk of water, doing this very carefully to avoid the chance of accident, and then add it, a little at a time, to the other ingredients, stirring them briskly during the time of addition and for some time afterwards, until it has become quite smooth and homogeneous. It should then be allowed to stand for two or three days longer, stirring in the meantime for half an hour daily. Having meantime dissolved the gum in the vinegar, add the solution gradually to the rest, and stir it briskly for some time, and again daily for three or four days. It will be found beneficial if all the ingredients, except the vitriol, be made hot before mixing, as the shining quality of the product will be greatly improved, and the time required in the manufacture will be shortened thereby. Another recipe is: 16 parts of ivory-black, 8 parts of treacle, 4 parts oil of vitriol diluted with 2 parts of water, 2 parts of the same kind of oil as in the former recipe, 1 part of gum arabic diluted in 64 parts of water for the final dilution in place of vinegar; all to be mixed and treated as in the first case. This makes an excellent blacking. Another recipe is the same as the last, but only taking 6 parts treacle, 1 part of oil, and omitting the gum arabic. This also makes a good blacking. *Paste Blacking.*—Take of india-rubber oil, ivory- or bone-black, treacle, and gum arabic, the same proportions as are given for the liquid blacking, but take care to dissolve the gum arabic in vinegar, using only one quarter of the proportions given in the other cases. The mass, when mixed, must be stirred daily for a week, when it will be ready for putting up. Another recipe for paste blacking is as follows: Ivory-black, 1 part; treacle, ½ part; sweet oil, ½ part. Mix them well together, as in the other cases, then stir in a mixture of hydrochloric acid, ½ part; oil of vitriol, ¼ part (each separately diluted with twice its weight of water before mixing them). The difference between liquid and paste blacking chiefly consists in the greater or less amount of liquid employed, and not so much in the materials and proportions. Blacking, both liquid and paste, should be kept in a cool and moderately dry place, and kept carefully corked, as exposure to the atmosphere is found to destroy most of its best qualities. I am not aware of any book being published on the subject, nor does it seem one of sufficient interest to induce a person to encounter the expenditure of time and labour needed to produce it.—C. E.

**Drawings of Steam Engines.**—H. M. (*Liverpool*).—Such drawings as you inquire about are not kept on sale. You should apply to some mechanical engineer, who may have sets of working drawings, tracings of which he might supply to you. As a rule, manufacturers do not supply tracings unless an order is in view, and then working details would not be given. The cost will depend upon the size and amount of work in the drawings.—F. C.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Glass Writing.**—W. T. G. (*Bristol*) writes:—"I have noticed on glass signs letters that look like mother of-pearl. I shall be glad if anyone can inform me where it can be obtained, the cost, and whether it is made in leaves like gold-leaf."

**Stereotyping.**—S. T. (*York*) writes:—"Can any of the readers of 'Shop' inform me if the dipping-pan is now used for stereo work? What is the use of the floating plate? How should the plaster mould be placed in the pan—face up or down? on the floating plate or on the bottom of the pan?"

**Clay Mixtures.**—HEATHFIELDS writes:—"Will any reader give me information about building with clay mixed with straw? It was, I believe, common many years ago in some parts of the country for cottages, and was very warm and comfortable. The walls were very thick."

**Fret Machine.**—D. B. (*Wymondham*) writes:—"Seeing in your valuable paper WORK, page 846, No. 104, a description of a fret machine, will J. H. W. (*Chatham*) kindly inform me as to measurements, and how to make it?"

**Sharpening and Clipping Machines.**—W. B. B. (*Edinburgh*) writes:—"Can any reader give me any information as to how horse-clipping machines are re-sharpened?"

**Fish Stuffing.**—F. M. (*London, N.W.*) writes:—"Will any reader give me information on stuffing fishes?"

**Staining.**—J. W. B. (*Huddersfield*) asks:—"How can I stain oak, birch, etc., black by a kind of liquid which will sink into the wood; for when oak is shut up tight in a box with strong ammonia, the strong scent or stench causes it to become brown. What will stain other woods brown to match it, and sink in also?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Turned Wood Cases.**—CHEMICUS writes, in reply to W. H. (*Stirling*) (see page 14, Vol. III.):—"I have found those manufactured by Messrs. E. B. Estes & Sons, of New York, to be both *good* and *cheap*. The *sole* English agents are Messrs. Kilner Bros., King's Cross Station, London, N. W. H. cannot do better than write to the latter for illustrated price list, which also contains several other kinds of turned wood goods."

**Carved Wood Bellows.**—TOPO writes, in reply to CARO (see page 14, Vol. III.): "Why does not CARO finish off his carved bellows himself, and enhance the pleasure of his work by making it complete throughout? It is simple enough; and of course he could save money by doing it himself. Examine an old pair of bellows (or buy a cheap set for the occasion), get a nozzle and tacks or brass-headed nails from the ironmonger's, and leather from the leather-seller's, and it is soon done. Or he can read instructions and see where materials are to be had in an excellent little work, 'Hints on Wood-Carving,' by Miss Rowe, School of Art Wood-Carving, City and Guilds Institute, South Kensington (price 1s.), page 71. I do not know where he could get prepared wood from; but no doubt Miss Rowe would be pleased to inform him, if he would drop a line to her as above, enclosing stamp for reply. Mr. E. Rogers, of Maddox Street, London, W., also furnishes all materials for wood-carving."

**Iron Lasts.**—W. G. (*London, N.W.*) writes, in answer to W. S. (*Highbury*) (see page 830, Vol. II.):—"You can get them at Penton and Sons', 1 and 3, Mortimer Street, W. (opposite Middlesex Hospital). They sell them in pairs—gentlemen's, 3s. 9d.; ladies', 2s. 9d.; youths', 2s. 9d.; boys', 1s. 9d.; children's, 1s. 3d."

**Dry Battery.**—H. E. (*London, N.W.*) writes, in reply to ELECTRIC (see page 14, Vol. III.):—"To make a dry battery, line some battery cells with stout sheet zinc, leaving a lug for connection (salt jars answer admirably, or for a smaller size those straight glass pound jars without any neck that jam is sold in). Place a carbon plate in centre, and fill in with the following mixture: Dissolve in a pint of water 1 oz. each of chloride of zinc and chloride of ammonium (sal-ammoniac), then add 1 oz. of oxide of zinc, and then sufficient plaster of Paris to make a rather sloppy paste. As the plaster would soon set and harden, add a small quantity of glue or gelatine dissolved in a portion of the liquid. When firm, pour melted paraffin wax over the top, to prevent evaporation. Make two air-holes through the wax, and keep in a cool place. Agglomerate Leclanché cells can be transformed into dry batteries by mixing with the ordinary solution—plaster and gelatine—and sealing over with wax. I had some of the latter working very satisfactorily; but being mixed without the gelatine, and kept in a rather warm place, they dried up in about five months."

**Engraving.**—L. S. L. (*Kirkcaldy*) writes, in reply to C. P. (*Wanstead*) (see page 765, Vol. II.):—"A very simple way to engrave the names mentioned by C. P. (*Wanstead*), or such-like work, is to heat the plate in front of a fire or over a spirit lamp; rub the whole surface, both face and back, over with a piece of paraffin wax, and when quite cool, write with a strong needle point, after which the plate should be immersed in a bath of nitric acid and water until the writing is bitten sufficiently deep. Should the plate be attached to a leather collar, of course it must first be removed, or a 'wall' formed round the space to be occupied by the writing. This also can easily be done with the paraffin wax. With ordinary care very beautiful results may be obtained."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—M. D. C. (*Liverpool*); T. E. (*Liverpool*); T. A. G. (*Stratford, E.*); DOWN; JOINER; A. H.; INQUIRER (*Birmingham*); F. R. H. (*Regent's Park, N.W.*); J. S. (*London, W.C.*); J. W. (*Edinburgh*); C. H. B.; A CONSTANT READER (*Dewsbury*); T. M. (*Gateshead-on-Tyne*); F. C. (*Manchester*); R. E. A. (*Sheerness*); DESIGNER; J. G. P. (*Crewe*); J. C. (*Bristol*); H. W. (*Wimborne*); J. H. I. (*St. Helen's*); F. C. (*Peckham*); W. M. (*Market Drayton*); INQUIRER (*Eccles*); B. A. B. (*Hampstead, N.W.*); H. D. P. (*London, E.C.*); G. P. (*Camberwell, S.E.*); F. P. (*Taunton*); J. W. (*Liverpool*); T. S. (*Carlisle*); J. G. (*Glasgow*); G. S. L. (*Hampstead, N.W.*); J. J. (*Stoke-on-Trent*); W. J. D. (*Manchester*); PEN AND INK; CHECKEREO; H. W. (*London, S.W.*); G. H. (*Darlington*); C. E. (*London, N.*).

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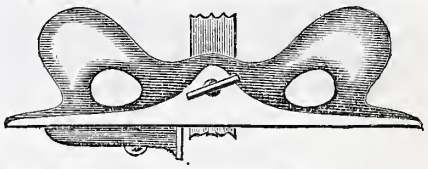

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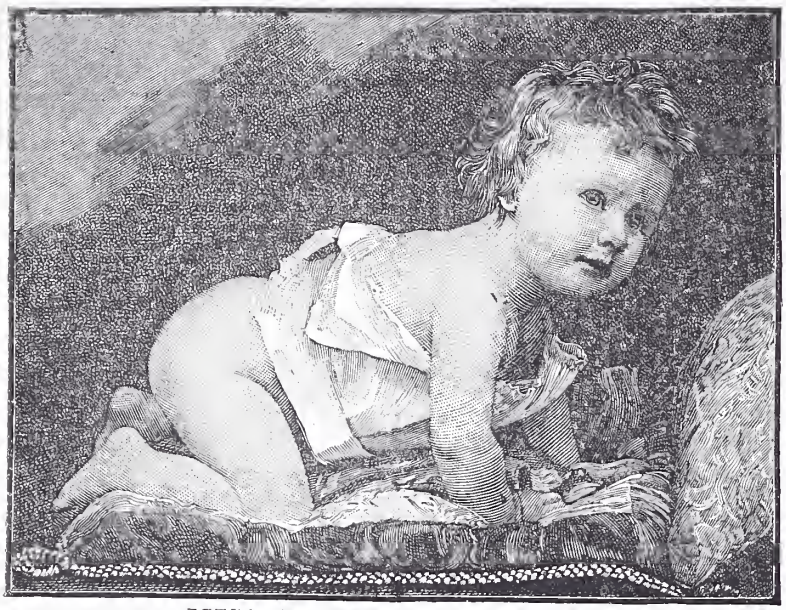

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 112.] SATURDAY, MAY 9, 1891. [PRICE ONE PENNY.

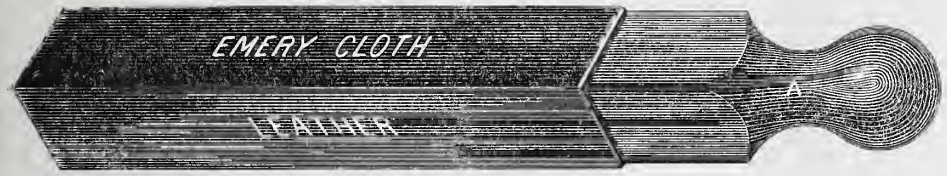
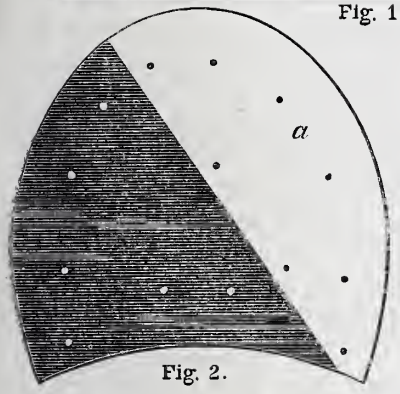



Fig. 1.

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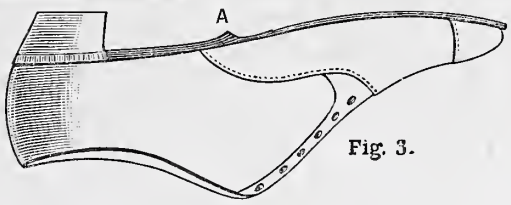


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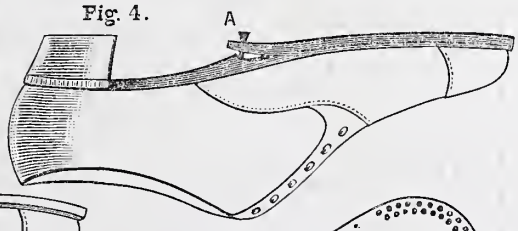
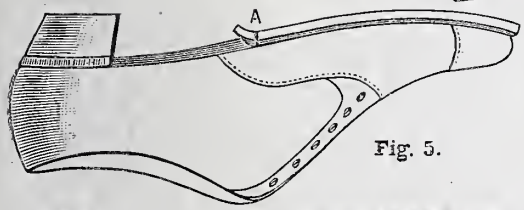



Fig. 4.

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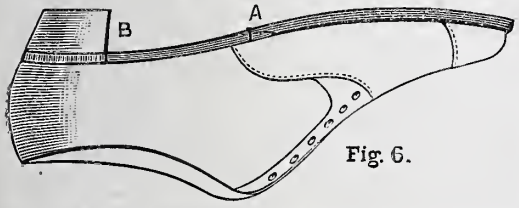



Fig. 6.

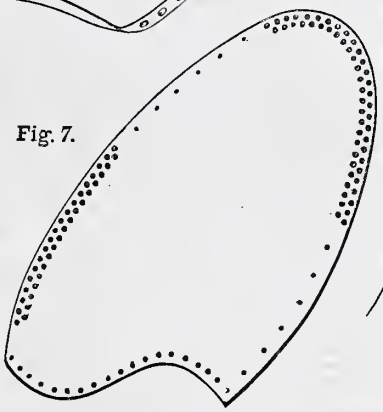


Fig. 7.

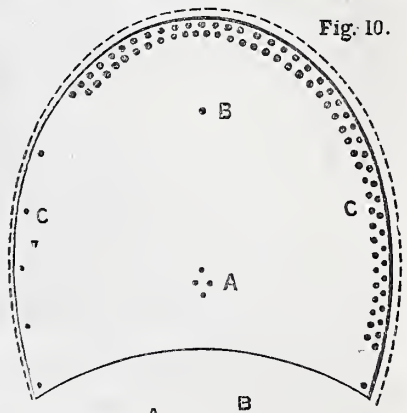



Fig. 10.

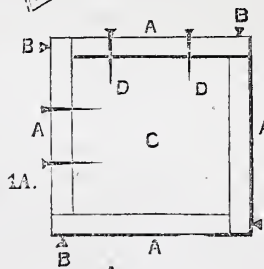



Fig. 1A.

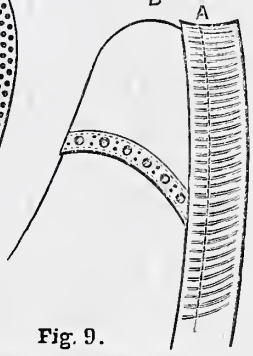



Fig. 9.

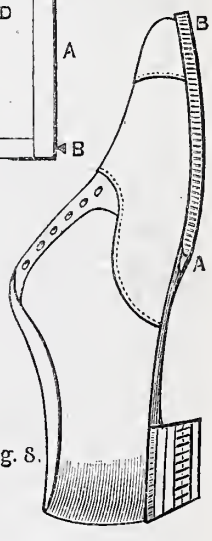



Fig. 8.

**Fig. 1.—Home-Made Sharpening Strop. Fig. 1A.—End View of Sharpening Strop, showing Construction. Fig. 2.—Lift in Heel with Worn Part (*a*) cut away. Fig. 3.—Shoe as it appears after removal of Old Sole and grooved at A for Junction of New Sole. Fig. 4.—Shoe with New Sole fitted on, overlapping Groove at A. Fig. 5.—Shoe with New Sole well fitted into Groove at A. Fig. 6.—Shoe, showing Solid Junction between Old and New Soles at A before Riveting. Fig. 7.—Mode of Pricking Sole for Insertion of Rivets. Fig. 8.—Position of Shoe for paning down Sole, as shown from A to B. Fig. 9.—Enlarged Sketch to show how Paning is done. Fig. 10.—Top Piece on Heel.**

## BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

### SOLING AND HEELING.

INTRODUCTION—COMPARATIVE COST OF LEATHER—GRINDERY, ETC.—THE SHARPENING STROP—TREATMENT OF LEATHER—PREPARING THE BOOTS—SOLING—HEELING—PRICE LIST OF TOOLS, ETC.

IN bringing these and the following articles under the notice of the readers of WORK, I do not think I am far wrong when I say there are a great many skilled workmen, of various trades, who read the many very interesting articles that are given us simply to gain an universal knowledge, as they do not touch their own particular trade farther than suggesting an idea or two, and therefore (although very edifying) they get but the theory, as they cannot experiment upon them, for want of spare cash as means to provide themselves with tools, materials, etc. But this can form no excuse for not putting these articles on Boot and Shoe Repairing into practice, for there are not many tools needed to start with, and leather can be bought in small quantities, and all the necessary grindery (rivets, brads, pegs, wax, hemp, paste, etc., etc.) can be bought, not only in small quantities, but at a very low rate; and last, but certainly not least, that which you are about to produce is a very great necessity, and if you do not do it yourself, you must pay to have it done; for boots and shoes are not only a luxury, but a necessity. Therefore, if a man makes this trade a study as an amateur, he at once increases his income—at least, equivalent to it; for shoe leather is like rent—to keep yourself dry and free from exposure. It is a continual outlay, and thus makes a diminution in your wages, which is often keenly felt if you have a family.

Now, this expense can be obviated by any man of ordinary ability, and he can save himself a considerable item of enforced expense.

For, in the first place, suppose your boots want soling and heeling, the cheapest you can get them done for is 2s. 6d.,

gentlemen's; and then they are done in a very inferior manner, and foreign leather nearly always used—not but what there are good tannages and parts in foreign stuff. But this class of repairer only uses what are called first-cuts (the neck end of the butt), which is the lightest leather, both in substance and weight, and consequently the cheapest. Well, a pair of soles of this kind only cost about 4d. or 5d., the top-pieces (heel-pieces) 1½d. or 2d.; so really the leather does not cost more than 7d. at the outside; so if they do not last long in wear, it is not to be wondered at. Besides, they are often put on so badly, and with such long rivets, that you cannot get the sole off again without pulling them all to pieces. But if you do them yourself, and take pains with them, you are sure to get enough wear out of them to well recompense you for the time and money you have spent upon them.

Now, if you are going to sole and heel a pair of boots, a pair of soles of English tannage will cost from 9d., and top-pieces from 3d.; iron rivets, ½ lb., 1½d. (you can buy a halfpennyworth): ½ in. is a very useful size; sand-paper, 1 sheet, size 1½, cost ½d., and ink, ½d. Then you have about 1s. 4d. left towards tools, and a better sole you would not have got, at a good many shops, had you paid 3s. 6d.

Most important in tools, and most needed, are an iron foot, a hammer, knife, nippers, glazing iron, and rasp (a price list of which I will give later on). This stipulation of tools is, of course, not sufficient to turn work out properly. But my aim is to say the least quantity possible, so that the first four or five jobs shall cost no more than if you had taken them to an ordinary repairer to have them done. Perhaps it is well to mention here that heeling, underlaying (that is, pieces under the soles), is better to start upon than soling and heeling throughout; as by this means you will gradually get the use of the tools, and your hand in for harder tasks.

Say, for instance, your boots want the heels set up on one side only, and the soles want a piece under the side, or toe-piece. This is often the case, and you can do a job like this with very few tools. But, of course, always buy a tool if you want it, and can afford it; and always try and do the work as well as you can, for it is work that, if you do take pains with, you will soon see you are making progress. As it is work that has come under every man's notice (when he has had to pay for it), he has some idea how it should look when finished.

One indispensable tool is a sharpening strop. You can buy one, which is generally a piece of square wood, solid, about 16 in. long, shaped at one end for about 4 in. to form the handle, or you can make one out of any piece of wood yourself. But while you are about it, you may as well make a good and useful one, in this way. Take four pieces of wood, ¼ in. thick, 12 in. long, and about 1¾ in. wide: place them together in a square, as A, A, A, A, Fig. 1A, and screw them together as B, B, B, B, Fig. 1A. Then cut a square piece, as C, and fix it in with two French nails at each side, as D, D, Fig. 1A. Then have a square piece, the same substance, about 6 in. long, and shape it for the handle, as A, Fig. 1, leaving about 2 in. square, to form a stopper for the square case, which you will always find very handy to keep your spare awls in, and also broken awls, the use of which I will explain later on. It is also very good to keep your sharp knife in, for if left with other tools, it gets blunt, and when you pick one tool up, you are apt to cut your hand if the knife is close to it.

When you have got it completed, as Fig. 1, paste a piece of leather on one side, and on the other three sides paste emery-cloth, sizes 1½, 1, and FF. For a fine edge to the knife use the FF, and dip the blade of the knife in water, and finish on the leather side. In sharpening a knife, always hold the blade quite flat on the sharpener, or you will get a round edge to it, and make it very hard to use.

Now, paste is very often wanted. You can get a halfpennyworth at any grindery shop. But then some of it is sure to be wasted, as it so soon gets dry. So the best way is to get a little rye-flour—a table-spoonful put into a jar, with a little *boiling* water on it, and well stirred, is economical, and you can always have paste in a few minutes.

Well, now you have leather and tools, we will start work. The chair you sit on wants to be cut down, if an ordinary chair, to about 14 in.; or anything that height will do. Your tools, for the time, can be put on the floor, or on the box you keep them in (later on I will describe the way to make a shoemaker's bench). But now we will sole and heel a pair of boots. We will suppose them to be riveted or machine-sewn, and the new soles to be riveted on; or, if hand-sewn, they must be clumped (a new sole on top of the old one), though I hope you will soon be able to sew a pair of soles on, and then they need not be clumped. Then, first of all, dip the boots into water—the soles and heels only—and hold them in for a few minutes; then let them get dry a little, so as to let them be just mellow. The leather must be put in water, and let get thoroughly wet through: take it out, and let it get nearly dry—not by the fire, if you can help it. If you do, do not put it close. Then rasp off all flesh (a rough flaky stuff on the back); then put the lap iron (a laundress's iron with the handle off) on your thighs, just above your knees, put the leather on it, grain side down, and hammer it well out even and gently, commencing from the centre. This makes the fibrous tissues more dense, and makes it more resistive of wear, and also more impervious to dampness and water in wear. But while your leather dries, take off the old top-pieces that are worn, and if the lifts are worn, cut or saw them through the centre, and take away that portion that is worn (as *a*, Fig. 2). This can then be replaced by a piece of new leather, which need not be of the best quality. There are other forms of building up heels, which I will explain as we make progress.

Now take off the old sole. This should be cut off to within about ¾ in. from where the new sole is coming down to. You can then mark it off at the exact distance or length that you are going to have the sole, and then start to skive it off from this mark in a tapered form to where you have cut it off. Then take your knife, and from the line scoop it out evenly, until you get about one-third of the way through (as A, in Fig. 3). Then tap it down lightly, right across where you have hollowed it out; this should be done with the pane end of the hammer. This hardens it to receive the pegs or rivets, and gives an extra drop to receive the new sole without weakening the old leather. Where the sole is going to be spliced to this part of the waist of the boot it must be skived, but not too thin, and this is best on the flesh side for light work, and on the grain side for heavier work. Then slightly paste the groove in the old leather, and the new sole also, where it has been skived; this tends to make the graft nice and firm when finished.

It is well to mention here, perhaps, that it is all important to properly work the leather before using—that is, wetting, fleshing, drying, and hammering, as explained above.

Then place the boot or shoe on an iron foot. The sole should be put on (the skived end) to overlap the groove about ⅛ in (as A, in Fig. 4), which, when riveted, should be well into the groove (as shown at A, Fig. 5). If the graft is well done, it will have the end of the new sole sticking up above the old leather. This must be pared off neatly with the waist, then paned and rasped off; and if these details are carried out, you will not only have a neat, but a permanently solid seam (as A, Fig. 6).

Now, before putting the rivets in, pare up the sole, but not too close—leave a small margin all round. About ⅜ in. from the edge, draw a line all round with a pair of compasses; if you have not a pair, hold a pencil between the thumb and finger, placing the second finger against the edge of the sole, which will answer the purpose. Then with an awl prick all round the sole, on the line, small holes to receive the rivets. The best way is to put them close where the most wear comes—that is, generally, at the toe and outside joint. Where it is best to use iron, and elsewhere brass, rivets, Fig. 7 shows about the form in which they should be put in.

Then, again, trim up the edge with the knife, being very careful not to cut the tops; then damp the edge, and pane it all round with the pane end of the hammer. This should be done with the shoe on the knees, with the heel towards you and the edge of the sole upwards, as shown in Fig. 8, and paned as shown at A B, same figure, commencing at A, and going right round the sole. This paning process is important, as it hardens the edge, tends to make it hollow, and prepares it to receive the next tool, which is the rasp. Fig. 9 shows the toe end of a shoe, and shows how this paning should be done to pane the new and old leather together, and keep the edge hollow (as at A, Fig. 9). Then let it dry, while you proceed with the rest. If you have had to repair the lifts (which you ought not to do, for when you repair your own boots, never let the heels go more than just through the top-piece: then you keep the heels in shape), in putting the pieces on, do not let the nails be too near the edge, or, when you put on the top-piece, one set of nails will come in contact with the other, and produce very unpleasant results. When you build the heel up, ready for the top-piece, it is well to make that side where the most wear is just a little higher—it tends to make you wear more even. Then tack your top-piece on, putting a nail at A and one at B (Fig. 10), and round it up with the knife, leaving a little on all round, more particularly the part that is to receive the most nails, as shown by the dotted line, Fig. 10. The rivets should then be put in, as C, C, but first mark it round and hole it, as you did for the soles, then pare and pane, as described above; then the edges of the soles and heels should be rasped, then buffed with a buff-knife (or scraper, as it is also called). This tool can be made with about 3 in. of old stay busk; the way to make and sharpen it is very well described in Work, No. 24, Vol. I., pages 372 and 373, in an article on the Scraper, by A Cabinet-Maker. Such a tool can be

bought, but it is seldom ready for use, so you might as well make one right out; a piece of glass, fresh broken, will suffice. Then sand-paper the edges with a piece of 1½ sand-paper. Then the tops of the sole and heel can be filed with the file side of the rasp, to make the heads of the rivets smooth and even with the sole; then buff off the grain of the leather with the scraper, and sand-paper it all over. This is called a rough bottom, and all that is needed for own work. Now you can rub just a little paste on the edges with a piece of rag, and ink the edges and the waist (American ink is best). This you let get just dry, then iron them up with the glazing-iron. The iron must not be very hot; its proper heat can be told in this way—that is, if it is put into water, by it only being hot enough for it to just cause a frizzle. A forepart iron should be used for the soles, but the glazer will do for the trial. This ironing process gives a nice gloss, which is increased and made more permanent by ironing a second time, at the same time ironing on a thin coat of heel-ball, which can be rubbed off smooth with a piece of old cloth, which will leave a brilliant polish.

But before I leave this, our first job of soling and heeling, I must tell you I always want you to bear in mind the following: that you can finish any job in repairing much better if you have a last inside; and that paning, rasping, buffing—in fact, all finishing—should be commenced from A for the soles (Fig. 8), and from B (Fig. 6) for the heels, the only exception being in using the knife, the action of which is just the reverse in both cases; that you should get as many tools as you can, but not till you want them, and always use them for their proper purposes; and last, that I shall always try and be as explicit as possible in describing the terms, tools, and means, so as not to lead the student into any mystery that will cause him to lose his patience.

I may briefly state that an iron foot may be bought at 1½d. per lb., and a handle for 5d.; or a Paragon foot (Blakey's) may be purchased for 1s. A shoemaker's knife costs 2½d.; a hammer, 6d.; nippers, 5½d.; glazing-iron, 6d.; and a forepart iron, 8d. These may be obtained at any grindery shop; but if any reader is unable to find, or pay a visit to, any such shop, he may get the tools named, and any others commonly used in the trade, at Penton's, 1 and 3, Mortimer Street, London, W.

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

TRACERS—SCRAPERS AND ENGRAVERS—POINTERS AND GRAVERS—SNAKE-STONE—PUMICE-STONE—TRACING PAPERS—DIAPHANIE—KEY-STONE—HOW TO USE THE PEN—GELATINE—RED TRANSFER PAPER—NITRIC ACID—ETCHING—GUM FOR PREPARING ACID—ACETIC ACID—BENZOLINE.

TRACERS are best made of small round pieces of steel, about as thick as the lead of an ordinary pencil, and about 1½ in. in length, fixed in a wooden holder, and pointed just sharp enough not to scratch or tear the tracing. A hard lead pencil may be sometimes used, but the point wears thick and does not make such a clean line.

Scrapers and engravers are steel knives thick in the centre, bevelled off on either side, and made very sharp at the edges. They are of various sizes, and used for cutting lines on the stone, or making corrections, etc. A sharp penknife is sometimes useful if handled with discretion.

Pointers and gravers are round or square pieces of steel, fixed in wood like a lead pencil, and sharpened to a very fine point or a flat surface. Should the student require one finer than can be bought, he could take an ordinary tailor's needle, fix it in a wooden handle with sealing-wax, and sharpen the point to the size required. It is well to have various sizes for different kinds of work, and a hone or oil-stone should be kept for the purpose of sharpening penknives, pointers, etc. Of course everyone will know that this cannot be used without a little common oil.

A small stick of water of Ayr, or snake-stone, should be kept for the purpose of repolishing any small portion of the stone without going to the printer; this must be used with water, and the stone rinsed well afterwards with a clean sponge and water.

A piece of prepared pumice-stone will answer the same purpose as snake-stone, and has the advantage that it need not be used with water, simply scraping it clean with a knife; but it is better to use snake-stone when the water would not interfere with the drawing.

The artist must always bear in mind never to work on the stone while it is wet, or the damp surface will cause the water from the ink to spread, and so destroy its properties. Should the breath of the artist go on the stone it would have the same effect; thus he should protect the drawing by holding a sheet of paper or a protector before the mouth if he is obliged to look very closely at his work.

Various kinds of tracing papers are used in lithography; first the ordinary kind, which can be drawn on with an H or HH pencil, ordinary writing, or lithographic ink, a good clear pencil line being about the best.

French *végétal* tracing paper is much clearer than the ordinary kind, but having a shiny surface will not take the pencil readily. Lithographic pens and ordinary writing ink make very good tracings on this paper.

Then there is a specially prepared transparent paper called diaphanie, used for tracing drawings for colour work, or where more than one impression or tracing of the same sketch is required to be taken.

For instance, a drawing containing half a dozen different colours would necessitate half a dozen different stones, therefore six different tracings would be necessary; but it being impossible to make so many *exactly similar* tracings, the artist makes *one* on the above paper in lithographic ink, and then hands it over to the printer. This tracing the printer transfers to a stone called the key-stone, from which he prints as many different impressions as there are colours in the drawing—in the above instance six—and transfers them to the different stones, using red chalk in the place of ink, thus obtaining six perfectly similar red impressions from the one original.

It is difficult to know where to draw the line between the artist's and the printer's work; but it is absolutely necessary that the former should know a little of the subsequent treatment his work undergoes after it leaves his hands, and also that he should thoroughly understand and appreciate the different purposes for which any point connected with the drawing is required.

Care must be used in making the above tracing to do so on the prepared side of the paper; and this is important, insomuch that unnecessary delay may be caused by carelessness in this respect, in having the entire tracing to redraw. The prepared side is found by slightly wetting the finger and thumb, and pressing a corner of the paper between them; then whichever holds most firmly to the paper will be the right side on which to make the tracing. As a rule, the maker's name reads correctly on the wrong side, but the student will understand that this should in no instance be depended upon.

The above papers must not be confounded with the prepared papers previously alluded to, as they are only suitable for making tracings on, whereas finished drawings and writings can be made on the former.

Gelatine is also a very clear substance on which to make tracings or engravings, but more suitable for the graver than the pen. When the tracing is required to be engraved, as in the case of fine work, the lines should be cut cleanly out with a fine pointer—not too deep, but just sufficiently so to take a piece out of the gelatine, which will eventually be filled with ink and transferred to stone. It would not be of any use merely to scratch the surface, as it would not then hold the ink; and care should be taken to brush the pieces cut out cleanly away, or they will smear the lines.

When the pen is used it should be allowed to glide over the surface, and not dug into the gelatine. This applies as well to diaphanie paper, for if pressed in the surface the pen is likely to take the preparation or coating off from the paper, and will not make a clear line, which is so necessary to produce a good tracing; and whilst on this subject, the student will do well to remember that a little extra time spent over the tracing will save him double, nay treble, the labour in finding out the different parts of the drawing, especially in colour-work when it comes to be reversed on stone.

Although gelatine is so very clear, still the artist will find that for all ordinary work diaphanie paper will serve his purpose the best; and if gelatine is necessary for some fine and intricate kinds of work, it may be more worth his while to draw the tracing with the pen than to spend time practising with the graver, though of course it would be as well that he should know this, as well as every branch appertaining to lithographic drawing and engraving. It would be impossible to give details of all the different branches of lithography, which at times apply as much to the artist as the printer; therefore these subjects in future will only be mentioned so far as they are necessary for the furtherance of the lithographic student's work, in the reproduction from an original sketch or design on stone.

Red transfer paper is required for laying down the tracings already made on to the stone when it is only required to be drawn in one colour.

To make this paper, take a sheet of white tissue paper, and rub powdered red chalk upon it with the palm of the hand, putting it on with a circular motion, so as not to make holes in the paper, and also laying it on as evenly as possible. Red chalk is preferable to black, as the drawing being in the latter colour, the outline or tracing is more easily distinguished from it. Should there be too much chalk on the paper, flick the back of it with the finger and thumb; this will remove the superfluous chalk without taking more off than is necessary. One sheet of this paper will last a considerable time, and is preferable to that which is bought.

Nitric acid is necessary for etching stones, and should always be kept in a glass-stoppered bottle, and marked poison. It is much better to buy small quantities at a time, as it evaporates and loses its strength.

Etching here must not be understood to mean the same as etching on copper, steel, etc., as it has quite the opposite effect on the stone; and it is really a mistake to so call it, but as it has become a trade expression it must be let stand.

After the drawing has been made the stone is required to be etched, otherwise subjected to a wash of nitric acid, diluted with gum, which eats into the stone everywhere excepting in those parts where the drawing has protected it. No matter how fine a line or dot is made with the lithographic ink it will still preserve the stone from the effects of the acid; thus when etching on copper is spoken of it is understood that the drawing is eaten out of it, whilst in the above instance the stone is eaten away in every part excepting where the drawing has been made, which is thus raised above the level of the stone to a degree imperceptible to the eye.

To prepare the acid for etching the stone, place a small quantity of gum arabic (and please use the best) in a glass jar, and pour hot water over it, letting it dissolve; this should be made at least a day before it is required for use, and only small quantities made at a time, as it will not keep good any length of time, especially in warm weather, and nothing would be so detrimental as to use sour gum, which would eventually turn the stone mouldy and damp, thus spoiling the work.

The gum should be made just thin enough to allow it to pass through a fine strainer or a coarse piece of muslin, and should be strained into a flat dish or basin (a common earthenware pie-dish is as good as anything), after which pour some drops of nitric acid in the dish, according to the quantity required. To test if it is of the required strength, mix it well with a small brush, and try it on the edge of the stone; if it boils with a bubbling sound it is too strong, *i.e.*, there is too much acid for the quantity of gum; if it just boils—that is, if it froths on the stone—it is about right; but if it does not boil there is not enough acid in it. Another test is to taste, but not to swallow it, when it should have a sharp taste like vinegar or a strong lemon.

Acetic acid is used for preparing the stone should any alterations be necessary after the drawing has been completed and etched. Thus, if a drop of gum be on the stone, before any work could be drawn on that part, it would have to be washed off with pure water, then with a drop or two of acetic acid diluted with water, which should be allowed to remain on the stone for a few seconds, after which again wash it with a clean sponge.

Benzoline may be used to clean the stone after the drawing has been made, and before it is etched, and if used with discretion a tint may be made with safety over any portion which has been thus cleaned, provided the stone is not smeary, and that it is allowed thoroughly to dry first.

The above are the principal materials required in lithographic drawing. Any incidental ones which are not included will be duly mentioned; as they are required, in future papers on this subject; but for the present enough has been said on all things that are absolutely needed, at the commencement, by any intending lithographer, to enable him or her, as the case may be, to make a fair start.

## FIXING GLASS IN FURNITURE.

BY D. DENNING.

Classification—Fitting Plain Mirror—Various Rabbets met with—Protecting Back of Glass—Blacking Edges—Fitting Plain Transparent Plates—Fitting Bevelled Plates—Explanation of "Sight" Size—Templates—Fastening in—Preparing Blocks—Transparent Bevels—Faults and Defects in Glass.

For all practical purposes the glass with which the cabinet-maker has to deal in connection with the manufacture of furniture may be classified into four different kinds: viz., plain edged, silvered and transparent and bevelled edged, silvered and transparent.

Inasmuch as they are all plates of glass, it may be supposed that they are all fitted into furniture in the same manner, and that a method which will do for one of them will do equally well for the others. In a very modified sense this may be taken as being fairly correct, but the cabinet-maker or fitter who attempted to fit all plates alike could certainly not be regarded as a master of his craft, for there are little differences which require attention. The work necessary cannot be considered difficult, and I hope by the time the reader has studied this article he will have an intelligent appreciation of what to do, and how to do it, whenever he wants to measure and fix a piece of glass in furniture. Presuming that a previous article entitled "Furniture and its Glass" has been read by those interested, we may at once proceed to take up sundry cases which are likely to occur.

Fitting a piece of plain edged silvered plate, *i.e.*, an ordinary mirror, may as well be the first supposed job to be taken up, not because it is necessarily the easiest, but for the very evident reason that we must begin somewhere. What we have first to do is to turn the framing to be glazed face downwards on a table or bench of convenient height, taking the precaution, especially if the wood has been polished, to have a piece of baize or similar material under the frame. If the back board is on, it must be removed, and it will be just as well to note whether this is laid on the back or fitted within the rabbet, but for the present we may consider we are doing with a back laid on the framing, and consequently larger than the opening for the glass. The back being off, we may as well look at the rabbet, not like owls, but like intelligent reasonable beings. If we do, we shall probably find that it is like one or other of the following diagrams, which may be taken as typical of the principal variations one is likely to meet with. The diagrams it may be well to explain represent in section the immediate parts with which we are concerned, and are shown with both glass and back fitted. The various portions will be recognised without difficulty.

In Fig. 1 we have a deep rabbet, but not a particularly wide one—in fact, it is as nice and convenient as could be wished for. All that has to be done is to measure the full size of the rabbet and get the glass accordingly. It just fills up the space comfortably, so that there can be no movement laterally or perpendicularly when the frame is in its normal position, which may be taken as upright. There is, however, nothing to prevent the plate moving backwards and forwards between the back board and the front. It is therefore necessary to fasten the plate so that it will not be movable. This can very easily be done by putting blocks or strips of wood behind the glass. They are simply glued to the framing, and provided they do not interfere with the backing board, their size and shape are unimportant. They need not be continuous, as it will be quite sufficient if they are placed a few inches apart. A convenient length for each will be two or three inches. On no account be tempted to try and fasten the plate down with brads or nails in the way shown by Fig. 2 or any other way, the risk of injuring the glass being far too great to be run with any regard to prudence. It is sometimes done. If desired, however, there can be no harm in driving a small brad or wire nail in a similar manner through the block, which it will hold in the event of the glue giving way. Care, of course, must be taken not to let the nail come in contact with the glass, for if it does the edge of this is sure to be chipped.

Fig. 3 represents a shallower rabbet than Fig. 1, being just deep enough to receive the glass without any space, or none to speak of, for the blocks.

In this case it might be supposed that it is only necessary to fasten the back down, and if the plates are but small this simple means will do very well. It will, however, be better to put a layer of soft flannel or a sheet or two of soft paper by way of padding between the glass and the back. If the glass is silvered by the old process, some such precaution is absolutely necessary to prevent the silvering being damaged. The newer process does not require such delicate handling, but it might get injured by direct contact with the backing board, especially if this is either rough or panelled. Some old-fashioned people, I believe, still advocate the use of flannel behind the glass in all cases where it would have been used in the days when the old silvering process was universal. It is simply because such people are not quite awake to some of the advantages of the new process. With this the necessity for flannel is quite the exception.

Fig. 4 shows a rabbet both wide and deep. Remembering that there is no occasion for such a wide margin of glass as there would be were the space to be filled, it is optional whether we get the glass to fit exactly or not. Certainly if to make it a close fit would necessitate our running over a measurement of a full inch, and bringing in a fractional part of one, which, it will be remembered, will be reckoned on calculating the superficial measurement as a full inch, we will just take a fair amount to go behind the rabbet. This leaves a vacant space both at the edge and behind the glass, which is free to be moved in any direction. We must therefore fasten it in by blocks which bind in both directions, as will be easily perceived from the illustration. If the space is too wide for the triangular-shaped block to wedge the glass down, the section of the block can easily be altered to that shown in Fig. 5.

In Fig. 6 we have a wide rabbet, as in the last instance, but a shallow one so that the wedge-shaped blocks cannot well be used. It is therefore necessary to use those of rectangular section, which, it is very possible, may not require any gluing in, as the glass and backing board will hold them. Now, it must be evident to anyone that if we have a back board fitted within the rabbet, as shown in Fig. 7, instead of as in former instances outside that, the available depth for the wedges is much curtailed. The methods to be adopted for fixing are, however, the same.

The following general directions should be noted. Blacken the inside of the rabbet against which the face of the glass rests, and

also blacken the edges of the glass—which, by the way, will be more or less rough. If the blacking be omitted the reflection of the wood will be unpleasantly visible, and the rough edges of the glass will reflect in an unsightly manner, unless they are an unusually long way within the rabbet. For blacking, nothing better than a mixture of size or weak glue, with some gas-black, can be used. Be careful not to let any glue get on to the back of the plate, but if any does accidentally get there, wipe it up directly. If allowed to harden, it may, in drying, very likely pull the silvering under it away from the glass, and leave an unsightly blemish.

Plain-edged transparent plates, such as are used in bookcase doors, may now engage our attention. It is clear—I mean the principle, not the glass—that wedges or blocks cannot be used, for there is no back panel with which to hide them. The glass, therefore, must fit as accurately as possible to the rabbet, where it is held by strips of beading, as shown in Fig. 8, which, after what has been said, can require no comment to render it intelligible. If, as will sometimes happen in spite of all ordinary precautions, the glass does not fit quite so tightly as it should, the only way is to put thin strips of wood in a somewhat similar fashion to that shown by Fig. 9, taking care that they are covered by this beading. This should be neatly fitted and mitred at the corners. The strips should be long enough not to require jointing except at the mitred corners. The beads may be fastened down with glue, which, however, is not a method to be altogether recommended, as in the event of a broken glass it is impossible to remove without destroying them. They may also be secured with wire nails or brads, but a much neater way is to use small brass screws with rounded heads. Instead of beads, the glass may be fastened in with putty, a method which I cannot recommend, as it seems to me to be a slovenly way of finishing off cabinet work. Those who prefer it will have no difficulty in finding out what is necessary without instructions from me.

The fixing of bevelled edged plates may now be attended to; but before doing so, it will be as well to say something about measuring for them, in order that there may be sufficient glass behind the rabbet to hold the plate securely, without too much of the bevel being hidden, for we have now not only to consider the cost of the glass, but also of the bevel—the latter of which, it will be remembered, depends on its width. Therefore, our object should be to hide as little of it behind the wood as possible—consistently, of course, with safety to the plate. Careless or thoughtless people have been known to argue that the more glass there is behind the rabbet, the more secure the plate will be, but this is not correct, as the diagrams (Figs. 10 and 11) will serve to explain. In Fig. 10 we have a bevelled plate with a very narrow margin behind the rabbet, and in Fig. 11 the same with a very much wider one. Now, on looking at these it is at once evident that the glass, being bevelled, is in contact only with the extreme edge of the rabbet, and does not lie flat against the bottom, as in the case of plain-edged plates. It is therefore unnecessary to have more than just enough glass to hold within the rabbet, and $\frac{1}{8}$ in. is generally deemed sufficient. Less may do occasionally, but cannot be recommended, and a safe rule to follow is to order the plate $\frac{3}{8}$ in. larger than "sight" size. Thus, if the "sight" size is $23\frac{5}{8}$ in. by $20\frac{1}{8}$ in., order a plate 24 in. by $20\frac{1}{2}$ in. This allows $\frac{3}{16}$ in. surplus at each edge, but then the edge is seldom perfectly regular, and this extra $\frac{1}{16}$ in. must be allowed as a waste margin for irregularities in cutting the glass.

As the term sight size may not convey much meaning to some, though it is a term well understood by those acquainted with the work under consideration, it may be advisable to explain it. Briefly, it means neither more nor less than the surface of the glass which is visible from the front when the plate is in position and fixed—that is to say, the whole of the plate, with the exception of that portion of it which is concealed by the rabbet. When a bevelled plate is ordered, it is not at all an uncommon thing to simply order it according to sight size, and leave the dealer to allow the necessary margin. It is better, in any case, to state whether the measurement named is "sight" or "plate" size, in order that there may be no mistake. If, under such circumstances, the dealer makes a mistake, the loss is his own. For irregular or fancy shaped plates, it is best to get the glass cut from a template. This can easily be made by cutting a thin board, or several of them joined together, to

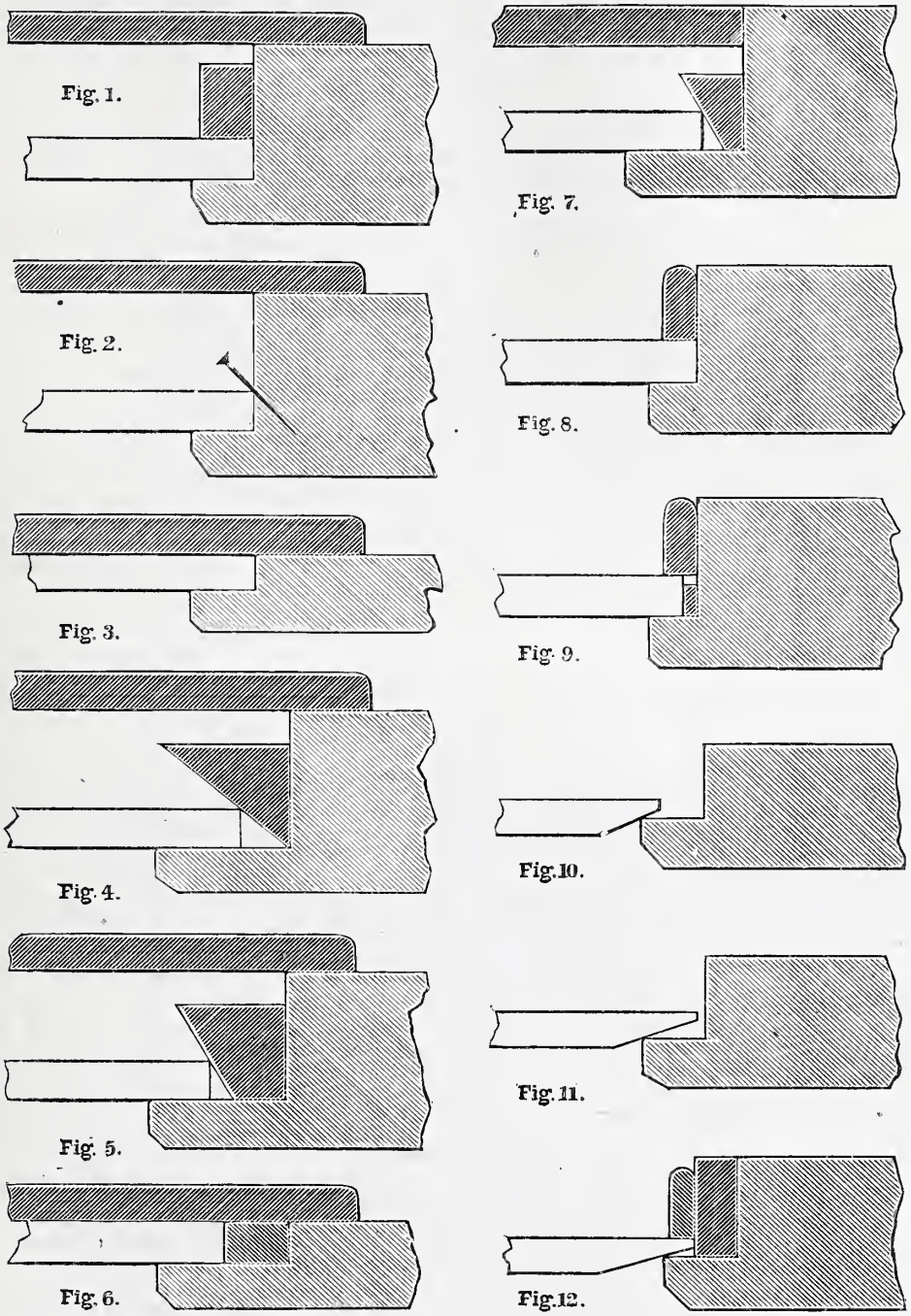



**Fig. 1.—Plain Silvered Glass in Deep Rebate. Fig. 2.—Ditto wrongly fastened. Fig. 3.—Shallow Rebate. Fig. 4.—Wide and Deep Rebate. Fig. 5.—Ditto with differently shaped Block. Fig. 6.—Shallow Wide Rebate. Fig. 7.—Backing Board within Rebate. Fig. 8.—Transparent Glass beaded in. Fig. 9.—Loose-fitting Transparent Glass blocked and beaded in. Fig. 10.—Bevelled Glass with little behind Rebate. Fig. 11.—Ditto with too much. Fig. 12.—Frame for Bevelled Transparent Plate with Rebate partially filled up.**

fit in the rabbet, and marking the sight size with a pencil. If the baeking board is made to fit within the rabbet, a simpler plan is to draw the template on a sheet of paper, which can easily be stretched on the board. Such templates will, of course, give the exact sight size, but it is best to state on them distinctly that the lines give "sight."

When it is practicable, frames to be glazed with bevelled silvered plates should, instead of being laid on a table or bench, be supported on trestles, so that the worker by looking underneath may be able to see that the glass is laid to show an equal width of bevel all round, and that the mitres fit accurately to the eorners of the framing. It will easily be understood that without care faulty fitting in these respects may result. With small plates there is seldom much difficulty, but as the size increases so will the need for more care. Let me here caution all whom it may concern not to attempt to alter the position of a plate by forcing it with a chisel, screwdriver, or other tool used as a lever. It is, unfortunately, no uncommon thing in some shops to see a man trying to foree a plate into position by this means. Sometimes he effects what he intends, and sometimes he damages the plate, especially if it is a large heavy one. All the movement necessary to get a plate exactly into its right position can be got by giving the edge of the framing a few light blows with the hand. The remarks which have been made about plain-edged plates are, on the whole, applicable to those with bevelled edges. When fitting these in, however, it will be found in the majority of cases that blocks, as shown in Figs. 4, 5, and 7, are the most suitable.

The best plan when working is, first, to get the plate into its proper place, then, being careful not to disturb it, fit the blocks in dry—*i.e.*, without glue. After they are placed, see that the position of the glass has not been accidentally altered. If it seems all right, proceed to glue down the blocks. It is not always necessary to blacken the edges and inside of the rabbet in the ease of bevelled plates as in plain ones; still, no harm can result from doing so.

The blocks which are needed do not require to be of very high finish, and seldom are so. It is no use wasting time over them. I have known large quantities of them prepared in the following manner. A board of 1 in. pine of straight even grain is taken. A piece about two inches wide is sawn from one end across the grain. From this the blocks are shaped by splitting it up into square pieces first, and each of these diagonally afterwards with a knife or ehisel. They may not look very elegant, but they serve their purpose; so what more ean be required?

Bevelled transparent plates are fixed in a similar manner to those with plain edges, but the rabbet should be only a narrow one. This can easily be arranged when making the frame, if it is then known that the plate is to be bevelled. If the rabbet is too wide it will generally be better to reduce it to the proper dimensions by gluing continuous strips of wood, as suggested by Fig. 12, than to waste money by having a wider bevel.

It will occasionally happen when a plate to exactly fill an opening is got, that the glass, through some irregularity at the edge, will not quite enter. In such a case a little judicious paring away of the obstructing wood with a chisel will often do all that is necessary, and is much more satisfactory than trying to chip the glass itself to make it fit.

Some discretion is often advisable in selecting which shall be the top or bottom of a piece of glass when it is fixed. For instance, we have, let us say, an oblong piece, one end of which will be high up, where it cannot be closely inspected, while the other will be where every defect is conspicuous. Naturally, it will be better to fix the glass so that its worst end, if there is any difference, will be at the top. I am not wrong when I say that cabinet-makers have been known simply to reverse the position of a plate supposed to be defective—perhaps actually so—instead of replacing it by a new one. The defect has been put where it is not so easily seen: that is all; the results have been perfectly satisfactory. The chief blemishes found on silvered plates are scratches on the metal or glass, water stains caused during the silvering, and small round bubbles or seeds in the glass itself. To all intents and purposes, it is impossible to get an absolutely perfect piece of glass of any size; though it may be sufficiently good for all purposes it will not stand the very minute inspection which some bestow on it. The scratches which are visible on a really excellent piece of bevelled silvered plate when it is held in broad daylight to reflect light direct from the sky are something to alarm the novice. In conclusion, I have only to say to purchasers of glass that before finding fault with any sold to them, it will be as well to take the opinion of someone who knows the material as to its quality, and that I trust the novice will find the foregoing hints sufficient to enable him to do whatever he may want in fitting glass to furniture.

## ELECTRO-SILVERING SMALL GOODS.

BY GEORGE EDWINSON BONNEY.

PREPARING THE SMALL GOODS—CLEANING—SCOURING—STRIPPING AND QUICKING THE GOODS—MAKING THE SILVER-PLATING SOLUTION—WORKING THE PLATING SOLUTION—FINISHING, POLISHING, AND BURNISHING SILVER-PLATED GOODS.

*Preparing the Small Goods.*—By small goods I mean the various little oddments which come to the counter of the country jeweller to be replated, such as alberts, charms, lockets, brooches, buckles, scarf-pins, rings, and one or two spoons or sugar-tongs. I should not advise undertaking the job of plating spoons and forks in dozens, nor anything larger than a dessert spoon, as larger articles demand more room than can be found in the small vat of a working jeweller, and more anode surface than he has at his command. More eare must be taken in the preparation of articles to be silver-plated than in the preparation of those to be electro-gilded. The hot solution of eyanide of gold will dissolve remaining traces of animal matter, but the cold solution of cyanide of silver has no such detergent effect on dirt left on the surfaces of goods intended to be silver-plated. We must, therefore, be sure to free the surface from the least trace of dirt of all kinds, whether in the form of rust, verdigris, tarnish, and any other form of corrosion, or in the form of oil, grease, lacquer, sweat, and other animal matter. The touch of a soiled finger on the prepared surface is sufficient to spoil it, and cause the silver to strip off from that spot when the scratch-brush or the burnisher is applied to it. All deep scratches, dents, cracks, and pits must be removed before the goods are re-plated; all necessary repairs must be done (and in doing these, avoid an excess of soft solder); all the previous coats of silver or of nickel must be removed, and the surface must be polished.

If the articles are free from eorrosion, but appear to be dirty from grease or oil, place them for a time in a boiling hot solution of caustic soda or caustie potash, then rinse them in hot water. It is always advisable to make this the first eourse of treatment, whatever may be their condition. If they appear to be lacquered, steep them for an hour or so in warm methylated spirit, then transfer them to a strong solution of ammonia, to loosen the lacquer. After such treatment, they should be well brushed with an old scratch-brush or bristle-brush, and rinsed in hot water. Use old brushes for this purpose, as it will not be advisable to use the same brushes for brushing the surfaces of finished goods. Tarnish may be removed by soaking for a short time in a strong solution of cyanide of potassium, to which has been added a few drops of liquid ammonia. Green verdigris and similar forms of corrosion may be removed by dipping in a mixture of equal parts sulphurie acid and water, to which is added half part nitric acid and a few drops of hydroehlorie acid. The articles should be strung on a wire, and swilled in the dipping mixture for a few minutes, until the corrosion has been loosened, then rinsed in plenty of elean water. After this, they may be brushed with an old scratch-brush, and again swilled iu water. If the verdigris is not all off, they must be again swilled in the acid pickle until quite clean.

Scratches on the backs of watch-cases and lockets, and pits left from corrosion in other articles, must be taken out with a fine file, then the file marks rubbed out by grinding with water of Ayr stone, after which the surface should be scoured with a cork dipped in powdered pumice, then polished bright in the usual way. Spoons and forks should receive similar treatment. It is not necessary to be so particular in getting a very finely polished surface for silver-plating as for electro-gilding, since the coat of silver can be got up afterwards; but the same care will be needed to get an uniform surface, free from scratches and pits.

*Stripping the Silver Coating.*—All the old coat of silver, nickel, or gold must be stripped off before we can successfully deposit a new coat on the article. It sometimes happens that the plater fails to get an adherent coat iu his first attempt. If part of it strips off under the scratch-brush or the burnisher, the whole remaining part of the coat must also be stripped off by the following means: Get a vessel capable of heating and holding acid at boiling point, such as a porcelain evaporating dish or a stoneware pipkin. Pour into it enough strong sulphuric acid to cover the article about to be desilvered, and make the acid hot over a gas stove or oil stove on a sand bath. When the acid is hot, sling the article in a piece of copper wire, immerse it in the hot acid, and add a few erystals of saltpetre. These will dissolve, and give out just enough nitrie acid to dissolve some of the silver. Move the articles about in acid, and add more saltpetre, until all the silver has been dissolved off. If proper care is taken, all the silver may be stripped off without pitting the underlying surface of brass or of German silver. When quite free from silver, the surface must be rinsed in water, scratch-brushed, and prepared to receive a fresh coat of silver. If the artiele has been nickel-plated, it must be swilled in either the before-mentioned stripping acid or in a warm mixture of two parts sulphuric acid

and one part nitric acid, taking care, in both processes, not to keep the article in the acid longer than necessary to strip off all the nickel. It is most important to have the article dry before putting it in the stripping acid, to prevent irregular action. Gold may be stripped off in a warm mixture of nitric acid three parts, and water two parts, to which must be added, as required, a few crystals of common salt or a few drops of hydrochloric acid.

Articles made of pewter, lead, tin, Britannia metal, solder, or any other lead or tin alloy, may be entirely cleaned in the caustic solution, without the use of acid. Rust on iron or steel may be removed by soaking in dilute sulphuric acid, to which has been added a few drops of hydrochloric acid. Both this metal and alloys of tin and lead must be first coated with copper in an alkaline coppering bath (described in the last chapter) before they are placed in the plating vat to receive a coat of silver. In the case of iron and steel, this must be done promptly after cleaning, before a film of rust can form on their surfaces. Lead and tin, and other alloys, must be plated immediately after they are taken from the potash solution, without rinsing in water. Articles made of brass, German silver, and similar white or yellow alloys, receive a more adherent coat of silver when first coated with mercury in a solution of proto-nitrate of mercury in distilled water. To make this, dissolve a few drops of mercury slowly in a mixture of equal parts nitric acid and distilled water, using only enough acid to dissolve all the mercury, then dilute the whole to twenty times its bulk with distilled water. Swill the articles in this when they are ready for the plating bath, then rinse them in clean water. This is named "quicking" the articles.

*Making the Silver-Plating Solution.*—The solution for silver-plating is easily made. Get some pure re-crystallised nitrate of silver, in the proportion of four and a half ounces to each gallon of solution required. Also get ¼ lb. of 95 per cent. pure cyanide of potassium for each gallon of solution. To make one gallon of solution, dissolve the silver nitrate in half a gallon of distilled water in the glass vessel intended to serve as a vat, and half of the cyanide of potassium in one quart of distilled water. Add small portions of the cyanide solution to the nitrate of silver solution, and stir well with a clean stick between each addition of cyanide, until all the silver has been thrown down in the form of white curds, and a few drops of the cyanide solution fails to cause a white cloud in the silver nitrate liquid. When this condition has been achieved, pour off the useless liquid (which contains nitrate of potash), and pour a quantity of clean common water on the white precipitate. Allow this to stand for a few minutes, then pour it away, and repeat this some two or three times, finally draining off all the wash water from the silver cyanide precipitate. Dissolve the remaining cyanide of potassium in distilled water, and stir this into the wet precipitate of cyanide of silver until all has been dissolved. Then add one-fifth more cyanide, and make up the solution to one gallon with distilled water. This solution will be worked cold. For an anode, use a plate of absolutely pure silver having a surface area slightly larger than that of the largest article, or total area of the largest group of articles, likely to be plated in the vat. It is best to have an excessive surface of anode, as we can always draw out this to suit small surfaces being plated. If the anode does not dissolve cleanly and freely in the solution whilst at work, add some more cyanide in small quantities at a time.

*Working the Plating Solution.* — Each article must be hung to a long hook made of copper wire, and suspended by this in the solution whilst receiving its coat of silver. For very small articles this hook may be made of No. 28, whilst for larger articles it may be made of No. 20. This hook is made in the form of an **S**, the lower end hooking behind a pin, into a bow, into a link, or to some projecting part of the trinket. The articles should be wired with wet hands before the final dips, and not touched with the hands afterwards, but placed straight away in the plating solution, suspended to the cathode rod attached to the zinc of the battery. Two or three cells in series will be enough to force current through the wires and deposit the silver in good condition. The articles should be coated white with silver within a few minutes of placing them in the depositing vat. They should then be taken out and brushed with a clean scratch-brush in clean water, to test the adherence of the deposit. If this does not strip, the article must be rinsed in clean water, and restored to the vat to receive a finish coat. The time taken to do this will depend upon the price to be paid for plating, since a longer time in the vat represents a thicker coat of silver. By carefully weighing the article after it is polished, preparatory to plating, and weighing again when dried, after it has been plated, we can find out the weight of silver deposited upon it. A thick coat of good adherent silver may be deposited in two hours; but the time taken will always depend upon the condition of battery and solution, so I cannot lay down a fixed rule. I may say that for 6d. a trinket we can only afford a mere blush of silver over and above the scratch-brush coat, and this may be laid on in a few minutes.

*Finishing Electro-Plated Goods.*—When the articles are sufficiently coated with silver, disconnect the slinging wires from the cathode rod, swill the plated goods for a few seconds in the bath, then rinse them in hot water, and rub or bury them in hot boxwood sawdust until dry. Plain patterns may be rubbed dry with soft linen rags after being rinsed in hot water. When dry, brush out all sawdust from crevices with a soft brush, and proceed with the polishing processes. If only a thin film of silver has been deposited, as for whitening buttons, etc., rattle the articles about in sawdust, and brush them with a mop of soft rag charged with plate powder. If a thicker coat of silver has been deposited, and the deposit has a "matt" appearance—*i.e.*, creamy white, without lustre—it must be scratch-brushed until the "matt" surface gives place to one having a dull lustre. This must be done with a clean medium scratch-brush made of medium brass wire, using stale beer as a lubricant. If doing this by hand, rest the articles on a sloping strip of smooth wood in a tub or similar vessel, and use the brush in strokes away from the workman, to avoid splashing the beer over the clothes. Rinse each article in clean water, and dry again as before, either in hot boxwood sawdust or by rubbing with soft linen rags. By using a fine scratch-brush to finish off after brushing with the coarser brush, a tolerably good surface may be given to the plated goods, and this, when polished with a plate-brush, will suit customers better than the higher polish imparted by revolving mops and burnishers. The work of polishing can, however, be more expeditiously performed on a revolving mop or dolly in a polishing lathe than by hand with brushes. A very fine polish can be imparted to silver surfaces with rouge applied on a revolving calico mop, finishing off with a softer mop of swans'-down, and finally polishing with the palm of the hand.

*Burnishing.*—The highest polish is given by the process of burnishing — that is, rubbing the surface with burnishers made of polished steel or polished bloodstone. The burnishers are kept lubricated with freshly-made soapsuds, and the strokes of the burnisher are all given in one direction. When only small portions of a trinket have to be burnished, just to stand in relief to the rest of the surface, the burnisher may be a highly polished steel bodkin. It should be polished on a piece of buff leather charged with rouge. An illustrated article on "Burnishers and Burnishing" may be found in page 411, Vol. IL of WORK.

## MEANS, MODES, AND METHODS.

### To Stain Mahogany Port-Wine Colour.

Procure a little quicklime, and stir it up in water, making a kind of weak limewash. Apply this to the surface of the wood until you get the required tint; allow it to dry, glass-paper off, and polish in the usual manner.—F. C.

### Gold Paint, for Touching up Frames.

Mix together gold bronze and copper bronze to the desired shade; if required a rich deep colour, more copper; if lighter, more gold. Mix with Japan gold-size thinned with turpentine, just as much as is required for immediate use.—H. H.

### Fastening Corners of Gilt Frames.

These are nearly always nailed together, but if a really good job is desired, in which no nail-holes are to be seen or the gilt interfered with in any way, proceed as follows:—After shooting the mitres true and clean, bore from the inside of the mitre with a small quill-bit out to the back side, not out to the edge. Then sink with a gouge to admit a fine 1¼ in. or 1½ in. screw; put screw in position to mark where hole comes in the other mitre, bore with a sprig-bit, glue slightly, and screw down. If this is done clean and well, we have a firm joint, and nothing seen on either edge—a great desideratum in gilt frames.—H. H.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Crimping Machines—Benches—Tools.

Two machines for crimping or corrugating wires of various gauges are shown in Figs. 5 and 5A respectively. That represented in Fig. 5 is used for small gauges of wire. I am not very well acquainted with the technical terms used in the iron trade; therefore, should I, during my descriptions of these machines, not use the accepted trade definitions, my readers must forgive me for my ignorance, although this want of knowledge on my part will not prevent me from giving proper explanations.

In Fig. 5 there is a thick standard, divided into two separate parts horizontally, as indicated by the cross line, and held together by a pair of screws, which penetrate sufficiently deep into the lower half of the

standard to afford the requisite strength, and whose heads are above the standards, as shown. On the front are two barrels, which receive the axles of the wheels. The latter are removable from the axles, and are held to them in such a manner as to prevent them rubbing against the standard, or slipping from the barrels, by washers, etc. Through the ends of each axle, opposite the wheels, is a removable pin to prevent the wheel and axle from being pulled out of its place accidentally.

In working, the wheels are brought sufficiently close to each other to receive the particular gauge of wire to be crimped by the perpendicular screws being turned. For various degrees of crimping, different pairs of wheels of the same diameter as each other are used, the cogs on each pair varying in thickness to those on the remainder, in order to secure long or short crimps, as the case may be. It is to allow all wheels to be properly fitted that the axles are made detachable from the barrels by removing the pin in the end of each.

The machine shown in Fig. 5A affords the same facilities as those gained from that in Fig. 5, the difference being that these wheels are used for stouter gauges of wire and larger crimps. Here the axles are supported by side standards at each end, in which fit square blocks (see view Fig. 6A) to receive the axle ends. The square blocks slide up and down the standards, and consequently carry with them the axles, wheels, etc., in order that a change of wheels can be made when required for purposes previously named. At the top of each standard is a cap, both caps being united by means of a cross-bar. Each cap is hinged at the back to a standard, and in front is removable, being held firmly, when desired, by means of a loose nut attached to a fixed screw, which latter penetrates through a hole in the cap.

For closing the wheels together there is an attachment at each side, shown separately in Fig. 6B. On the outside of top axle-block is a stout barrel, through which passes a movable screw-rod. In a similar manner, there is outside each lower block a barrel, into which is firmly imbedded a horizontal screw, which enters the screw-rod just alluded to. It should now be seen how the wheels can be brought to the requisite adjacency to each other by means of turning the side screw-rods over the side screws. I will now pass on to remarks on the benches and tools.

Simple benches only are used by wire-workers. There is, therefore, not the slightest necessity for me to give drawings of such. They are used in a great variety of sizes, according to the shape of the shop wherein they may be fixed.

Of the tools proper only a few are necessary. These are large shears (Fig. 6), hand shears (Fig. 7), nippers (Fig. 8), pliers (Fig. 9), vices, and hammers. There are several adjuncts, which, however, I prefer to term accessories, and shall describe in future papers, where I can deal more appropriately with them. The first of these tools is used for cutting up bundles of wires into required lengths, and for this purpose the shaft (C, Fig. 6) is fixed in a large vice and firmly secured, the cutting being done by working the handle pump-wise. The hand shears are used for similar operations when the wires to be cut are not so thick or strong as to require the aid of the large shears. The assistance of the pliers is called in for "turning over," and the nippers for "squeezing down" and clipping off superfluous ends of

Fig. 5A.—Another Form of Crimping Machine.

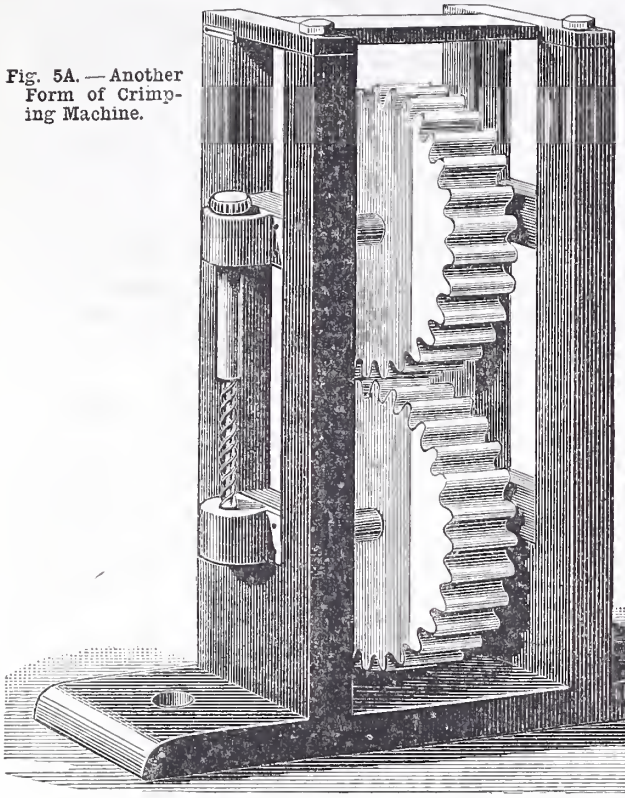
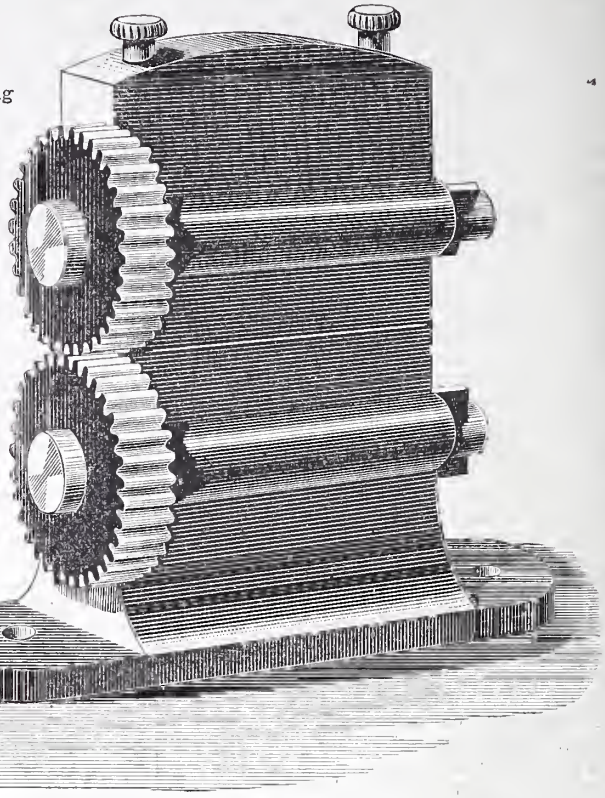


Fig. 5.—Crimping Machine.



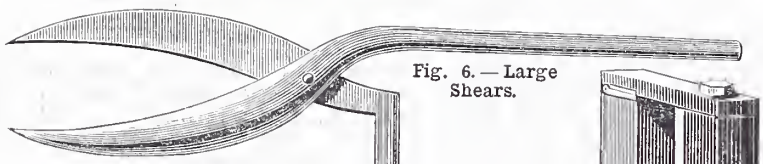


Fig. 6.—Large Shears.

Fig. 7.—Small Shears.

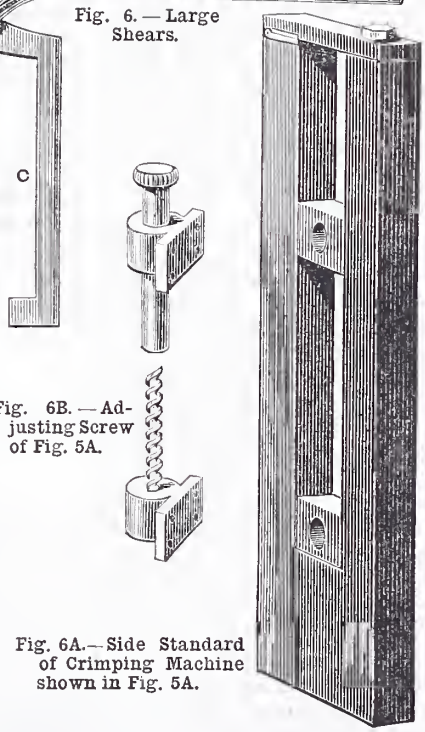



Fig. 6A.—Side Standard of Crimping Machine shown in Fig. 5A.



Fig. 6B.—Adjusting Screw of Fig. 5A.

Fig. 8.—Nippers.

Fig. 9.—Pliers.

wires. Hammers and vices need no commenting upon. The different processes previously named in connection with these tools will be described by me later on.

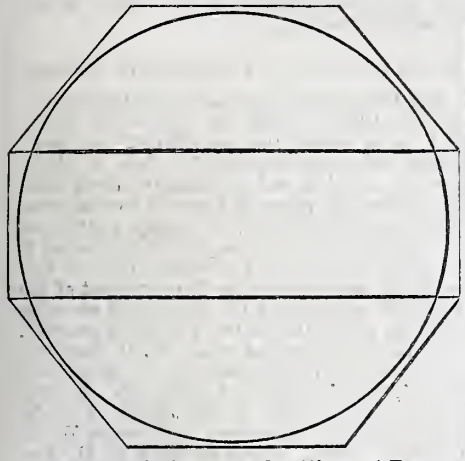


Fig. 1.—Jointing up and cutting out Top.

## HOW TO MAKE A ROUND TABLE.

BY H. HINGE.

METHOD OF CUTTING OUT TOPS—SETTING OUT—SADDLE FOR MORTISING LEGS—SHAPING RAILS—FRAMING UP—SECURING TOP, ETC.

A THREE-LEGGED round table appears at first sight a simple job, but if a man has never seen one made, or been instructed in the art of making one, he will find a difficulty in doing so unless he goes the right way to work and begins properly.

Where round tables are manufactured for sale, workmen generally get them to make by the dozen, and it is astonishing how quickly they can be made. The method generally adopted is as follows :—To begin with, the tops are jointed up ; these consist of three pieces of stuff, 9 or 11 in. wide (unless a special size is wanted), of dry, sound pine or deal; if 9 in. wide, the middle piece is cut off, 2 ft. 3 in. long; if 11 in. wide, 2 ft. 9 in. long, by laying another piece of stuff alongside the middle piece, and marking a circle with a trammel,

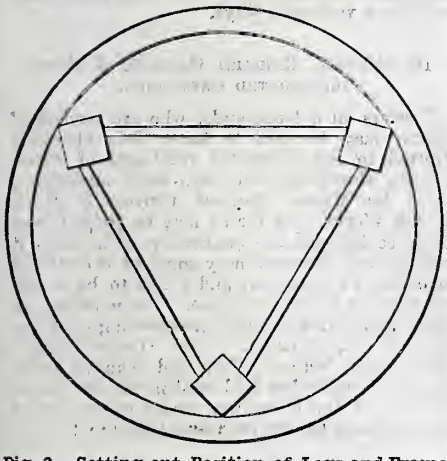


Fig. 2.—Setting out Position of Legs and Frame.

or some other means. It will be seen, by cutting the next length off on the bevel, and reversing the edge for the other piece, that a considerable quantity of wood can be saved in cutting out a lot of tops. Fig. 1 will explain the method of cutting out tops. The tops are seldom more than slip-jointed (shooting the edges straight with a plane, and gluing and rubbing). Of course, if a better class of thing is wanted, it can be grooved and tongued together, or dowelled. Now, to set out for the frame, we want a board as large as the top—the top will do very well if the joints are dry. Prepare it by planing it up on one side, and mark out the circle you want the top to finish, and then mark another circle $1\frac{1}{4}$ in. less, which will indicate the outside size of the frame. Divide this into three parts to form a triangle, and mark the size of the legs, keeping the square of the leg on the spot, as shown in Fig. 2. When all three squares are marked, it is only necessary to fill in the rails, letting them stand in from the outside of the legs as much as is necessary to give strength and room for the tenon. The frame is now "set out," from which we can get the lengths required for the rails, and the right bevel to mortise the legs. A bevel should now be set by laying the stock of the bevel along the line which indicates a rail, and the blade set to the angle of the leg. A piece of 3 in. scantling is now planed up square, say a foot long, and pre-

Fig. 6.—Round Table when finished.

pared by marking it with the bevel, and from the bevel a line taken up square (to receive the leg for mortising), the piece is cut out true to the lines, and we have what is called a saddle. Fig. 3 shows the saddle with a leg in ready for mortising. The legs are set out 2 ft. 4 in. or 2 ft. 5 in. high, and the breadth of the rail marked on it, allowing an inch from the extreme height of the leg for what is termed a hancheon, so that when the leg is sawed off level with the top of the rail the mortise will still be down an inch to give strength. When the leg is secured in the saddle, which is generally held firm by the bench holdfast, the chisel is held quite upright, and the mortises cut in the ordinary way. The rails are generally made of $\frac{3}{4}$ in. stuff, about $4\frac{1}{2}$ in. or 5 in. wide. The length we can get by measuring on our setting-out board, allowing it long enough for the tenons. When these are planed up and taken to a breadth, one of them is marked on the bottom edge for shaping, which generally takes the form of Fig. 4. All three are held together in the bench screw, and cut out with a bow-saw, and trimmed up with spokeshave or rasp, and all done that is necessary while in that position. If a quantity is being made, a templet, or pattern of thin wood, would be made to mark from. Care must be taken not to have the tenons too tight, or else they will split the legs, but yet fill nicely the flat way, and in the width be tight, as there is no danger of splitting that way. In setting out the rails, a shoulder is only made on one

Fig. 4.—Rail properly shaped and tenoned.

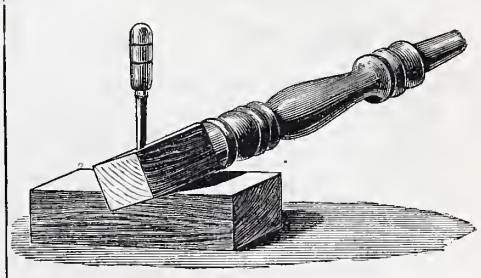


Fig. 3.—Saddle to hold Leg for mortising.

side (the inside), and, instead of being square, it is bevelled about a quarter of an inch, which will cause the legs to stand out when the table is framed up. The rails should be smoothed up and all done we consider necessary before the table is glued together ; it may be found necessary to use a cramp to get the joints up. All being on the bevel, it must be watched where it is pulling, or else it will do mischief. Blocks of wood should be fitted in the corners and glued in, which will greatly strengthen the frame. When the glue is set, the tops of the legs should be bevelled off with the frame and planed true. Sometimes pins, or dowels, are bored in the legs to keep the joints up, but a cabinet-maker would scorn the idea of ever putting dowels in to hold a tenon up. A rail about 3 in. wide and 1 in. thick should now be fitted across the frame to hold the top true. Fig. 5 shows the top of the frame with rail in. The rail is let down the thickness of itself to come level with the rails, and nailed down firmly. Holes are bored in this rail to receive some stout $1\frac{1}{4}$ in. screws to screw the top down.

The top is prepared by cutting round

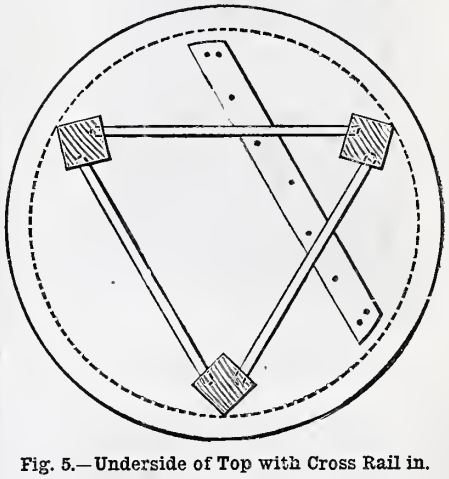


Fig. 5.—Underside of Top with Cross Rail in.

with a bow-saw, and cleaning up the edge with either spokeshave or sharp smoothing-plane, placing the best side down on the bench. The frame is placed on it in such a position that the flat rail comes across the joints of the top. It is now screwed firmly

down, and, placing it on its legs on the floor, the top is nailed to the other rails from the top side, and a good 2½ in. or 3 in. nail sent down into each leg. These are punched down with a punch well below the surface, to admit of the top being smoothed up with a sharp smoothing-plane, the sharp edges of top being taken off with a piece of coarse sand-paper. The top is sand-papered across the grain (a little white putty having previously been put in the nail-holes) till smooth and clean, and our round table is complete.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 13.—Pitman's New "Demon" Water Motor.

Mr. P. Pitman, Aubrey Road, Withington, near Manchester, has sent me a prospcetus of his New "Demon" Water Motor, and a specimen of the smallest or No. 1 size for testing. The motor itself appears to be well made, and there is no fault whatever to find with it in this respect. The following are particulars of its dimensions, taken from Mr. Pitman's prospectus, in which all of these are stated to be approximate only:—Bore of pipe, ¼ in.; diameter of pulley, 2½ in.; weight, 24 lbs.; height, 9 in.; breadth, 8 in.; revolutions per minute at 60 lbs. pressure, 1,800; power, quarter man. Price, 25s.; regulator extra, 3s. The general description is as follows:—"Inside the motor is a drum, on the eircumference of which are several cams. The water entering by the supply pipe forces these cams to rotate, until each cam in turn comes opposite the exhaust pipe, when the waste water falls through the exhaust exit of its own weight. The mechanism is not subjected to severe shock; there is a steady and continuous outward impulse, and such changes in velocity as do occur balance each other exactly. The shaft and all wearing sur-

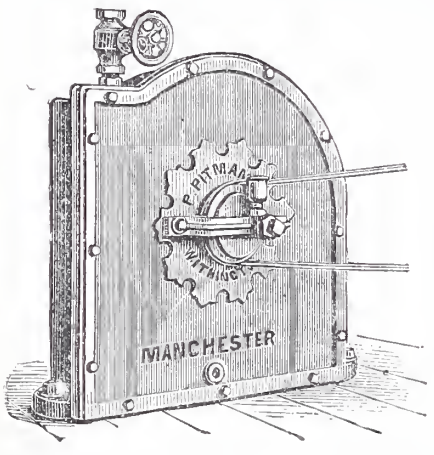



**Fig. 1.—Pitman's New "Demon" Water Motor.**

faces are of hardened steel, gun metal, and brass, and are fitted with oil cups and lock nuts. The pulley wheel may be removed and another of more suitable size put on in its place, or an additional wheel may be keyed on the opposite side, if found desirable. The working parts are boxed in a removable cover, being fitted to facilitate examination, etc., of the machinery." It is further claimed that "it is the cheapest and best motive power engine (both in first cost and when working) that has yet appeared;" and that "this engine is a most useful and economical motor for driving every description of small machinery; and is now thoroughly established as a success in the hands of practical users." Its appearance and construction are fairly shown in Fig. 1, which, it should be said, is from a photograph of No. 2 motor eomplete.

On receipt of the sample motor, I put it into the hands of a practical man for thorough testing, and the following is his report:—"In reading through the instructions for fitting in Mr. Pitman's circular, I notice that he says:—'When

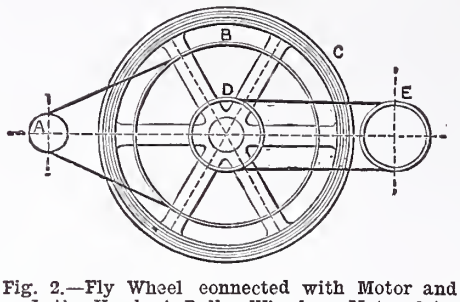



**Fig. 2.—Fly Wheel connected with Motor and Lathe Head—A, Pulley Wheel on Motor, 3 in. in diameter; B, Driving Wheel of Fly Wheel, diameter 18 in.; C, Heavy Rim of Fly Wheel, diameter 28 in.; D, Smallest Rim of Fly Wheel, diameter 6 in.; E, Pulley Rim on Lathe, diameter 6 in.**

feasible, I recommend, as the most economical method of driving, that the power be conveyed direct from the motor by belt or rope, *without* the intervention of countershafts or separate gearing.' I understand this to mean to save power, not expense. I therefore connected motor to water supply, and ran a small gut direct to pulley of lathe head. The power and speed given off were so small that when I placed a piece of wood to the ¼ in. drill which was in the lathe, the motor immediately stopped.

"Now I entirely disagree with Mr. Pitman's idea of driving, as the above and what follows will show. If he knows anything of the 'theory of machinery' and the 'regulation and modification of force and motion,' he must be aware that he must have a fly wheel to equalise the inequalities which may occur during the running of the machine, lathe, or whatever he may be driving. Bearing this in mind, I proceeded to drive a fly wheel in the manner shown on the left of Fig. 2. The difference in gearing—3 in. at motor and 18 in. at wheel—at once showed signs of improvement, as the motor increased speed, and in a few moments ran the fly wheel at about 200 revolutions per minute. I next ran another gut to the lathe head (as shown to the right of Fig. 2), but the extra friction proved fatal to the speed, and eaused the fly wheel to run at 50 revolutions per minute. This shows that the intervention which Mr. Pitman speaks of, but which he does not recommend, is absolutely necessary. I have thoroughly tested the motor at other combinations of speeds, but find that which is illustrated the nearest to perfection. The quarter-man motor can drill a $\frac{1}{16}$ in. hole in brass, but very little pressure must be used, or it will stop.

"After exhaustive experiments with the New 'Demon' Water Motor, I find that it will run well if unopposed to any varying resistanee, but should the slightest irregularity in the resistance at the point driven continue, the motor will gradually stop and the impetus given by the fly wheel will be exhausted. Further, the time taken to regain speed is so long as to cause it to be entirely unfit for anything that it is recommended for in Mr. Pitman's circular. I have carefully examined the working parts, both inside and out, and find them well made, and capable of running for a long time without readjustment."

From this statement, the only inference to be drawn is that, although as far as workmanship and materials are concerned there is no reason whatever for taking exception to the machine, yet when it is set to work and subjeeted to a practical test, the power generated is so small that, beyond running any small machine with which it may be eonnected, it is not capable of overcoming the resistanee to the power that must naturally be expected, and will, as a matter of eourse, declare itself as soon as it is sought to carry out the kind of work, be it what it may, that is usually effected by the agency of the machine in question.

### 14.—Adams & Co.'s "Photographic Annual."

The "Photographic Annual for 1891," issued by Messrs. Adams & Co., 81, Aldersgate Street, E.C., is in reality the price list of these well-known wholesale and export dealers in photographic materials and appliances of every kind, for, of the 304 pages of whieh it consists, one-third, roundly speaking, is literary matter and two-thirds pricc list. The priee of the annual is 1s. 9d. post free, and the annual itself is well worth the money asked for it on aceount of the value and excellence of the papers that are to be found in it and the portraits which it contains, these being photographs of Mr. W. H. Harrison, editor of the *Photographic News*, printed on Schölzig's ready sensitised paper; Mr. J. Trail Taylor, editor of the *British Journal of Photography*, an Alpha print by the Britannia Works Company, Ilford, from a negative by H. Van Der Weyde; and Mr. Henry Sturmey, editor of *Photography*, printed on Fry's bromide paper, from a negative also by H. Van Der Weyde. Among the contributions are papers by Captain Abney, Mr. W. Jerome Harrison, Professor W. K. Burton, Mr. Chapman Jones, Mr. H. Snowden Warde, and other gentlemen well known in photographic circles.

### 15.—Messrs. Cox & Co.'s Price Lists.

Messrs. Cox & Co., Electricians and Electrical Engineers, have recently opened new premises at 11, Fetter Lane, Fleet Street, London, E.C., opposite the *Record* Office, for the sale of all scientific materials. The illustrated catalogue issued by these manufacturing electricians should be specially useful to amateurs. One useful feature in the eatalogue is that it is split up into different parts, distinguished as lists and sheets, each bearing a different letter with the exception of their "Temporary Priee List of Manufactures," which deals chiefly with electric bells, batteries, light fittings, and sounder telegraphs. Thus, List E forms an illustrated appendix to their electric list; Sheet M, the price list of thermometers, barometers, drawing instruments, and meteorological and other apparatus; and Sheet O deals with optical apparatus, race, field, and opera glasses. A visit to Messrs. Cox & Co.'s establishment cannot fail to be instructive and useful in a variety of ways.

### 16.—Messrs. Richard Garrett & Sons' Illustrated Catalogue.

Farmers on a large scale, who are readers of Work, may be glad to have their attention directed to the illustrated catalogue of steam engines, threshing and barn-work machinery, issued by Messrs. Richard Garrett & Sons, Leiston Works. As far as may be judged from the price list, and the engravings with which it is illustrated, the machinery supplied is certainly important in character, and seems to be of the best possible design and make. The most noticeable is their threshing and corn-dressing machine, Class O. F., fitted with the "Garrett-Ellis" patent drum beaters. Corn and manure drills, horse hoes, and other field implements are manufactured by the Company, whose works are of long standing, having been established in 1778.

I have received from Messrs. Henry Zilles and Co., 24 and 26, Wilson Street, Finsbury, the April part of *The Amateur*, eontaining some well-conceived figures for Pyrography or Poker Work. The figures, three in number, are equally well calculated for other decorative purposes and processes.

THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—Questions Answered by Editor and Staff.

**American Lever Watch.**—Horol.—Grip the staff in a pair of pincers in one hand, and take hold of the balance with the other, and turn it round till the slot or notch in the staff is exactly behind the pin that works the lever; and see that when the pin is moving the lever, the ends of the fork are free in the notch of the staff when going in and out; and when the staff is round, that the pin is out of the fork. See that there is a little shake or freedom. Try both sides, and make the shake equal both sides. Regulate the depth of escape wheel on the pallets, till the escape teeth, when fallen on the pallet, only just catch on the safe corner of pallets. The best way to test the hair-spring for length is by trying it for time. If you have not broken any off, it should be long enough; but supposing any should be broken off and you find the clock gains, unpin the spring and lay it on an oilstone, take a cork, and gently grind it down, a little for width. Then re-pin it, and try again.—A. B. C.

**Nickel Solution.**—Curious.—The fault is not in the battery alone, although that is small, and I am surprised at the good results obtained from it. Your nickel solution has lost its free ammonia and become acid, hence the articles come out black. Get some blue litmus paper from a chemist and test the solution. If it turns the paper red, add some sulphate of ammonia, or liquor ammonia if you prefer it, to the solution until it ceases to redden the paper. If this does not cure it, add some more double salt of nickel (2 oz. to the gallon) to enrich the solution, stir up well, then pass the whole through a calico filter to remove the loose dirt. After this, test as before for free acid, and get it neutral before you attempt any more plating.—G. E. B.

**Bending Cased Tube.**—J. B. (*No Address*).—I am not quite clear as to whether you want to bend your $\frac{3}{4}$ in. cased tube to fit a curved bay window or an angular one. If the former, take a block of hard wood—say 3 in. square by 6 in. long—and bore a hole about 2 in. from one end. Let it be of such a size as to allow the pipe to slip easily through; fix the block of wood in a vice; place the tube in the hole, and gradually bend it, passing it through the hole as you do so; do not bend it too much the first time, and be careful to keep the tube always in the same plane—that is, after bending in one place. Do not lower or raise the tube when you make the next bend, or it will be "all of a twist," and very difficult to get right again. The way I usually fit up cased rods for a sharp angle bay is to mitre the ends, and to bend a piece of solid rod and fit it to the tube tightly and drive them on tightly: this makes the best job of it, as it is not practicable to bend cased rods or tubes sharply without damaging the brass casing. I might mention that the edges of the holes in the block of wood may with advantage be smoothed off a little.—R. A.

**Driving Lathe.**—Lathe.—If you cannot drive by the foot, there are many other ways you might adopt. A weight would do; but then, who would wind it up for you? also, it must be *very* heavy. Say you want 3,000 ft. lbs. per minute to drive your lathe, then you would require 1,000 lbs. falling one yard for every minute you work, or a weight of 60,000 lbs. falling one yard for every hour you work! I believe the Britannia Company, Colchester, make spring motors. You might have a little steam engine, like the hair-dressers do sometimes, or a gas engine, or a hot-air engine; or inquire what the water company would charge you per 1,000 gallons if you had a water motor; if not more than 6d. per 1,000, you could probably run a lathe by water for about 6d. per hour if the head is 60 ft.—F. A. M.

**Mounting Cushman Chuck.**—New Reader. I think from your question you must be trying to get your chuck true upon its face-plate by means of the screws; that will never do. Take it off, and observe the back of your Cushman; there you will notice a shallow recess, about $\frac{1}{16}$ in. deep, surrounding the central hole. You must turn away the outer part of the front of the flange, till you have produced a low cylindrical excreseence, not quite $\frac{1}{16}$ in. high, on to which your chuck will fit *without shake;* then fix your screws in any position, and the body of your chuck should run true. If you have already done this, and yet you find it does not hold work true, I would fit a small emery-wheel in a drilling spindle, and use that to grind the jaws of the chuck true; clamping a ring while truing the inside, and a bit of turned iron while truing the steps of jaws. You must not, however, expect absolute truth.—F. A. M.

**Carriage Varnishing.**—Barouche.—Carriage painting requires a seven years' apprenticeship. Without being so brief in reply as is the question, unfortunately, a concise account of the process shall be given, so that the tyro shall not go wrong and waste his time and money, and quite spoil his job at the attempt. An important omission in the question is not having said what sort of a carriage the learner desires to operate upon; another omission is not stating how much the carriage is worn that needs renovating, so that I am obliged to assume it to be a particular carriage, and that it needs to be varnished only, not retouched with paint and relief colours in part worn bare. Yet, I must not assume that, for no carriage that needs varnishing is perfect in its paint or colour beneath the varnish; again, if the colours had been mentioned, it would have enabled me to tell how to mix the repairing colours to match. These preliminary remarks should be noted by those who ask questions in Work, as, if the questions are fully stated, it makes the replies briefer and satisfactory. Why I ask what sort of a carriage it is, is because every description of carriage is constructed to take apart, and be put together for the special object of painting and varnishing a part properly. This is an important technical art in coachmaking, various carriages being taken to pieces in different manners. And this is what you must know, or your job will be a sorry botch. As the writer has assumed the *nom de plume* of "Barouche," perhaps it is a barouche he wishes to varnish; if so, it is one of the most difficult of open carriages to work upon. These carriages are built mostly on perch carriages, with Cee and under springs, costing new, from 180 to 220 guineas. I will assume the carriage to be a Stanhope phæton, as that general type of carriage will serve best to explain how many others are taken apart. Proceed thus: When thoroughly washed, put a trestle under the bottom of body, just behind the holting-on of the back-bed or "horn-bar" of top-carriage; this trestle must be about 3 in. higher than the bottom of body, so as to raise the body up, the springs will come open that much; do the same behind with a trestle under the bottom of body, just in front of the back crossbar, 3 in. higher than the normal height of bottom of boot. The fore carriage is termed top and bottom carriages, joined by a perch-bolt at the wheel-plate, where one turns on the other. They are parted by knocking back a bent linch-pin or key, which goes through a slit on the point of the perch-holt; you will need a steel drift-pin to effect this, as the key must be broken off close to the slit, mostly to get it out. Then the nut must be unscrewed right off; this needs a strong wrench, with jaws nearly 2 in. open, as this is mostly rusted and set fast, and you have to sit on the ground to work at it; take care it does not slip off the nut against your head, for you must pull towards your face, and it may cut an ugly gash that will delay the job a little while. I have seen it happen, even with experienced men. I may say that I admit writing feelingly on the subject, so I adopt a double-hammer tapping plan—that is, hold a 4 lb. hammer at an angle of the nut, and with a 6 oz. hammer tap the diagonal angle; this mostly starts the nut an eighth turn; then you may use the wrench to finish taking it off. Now, by lifting up the fore part of the vehicle body, the perch-holt comes out of the bottom bed only (it is almost a fixture in the top bed); pull away the under-carriage with front wheels, and let the body down again in its place on the trestle. The top carriage has now to be removed; this is done by unscrewing nuts from four bolts through the ends of the bed and horn-bar. You must have someone to help you here, not so much to get the beds down from the bolts, as to keep them from dropping from the bolts suddenly, and perhaps breaking the dub ends of beds in concussion with the ground; the foot sometimes saves the wood striking the ground: so much the worse for the foot. The hind part of carriage, *i.e.*, the back-bar, springs, hind axle, and wheels, are easily removed—four bolts go through the body bottom sides and bar; take off the nuts, and tap up the bolts quite out of their holes, then wheel back that part away from the body. You will find a lot of dry mud on the bottom of body, that the washing-off could not reach; get this quite clean. You may say, that part is out of sight; but varnishing is for a double purpose: preservation from decay as well as nice appearance; and, though the bottom is never varnished, it is japanned to preserve it, and made smooth for easy removal of mud in washing. Now remove the dash-iron by taking off the four nuts, and the side wings, and top-rail of body, mostly fixed with nuts. I must not pause long over little difficulties, as of a nut turning round yet not coming off; should this occur, hold the end of a bar of iron at one edge of the nut, and with a light hammer and sharp cold chisel cut the nut in halves. Should the bolt turn in the wood instead of the nut unscrewing, drive a piece of saw-blade under the bolt-head; the saw-blade to be cut out with a long notch the size of the square of the bolt. Get someone to hold against the pull of the wrench; if there is any difficulty, always cut the nut in halves, it saves time. Brush the lining thoroughly, and cover up with brown paper, American cloth, etc., tacked down to the rail at the edge of the seaming; lace the tacks only just to enter enough to hold. The hind seat is usually fixed with four or five screws, and they are mostly rusted in; consequently have a good taper blunt-edged screwdriver, tap it well into the notch of the screw, and jerk at the same time as you turn with all your might. I have heard coachmakers say you must not stand to a nicety about rupturing blood-vessels in trying to get out screws; sometimes the set-fast screws need to have their heads chipped away a bit at a time; then the seat lifts up clear of the screw, to be unscrewed by a hand-vice. When all these separate parts are away from the body, you will see that these detachments were necessary for varnishing, and moreover, useful to point out the state of preservation of the woodwork of body and carriage, and the reliability of the bolts, springs, axles, and ironwork generally. The wheels must be taken off the axles by unscrewing caps and nuts; these are put away in a marked box. The tyres may be worn, and need renewing or contracting to brace up the loose joints of felloes and spokes; if so, do not attempt these difficult jobs for a tyro, but write to a wheeler to send for the wheels; it will not be expensive, and is sure to be well done. I can name plenty of good men in town or country if needed; they will put everything right, even to painting correct colours ready for varnishing. The taking apart just described is called "unhanging" in the trade, from the old-time plan of unhanging a body swung on braces. Two men would do it in from three to four hours, or a coachmaker would show you how. Now, your varnishing must only be attempted when the old surface of varnish is prepared to receive the new. Every part must be flatted off with pumice-stone powder and water, and a piece of strong woollen cloth for rubbing. Begin at the upper parts, finish cleaning off, and work downwards, cleaning as you go with clean sponge; a very clean wash-leather is most essential. If the boot sides are sun-cracked in the old varnish, you must turn the body on the side, on old cushions, and pumice-stone down with lump pumice-stone, till you have worn down the cracked varnish to the body colour; it will then appear a dull slate colour. This, if black, is first japanned with japan, which is a semi-opaque black varnish. Should any small parts have been rubbed through to the lead-colour priming coats, these must be touched with black first, or, better still, give it all a coat of dead black, laid on quite thin, then flat-off lightly with pumice-stone powder, and when dry, japan it, using a good flat pointed brush and a small tool to get into the corners. Now for a wrinkle; you do not want to show the brush-marks on the varnished surface, as if combed after painting; this is avoided by holding the brush very slanting, about 35 degrees of angle to the face of the work; if held at 50 degrees the points of the bristles rake the japan or varnish, instead of *sleeking* it at the finish off of the stroke. The touching-up of relief-lines requires care, with sable or camel-hair pencils and colour to match. The rims of wheels, edges of springs, and shafts, are the most worn parts, and may need body colour as well as "picking out." Allow a day or two for colours to dry before varnishing. Do not attempt to varnish in a dusty or damp place; it must be a clean, dry place, even if warm; it will be better for the lustre of the varnish. The wheels are swung on a projecting spindle, so that you can get at the back and front faces of the wheel—beginning at the nave, and working down the spokes to the rim, which is done last, at the tyre edge, which, being dirty mostly, however clean it may appear, ensures the brush being kept clean till the last stroke. If you decide to give any part two coats of varnish, flat-off first to an egg-shell dulness. A clever painter will catch the drying of the first coat on the "tack," and with a delicate handling of brush give a second coat in a few hours after the first, instead of waiting two or three days and then flatting-off the first coat. When varnished, avoid walking about near it, as it raises dust, which makes the varnish specky. Avoid the job being near a manure heap, which will make the lustre of the varnish iridescent or rainbow-hued, ending in dulness. After the whole has stood for a few days and it feels fairly hard, wash off every part with clean cold water, with sponge and leather; you cannot wipe off too dry, the oxygen in the water is absorbed by the varnish, and makes it almost as hard as glass. This is the secret of the lustrous enamels now being sold: they contain a supply of oxygen. Now a question: Are you sure your carriage needs varnishing? You may say it looks so dull; that is no proof of want of varnish. The following fact, which I can vouch for, will explain:—Mr. Murchison, the celebrated geological explorer, sent his travelling carriage to his coachmaker to be varnished, but said it must be ready in three days to go abroad; he came punctually with post horses for his barouche, and was astonished to find his carriage more lustrous than he had ever seen it before, even when new, and asked the coach-maker what sort of varnish he had put on. "None at all," was the answer; "I have taken off some." "Explain!" said the great explorer. "Your carriage was overloaded with varnish, and it has been flatted-off with pumice and water, and polished with rotten-stone and oil, and the lustre worked up with the hand and old worn silk handkerchiefs. It will stand the hottest sun or keenest frost better than new varnish." This will impart to you how you may improve the panels of your carriage, for they receive little wear compared to wheels, springs, and carriage, should the panels appear dull and you defer varnishing. To put a carriage together that has been unhung, first, put up the top carriage, then the under carriage, well greasing the perch-bolt and wheel-plate. To do this, the wheels, front and hack, may be put on the axles temporarily to uphold the springs; remove the trestles, and clean and oil the axles one at a time, bolt on dasher wings and body-rail, then touch up the nuts with colour or japan afterwards. As to where to get materials,

the largest and best selected stock of carriage materials, rough and finished, is to be got of Messrs. Whittingham and Wilkins, 136, Long Acre, W.C. They will advise in the selection of prepared colours, varnishes (always copal), and brushes and pencils. —J. C. K.

**Duplicating on Photo Plate.** — AMATEUR. — If small grooved strips of wood are attached to the upper and lower part of the framing of the camera, immediately in front of the position the sensitive plate will occupy, and a piece of blackened zinc sufficiently wide to cover *half* the plate, and sliding in this groove from side to side as occasion may require, all that is necessary will be provided for taking *two* pictures on *one* plate. The screen being fitted, one exposure is made; close the shutter of the slide, and alter the position of the zinc screen, and make the other exposure. This is a very simple, workable, and effective contrivance.—E. D.

**Wiping Joints.**—A NEW READER.—It *is* usual to "tin" the parts to be joined, but the tinning is done by wiping the molten metal round the joint, which, of course, is previously cleaned and greased with tallow or a mixture of resin and tallow. You say you melt down the "ordinary" solder in bars. What do you call ordinary solder? Perhaps you have been using tinman's solder. If so, this is too fine—that is, it will "run" too freely, and could not be wiped up into the right shape. Your solder for wiping joints should be a mixture of lead, two parts; tin, one part—pounds, ounces, or anything you please in the above proportions.—R. A.

**Oval Boiler Lid.**—J. S. (*Poplar*).—To make this, first ascertain the inside circumference of the boiler. A rough estimate can be formed by taking twice the length and once the width of the article. Having found this, divide it into three or more parts, according to the length of the stuff you have to cut the rim out of. Thus, if the boiler requires a rim 39 or 40 in. round, three lengths off a "single" plate which is 14 in. long would do very well. Cut them 1⅜ or 1½ in. in depth. The pieces should be not quite straight, but slightly curved; tack them together so as to preserve the evenness of the curve, and fold over ½ on the inner side of the curve (this is done on the hatchet stake); flatten it down, and turn round; shape to the boiler and tack it so that it fits well, but not too tightly. Next throw off an edge—this also on the hatchet, unless you possess a "jenny." This will put the rim out of shape, so it must be put right again before proceeding with the next process, which is cutting out the top. Place the shaped rim on a plate of tin of sufficient size and mark round the outside of the edge of the rim: cut ⅜ of an inch larger all round—this will allow for hollowing; for this a wooden block will be required, and one or two block hammers, and this is the process that will give most trouble. Make a ring of blows about 3 in. from the edge all round, and then work towards the outside, smoothing out the puckers as you go along. Use light blows, then go over it again with slightly heavier blows, and you will find it working up. When hollowed up sufficiently, smooth it off. Place it on a flat place, and see if it touches all round; if not, press it into such shape that it will do so. Throw off a wide flange on a crease iron or bick iron, if no jenny is available; then turn up an edge, and slip rim in, and pane down the edge. The making and fixing of cover handle I think you will not need to have explained.—R. A.

**Mosaic Flooring.**—MOSAIC.—Form the foundation of hard dry material well rammed, and bring it up within 6 in. of the finished surface. Cover this with 3 in. thick of broken stones, well rammed down, and lay upon the stones 2 in. of cement concrete, formed of six parts of crushed bricks and one part of cement. This must be finished level, and allowed to set hard. Then lay out the centre portion of the floor between the borders by means of laths 3 in. by 1 in., planed straight, and laid to the exact size of the centre portion. The tesseræ can be had cemented together in slabs about 8 in. square; but when made in this way they are above 1 in. thick, and the surface of the cement concrete must be ½ in. below the slabs to allow for cement jointing. They can also be had fixed on strong paper, the face being next the paper, and in this case are not so thick as when formed into slabs; but they are much more difficult to lay, on account of not being able to see the face of the work. Great care is also needed in jointing one to the other, and there is a danger of the outside pieces coming off the paper when they have to be fixed by hand. In whichever way you get them, they are laid in the same manner as encaustic tiles on a bed of cement, and beat down level with the laths by means of a hammer and a piece of flat board. If you refer to page 428, No. 79, Vol. II. of WORK, you will find a description and sketches of the method of tile laying, which may be of service to you. You will receive from the firm supplying the tesseræ a plan showing the various parts of the floor in colours, which, if they are formed into slabs, you will easily understand, and if they are fixed on paper, will be marked or numbered for your guidance. You must be very careful in handling them, if on paper, to see that none of the pieces drop out; should any do so, you will have to insert them after you have beaten them down. The paper will come off while you are beating them down. You will also, most likely, receive printed instructions for laying them when the plan is sent. As you have not laid any before, I should advise you to get someone to assist you in laying them who has had experience, as they are much more difficult to lay than ordinary tiles.—M.

**Polishing Paste.**—PASTE.—(1) *Sweet* or *olive* oil will be best for moistening the paste. (2) Emery is the active ingredient in most preparations for polishing metals, though putty-powder (calcined oxide of tin) is also a valuable material for that purpose. But PASTE asks how a *cheap* paste for polishing knives may be made. The following has been recommended as inexpensive, and at the same time efficacious, and not liable to wear away or blunt the knives:—Brickdust and scraped yellow soap are to be pounded and mixed together. The paste is moistened with water, and applied on flannel. The blades require to be washed with warm water after using the paste.—S. W.

**Choice of Trade.**—TERRA COTTA.—Without knowing what your capabilities are, it is difficult to advise you, but assuming that you have to work for a living, I should advise you to remain at your present occupation, and learn all the different branches of the trade. You should also make yourself acquainted with the various clays and brick-earths, methods of mixing, moulding, and burning, as these vary in different districts. As to wages, if you get to be expert in all branches you might get £2 per week or more, or you might get to be a foreman or manager in a large works, at a higher rate. If you have any talent for modelling, and follow it up, you can obtain better pay. Terra-cotta and encaustic tile work are also higher branches, if you can get into them. To become a draughtsman, you should go as an apprentice or articled pupil into a drawing office. After serving your time, you might get 25s. or 30s. per week to begin with, gradually advancing according to your abilities; but you will require influence or have to pay a premium to get into an office, and would probably receive no salary till out of your time. You can learn drawing while at your present employment by joining a science class, which would not cost more than 5s. per term. You should learn freehand, model, perspective, machine and building construction, plane and solid geometry, and mathematics. If you get to be expert at these, you might then get a situation as a draughtsman.—M.

**Silvering Buttons.**—E. W. (*Leith*).—There is no method I know of to "silver" brass buttons to stand exposure for an unlimited length of time to all weathers except the Sheffield method of plating, or the way in which harness is plated—that is, by covering them over entirely with sheet-silver. Even these would be bound to wear through with continual cleaning; and besides, silver could hardly be applied in the form of sheets to any finished buttons except plain ones. Are you not asking for an impossibility? Look at the silver in your pocket, and you will see how sixpences and other coins get worn down. Now, should not this bit of common experience have caused you to question the possibility of depositing silver in anything like the same thickness you here see worn off? Cannot you procure the buttons in German silver instead of brass? then you would always be able to restore the colour by brushing where the plating had worn off.—H. S. G.

**Light Dog-Cart.**—N. I. (*Falsgrave*).—The measurements of a dog-cart suitable for a pony thirteen hands are as follows:—The framework of the body to be of oak and panelled with baywood or birch. The length of body on top rail is 36 in., the length of the body at the bottom from the back to the front in a straight line is 57 in., the depth of the side is 20 in. The width of the body at the top is 36 in., at the bottom 34 in. The front dash and the splash wings can be of birch or white-wood or enamelled leather; the splash wings if of wood will be 36 in. long, 6 in. wide, and ¼ in. thick. The shafts are of lance-wood, and fit at the outside of the body. The length of the shaft from the tip to the draw-bar is 63½ in.; the rest of the shaft extends to the end of the body. The seats are 36 in. long by 13 in. wide, the front seat having a back-rest upholstered both sides. The springs are 46 in. from centre to centre of eyes, with five laps or plates in each spring, 1½ in. wide, and ¼ in. thick each lap. Either the Collinge or mail axles can be used. The wheels will be 4 ft high when finished. The nave 8 in. long by 6 in. wide. Spokes, width 1½ in. by 1¼ in. thickness. Felloes, thickness 1⅜ in. The width of the tire 1⅜ in. by ½ in. thick. The lamps, as is now fashionable, should be placed at each side of the body near the wheel. The body should be painted black without any finishing or striping, with just simply a monogram in gold or colour in the centre panel at the back and the two sides, or a crest if entitled to one; the wheels, springs, and shafts to be painted vermilion picked out with a quarter-line of black. I do not understand your first query. Is it a lorry for a pony you mean? If you could send a rough sketch of what you want it would greatly oblige.—W. P.

**Clock Parts, Etc.**—H. R. P. (*Lambeth*).—Pack your clock, and take it to Grimshaw & Co., 35, Goswell Road, Clerkenwell, and tell them to make your face and fit hands; give them instructions as to shape, size, style, etc. They would also get a case made for you as you want; or for case you might try J. J. Stockall, 6 and 8, Clerkenwell Road: he may be able to get a case made for you. —A. B. C.

**Sizes of Bassinette.**—H. W. (*Manchester*).—Your query for sizes of wooden bassinette, coach style, to seat two children, is one to which I am unable to reply. I am frequently drawing bassinettes (on paper) for manufacturers, but as I do not draw them to scale, I never trouble to measure them. There is no reason why you should not discard stock dimensions, and use your own judgment as to those most suitable for your purpose.—J. S.

**Polishing.**—J. W. (*Birkenhead*).—Undoubtedly, polishing is better for such a piece of work as your small cabinet than varnishing. This has been repeatedly stated in "Shop." If you have already stuck down the frets on the panels, you will only make a mess of the job if you try to stain, varnish, or polish the sunk ground, either with glaze or anything else. It will be necessary to leave this part of the work in the white. If you wish to do so, you may oil it, but it is questionable whether you will improve the appearance by doing so. The plain portions can be polished after staining black or any other colour. Stain first, then size, and finally polish in the usual way, using black polish if the job has been stained black. Dull down, if required, with emery powder. Black polish can be made by adding a little gas black to ordinary polish. If you want your little cabinet well finished, it may interest you to know that Mr. F. Warrington, 47, 49, and 51, Heath Street, Myrtle Street, Liverpool, makes a speciality of finishing work for amateurs. He is a polisher of wide experience, and his charge for doing the cabinet will only be trifling.—D. D.

**Upholstery.**—T. G. (*Neston*).—The job you propose is a very ambitious one for a novice. You would require to know vastly more than the mere construction of the roll and its stitches before you could have the slightest chance of success. You could hardly have selected a more difficult job in ordinary upholstery. The small chairs you might possibly manage to do—after a fashion—but not the couch and easies.—D. D.

**Chess Board and Scraps.**—R. W. M. (*Kildare*) —To make a chess board, get a sound dry piece of mahogany. Clamp the ends so as to form a square of the desired size, and you may consider the base ready. Get some veneers of the colours you intend to form the squares of. Cut them into the requisite number of square pieces. Glue them down in proper order on a piece of paper. Outside them lay a piece of stringing, either plain or mosaic, and beyond them borders of a suitable width of mahogany. Lay on one side till dry, then go over the unpapered side of the veneers and the top of the base with a toothed plane. Glue and lay down the veneer. When the glue has set, clean off the paper, smooth down, work mouldings (if any) on the edges of the board, and finally finish off by French polishing. For the complete process of laying veneers, read the exhaustive series of articles on the subject in Vol. I. of WORK. I am afraid that you will have some difficulty in removing your scraps from the screen, as they have been varnished, without injuring them. A good deal, however, will depend on the material to which they have been stuck. If it is calico or any similar substance which will allow moisture to act on the backs of the pictures, the removal will be easier than if it is finished with a waterproofed facing. With a porous backing, all you have to do is to apply warm water till the glue is sufficiently soft to allow of the pictures being removed. In the other case, give it up as a bad job.—D. A.

**Polishing.**—G. W. (*Plumstead*).—To finish a wide surface with glaze, free from dull streaks and from ridges, the glaze should be used as a polish; see that the surface is free from oil, the rubber soft and free from lint. Apply the glaze as evenly as possible, going over the surface several times, until the rubber is nearly dry; then with the smallest quantity of oil and a little spirits go over the glaze, very lightly at first, varying the direction of the rubber to avoid ridges. A *dull*, even surface may be obtained by adding one-third to one-half of sandarach to the solution of benzoin, and using the rubber damp only—not saturated.—F. P.

**Milling Machine.** — DESPAIR. — The milling machine bears about the same relationship to the file that the circular saw mill bears to the hand saw. There are, of course, some kinds of work to which files must be applied and milling cutters cannot be used instead. Milling cutters may be worked at such a high rate of speed, and the feed of the work into cut can be so rapid, that any work a milling machine can tackle may be done on this machine quicker than on any other. As to the quality of the work, its evenness, straightness, and smoothness are the nearest approach to perfection of that of any machine tool, and if keen-edged cutters are employed, there is no way of improving this, short of grinding and polishing. Milling by circular cutters is not treated upon exclusively in any book, but a dozen pages are given on this subject in "The Metal Turner's Handy Book," price 2s., published by Lockwood & Son, and the information there given would enable you to form an idea of the capacity of this method of shaping metals. For the purposes you name, a valve milling machine would be the kind best suited, having two or four spindles and using end or butt cutters. There is no better machine than this to do such work; it is specially designed for milling the square and hexagon parts of brass cocks and similar fittings. The spindles are adjusted independently by hand wheels, so that the cutters can be brought together or separated to any distance within the limits of the machine. After adjusting the cutters and milling two opposite sides, the work is rotated through an angle of 90° for a square, 60° for a hexagon, or 45° for an octagon, and again traversed between the spindles, by which process two other opposite flats are milled true and to precisely the same gauge. This second process would complete a square, but a third traverse is

necessary for a hexagon, and a fourth for an octagon.—D. H.

**Gilding on Glass.**—YOUNG SIGN WRITER.—The process is too long to describe in this column; it requires one or two articles to treat upon it practically, and give full working details. Perhaps the Editor will soon see his way elear to give these chapters. I am not at all surprised that you should know nothing whatever on this subject, as there are many good writers who never attempt it, and look upon it as the work of a speeialist, such as the glass embosser. It is not very difficult, however, and, had I the space, I could give such clear direetions that any sign writer eould execute the work with ease and eredit. You ask about the size used for fixing the leaf to the glass: you are mistaken in surmising that this is the ordinary gold size, for it is not, and no decent work could be done with it. The size is made by the writer as follows:—Purchase some fine isinglass, or Nelson's No. 1 gelatine, and take as mueh of this as ean be placed on a shilling without piling it too high; place this in a tea cup half full of boiling water, and stir well till thoroughly dissolved. Before the size has had time to eool, fill up the cup with pure spirits of wine, and incorporate well together. The size is then strained through a piece of fine linen, or, better still, silk handkerchief, and is then ready for use. The gold leaf used is the ordinary kind. The lettering is first set out on paper, being of eourse reversed: this is pasted on the outside of the glass. The glass is thoroughly cleaned inside and polished with tale. The letters are then formed with the size, using a good camel-hair pencil, and the gold leaf is lifted from the cushion with a "tip" and dabbed with eotton wool. When dry, the gold assumes a burnished appearanee; and if now it is rubbed with a pieee of eotton wool, the brillianey will be increased. The gilding is now repeated, the same process being followed; and, when dry, the loose gold round the edges is removed with cotton wool.—H. L. B.

**Air Gun Walking Stick.**—G. E. B. and W. LONGDEN.—There is a lock to the gun in the fore half of the barrel, between the trigger and the middle serew joint. The air-ehamber is in the rear half of the walking stick, of thin iron; the barrel, half serewed in front of it, though only bored for a ¼ in. bullet and charge, is necessarily of stout iron to continue the outward semblanee of a walking stiek. It is in this thickness of iron between the bore and the outside that a slotted recess is eut in whieh the trigger-spring works—out of sight, as it is cased in by a thin covering of iron flush with the rest of the stick; an outer skin, as it were, just at this part only. This spring aets upon a plunger just at the baek of the charge ehamber. When the trigger is pressed, this plunger—about ¼ in. diameter or less—strikes a piston in the centre of barrel air-chamber just past the joint of the two barrels. This lets out a jet of air, which passes the plunger and drives out the eharge from fore barrel. The valves are packed with soft leather, and the piston is kept up to its plaee by a eoil-spring till driven back by the plunger striking it in the eentre. The look in its reeess is somewhat like the ordinary lock and spring of a gun, but small. The air does not get to the lock, as it is outside the ehamber or charge bore. The outlet for the charges of air that escape is the same, but pressure is less forcible towards the last charge of five or six charges or air impulsions.—J. C. K.

**Indiarubber Felloes.**—J. H. (*Winchcombe*). Mr. Aves, Barbiean, E.C., rubber felloe manufacturer, is the inventor, to whom apply.—J. C. K.

**Enamel Cloth.**—E. L. (*Woolwich*).—For enamel cloth used for infantry men's valises, try Whittingham & Wilkins, 135, Long Aere, W.C.—J. C. K.

**Prize Bookcase.**—W. H. B. (*Birmingham*).—If you will kindly let me know what you eannot understand, I shall be pleased to put you right.—E. D.

**Sign Writing—Spaeing Letters.**—IMPROVER.—The whole of the information you require is to be found in the articles on "Sign Writing and Lettering," which appeared in Vol. I. of WORK, part in one chapter and partly in others. Get Part 4 or No. 17, and you will find pretty elear instruetions therein for giving a symmetrieal appearanee to words. It must be remembered that all letters should not be the same distanee apart; for instanee, the space between such letters as K, O, P, Q, V, W, and Y, and the letters on either side of them should be less than for ordinary letters; and the same rule applies to "serif" letters; they must be kept eloser together (see example, page 259, Vol. I., in above number of WORK). I have also given directions for spacing large letters on high walls in one of the chapters, but am unable to trace the exact chapter just now. Briefly, no fixed rule can be followed, as no two situations would be alike, and the letters must, of course, be formed as to size and spacing to suit the circumstances of the case. An experienced writer finds no trouble in doing this, but a novice will find it easier to first measure his space on the wall and then arrange his matter on a blank wall near the ground. When the size and spacing of his letters are satisfactory, he can take full measurements, jot them down in his pocket book, and then, by the aid of these and a measuring rod or straight-edge, proeeed to set out his work on the gable end of the house or any other high situation. All this is really not diffieult, and you should watch a good sign writer at work. There is not mueh scope in your town, I know, for very high-class work—the narrow streets will not allow it—but you, no doubt are frequently in Birmingham, and here you can often see writers engaged, sky high, on gigantic letters. In London, "sky signs" are injuring this class of work.—H. L. B.

**Volume of WORK.**—OLD NORWICH.—15 per eent. duty will be ehargeable upon volumes which you may send to Canada.

**Cost of Dynamo.**—ELECTRIC.—You have neglected to give the voltage of the dynamo, hence I eannot give you a definite reply. A dynamo to give 10 ampères of current may have a voltage of 10, 20, 50, 100, 500, or more volts, and its eost rises with the voltage from £10 to £100, or more. The horse-power will also rise with the voltage from ⅛ h.p. for a dynamo to give a eurrent of 10 ampères at 10 volts pressure, up to 7 h.p. for a maehine giving 10 ampères at 500 volts pressure.—G. E. B.

**Shocking Machine.**—F. V. (*London*).—Have two sliding bars for handles. The left-hand handle should be fitted with a lever moving a switch to throw the battery in or out of action. A noteh is made in the upper part of the bar, and in this notch fits the short end of a lever to prevent the bar from being pulled out until a penny, falling into a small seoop at the longer end of the lever, tilts it up free from the notch. The other sliding bar is to be connected to the sliding regulator of the eoil, and must also have a transverse pieee of brass fitted to it to sweep the penny into the till as the bar is drawn out. Attach a cord or pieee of eatgut to the sliding regulator and pass this cord over a pulley on the spindle of the dial hand. Cords attached to weights should draw the handles back when they are released. By pulling out the left-hand handle the battery is thrown into action. By drawing out the right-hand handle the strength of the shock is regulated, and this is shown on the dial. When the handles are released, they are drawn into the box, and the locking lever falls into its place again and locks the switeh.—G. E. B.

**Staining.**—CLYDESIDE.—You will find in No. 95, Vol. II., a paper on "Imitation of Woods by Plain Staining," etc. A direct referenee is made to maple staining, and I can only add that yellow pine, if simply varnished with eopal, two or three eoats, or twice sized and once varnished, if expense is an object, will be as near the tone of maple as you will get it without painting and graining. Now go earefully through the paper, and then ask yourself—Is it fair to want more from us? If you desire to ornament the eot, put some of the same ingenuity and perseverance at work in reference to papers on "Imitation Inlaying" that you have already displayed in making the eot itself.—DECORATOR.

**Pitch Pine.**—SAW MILL.—You question the correctness of sentence eommeneing "Real pitch pine," to "from the Baltic," in page 694, Vol. II. I have to answer that (1) the articles being treated from a grainer's point of view, "Real piteh pine" was a term used to express, in a general sense, those figured varieties of pine wood belonging to the natural order *Coniferæ*, commonly known to the grainer as "pitch pine." The illustration accompanying the paper was used for explaining technical processes, and shows a simple grain of the wood alluded to. (2) I am aware that much pine wood comes from the States, as instanee the celebrated pitch pine of Savannah; but it does not eome from the States *only*, as your note implies, for in 1876, I find, nearly 300,000 tons of white pine and 40,000 tons of red pine were exported from the *Dominion of Canada*. (3) Beyond this, the genus *Pinus* is not only indigenous to the countries of the Baltie, but even to Northern Britain; and, finally, I beg to state that the writer has a very intimate eonnection with a seaport, very remote from Liverpool, to whieh piteh pine is imported from the Baltie, and where it is largely used as stated in the artiele.—DECORATOR.

**Paint Queries.**—W.S. (*Inverness-shire*).—For full particulars of plain painting and the nature and uses of all painters' pigments and fluids, see series of papers thereon in WORK, Vol. I. Get it at once before the price goes up to a guinea, whieh is its true value to most people! For external—*i.e.*, preservative—painting little or no turpentine is neeessary. The provinee of the latter oil is to thin the linseed or get "dead" surfaces of work. Quantity of driers depends partly on the pigment used, some having a natural drying power, and others quite the opposite. For most pigments and lead paints, one of driers to ten of pigment in winter, and one to sixteen in summer, would suffiee. This, again, is qualified by (1) the strength and quality of the driers, and (2) the purity of the oil. Boiled linseed oil is usually substituted for the ordinary raw oil for external painting, and partieularly for ironwork. Being boiled upon *oxides of lead*, etc., it takes up their drying nature, and is therefrom often termed "drying oil." The process makes it thieker and darker, and hence it is only suitable for dark-coloured paints. The drying power makes it also more susceptible to blistering on most kinds of woodwork, and many painters don't use it at all nowadays. Red lead, being *oxide of lead*, is a natural drier, and this, added to its natural weight, causes it to settle and harden when lying by. Remedy—Mix only as mueh as you want for use each day, and so keep it well stirred. You will gather that the oxide of lead communicates its powers of oxidisation to the oil it is mixed in, and thus not only dries it when in ordinary use, but continues such action upon it when standing, and makes the paint "fat," in professional parlance.—F. P.

**Emigration and Employment.**—ABSTAINER.—It seems from your letter that you are an able-bodied man, ready and willing to turn your hand to anything, and that you have saved a little money. Further, to judge from the locality in which you live at present, you are accustomed to agricultural work, and can do a little in chair-making. The best thing you can do is to write to John Pulker, Esq., Emigrants' Information Office, 31, Broadway, London, S.W. State your age, say you wish to emigrate to South Africa, and ask him to send you sueh papers as may tell you what to do in order to obtain assistanee in getting there. He will send you the neeessary forms of application, etc. You might eertainly be able to work your passage out, but I am not acquainted with any shippers, so with regard to this I can give you no particular information as to the best means of getting a ship. As, however, you are not a sailor, you would be unaccustomed to the work on board ship, and, I daresay, would find difficulty in getting on any ship's books. You would find it better in every way to go out as an emigrant assisted by Government.

**How to Make a Telephone.**—H. P. (*Oxford*).—An artiele on the above subjeet appeared in No. 23 of WORK.

**Machine Rollers.**—BREMNER.—I fear the advice you ask for in your letter will not be of mueh service, as I can scarcely understand what your difficulty is. The "hopping" of rollers over the type suggests to me that the runners of your maehine are too low, or perhaps worn rough; then the "lifts" would not support the rollers at all, and their full weight would press on the "forme." Try nailing on strips of thiek wrapper or cardboard with tinned taeks, the length of the runners from the slab to the "piteh." If one thiekness is not suffieient, add others till the rollers "fliek" over the "forme" merely. After washing your rollers after the job is off with petroleum, or turpentine, or terebine, do you sponge them over just before using them again with a sponge and elean eold water? This restores the "bite." The sponge should be merely well damped, not wet. If you find the "suetion" is not renewed by this means, your rollers want re-eovering with new composition, which should not be used too "green"—*i.e.*, too new. Be eareful to see that your roller "lifts" are exactly of the diameter of the roller-mould, or they will be sure to jump on the "forme." I strongly recommend the "Durable" roller composition as being more economical and lasting longer, and also having more bite or suetion on the ink-slab and formes. If you have a "blank" page, or a title, or other light page, or part of a page in the forme, nail on the runner nearest to it, exaetly opposite it, an extra strip, or even two, to lift the ends of the rollers higher still over that part. A little experimenting in this direction will give you a new sense of power over your ink supply, and enable you to avoid a light page being over-inked, and a heavy page thereby being robbed of its full inking. Write again if I have misunderstood your queries, and send to the Durable Printers' Roller Co., Limited, 57, Shoe Lane, for price list and information.—J. W. H.

**Bookshelf Leather.**—C. A. F. (*Holland Park*).—This is obtainable of Messrs. E. J. Willson & Son, 21, St. Bride Street, London, E.C.

**Cast Brass Cooking Utensils.**—If anyone ean supply you with the articles mentioned in your query, it would be Messrs. Benham & Froude, Chandos Street, London, W.C.—R. A.

**Spark from Induction Coil.**—R. E. L. (*Chingford*).—From a coil having a core 9 in. in length by ¾ in. in diameter, wound with 4 lbs. of No. 35 silk-covered copper wire as a seeondary eoil, and having a eondenser of 150 sheets, you should get at least a 2 in. spark, if the eoil has been properly eonstructed. I see, however, that you have started with an initial fault in employing No. 16 double cotton-eovered wire as the primary. The insulation should be silk-covered, soaked in melted paraffin. Shellac varnish is not the best insulator. You fail to get more than a ¾ in. spark because the coil is badly insulated, and therefore you increase the trouble by employing more eells, since the higher tension eurrent then pierces the defective insulation, and the extra eurrent is absorbed in the coil instead of traversing the secondary, and appearing at the points in the form of sparks. If you go on increasing the cells, you will entirely ruin the insulation of the wires, and also the condenser, by internal sparking. The effieieney of the condenser is shown by deereased spark at the break, and increased spark at the terminal points.—G. E. B.

**Induction Coil.**—R. MCC. (*Glasgow*).—A 7 in. core should not be 1 in. in diameter. Half of this is quite enough for sueh a small eoil. The paper tube should be only $\frac{1}{16}$ instead of ¼ in. in thickness, and should fit close to the core. The primary should be No. 18 or 20 silk-eovered, not No. 16 double eotton-eovered wire. You eannot get this large size close enough to the eore to properly magnetise the iron. If the eoil is for sparks, you will find better results from No. 36 than from No. 34 as a seeondary. Soak all the wire in melted paraffin wax before winding it on the coil. See that the hammer of the break is not too heavy or the spring too strong to allow free working of the break.—G. E. B.

**Electric Bell.**—A. G. F. (*High Wycombe*).—If you get No. 18 of WORK—and you can get the number direet from the office for 1½d.—you will find therein a full illustrated description of the "parts of an eleetric bell whieh cause the bell to ring," and "proper" instruetions showing the way to make them. In a series of articles on "Burglar Alarums," running through the first volume of WORK, the making and fixing of electric bells are described.

The articles appeared in Nos. 12, 18, 20, 27, 31, and 33 of WORK.—G. E. B.

**Whitening Silver-Soldered Joints.**—C. C. (*Birmingham*).—I suppose you have hard-soldered the joints, and in doing this have brought the copper of the silver alloy to the surface. This causes the smoky brown stain of which you complain. You have failed in boiling out the stain in dilute vitriol, because you are using the pickle too strong, and do not warm your work enough before putting it in the pickle. Use one part oil of vitriol to forty parts of water, and heat the work to a dull red after soldering. If the joint is soft-soldered, or the silver is poor, you must electro-plate the article to whiten it after soldering.—G. E. B.

**Fan Mounting.**—A. H. W. (*London, W.*).—Mdme. Ida, 7, Prince's Street, Regent Street, London, W. (entrance in Castle Street), intends taking up fan mounting. She has only lately commenced business on her own account, so the fan mounting may not be started yet. A. H. W. could inquire there. Also of Mrs. Haitland, Amberly Art Studio, Crouch Hill, N.—C.

**Small Tin Boxes.**—PASTE.—You can obtain small tin boxes such as you inquire for, suitable for paste, blacking, etc., from either of the following:—A. Truelove, 14, Carver Street, Sheffield; or G. Stradling, 21, Florida Street, Bethnal Green, London, E.C. They are very cheap, and the makers will quote you a price according to the quantity that you require.—R. A.

**Claws or Feet for Fountain.**—J. R. P. (*Uttoxeter*).—You will get these through any local furnishing ironmonger; if not, try and make some yourself—first modelling them in clay; then take a cast in plaster of Paris, and from this make castings of melted compo. pipe. As they are for ornament only, they can afterwards be soft-soldered to the legs of the stand, as shown in the design.—C. M. W.

**Electro-Motive Force of Batteries.**—R. E. L. (*Chingford*).—The E.M.F. of zinc and carbon immersed in the ordinary bichromate of potash solution employed in charging battery cells is about 2 volts at the instant of closing the circuit. All sizes of plates have the same E.M.F. The internal resistance of a single cell having plates 7 in. by 4 in., and placed ½ in. apart, would be about ·03 ohm. Therefore, the current at the terminals of a battery of three such cells would be at the moment of closing the circuit $\frac{3 \times 2}{3 \times \cdot 03} = \frac{6}{\cdot 09} = 66{\cdot}6$ ampères. Through a resistance of 1 ohm, the current would be 5·5 ampères only at the moment of closing the circuit. The E.M.F. falls, the internal resistance rises, and the current falls as soon as current begins to pass. As the E.M.F. of the three elements under favourable conditions in a solution of 1 sulphuric acid to 12 of water is only ·57 volt, we must employ plates of sufficient size, and put them near enough together to pull down the internal resistance to ·5 ohm, if we wish to get a current of 1 ampere from the battery.—G. E. B.

**Drain Work.**—W. B. & Co. (*Hammersmith*).—You will probably find a suitable book in the following list:—"Handbook on House Sanitation," by E. F. Bailey Denton, price 4s.; "Sanitary Engineering," by J. Bailey Denton, price 25s.; "Sanitary Engineering," by Baldwin Latham, 21s., published by B. T. Batsford, 52, High Holborn; "The Sanitary Drainage of Houses and Towns," G. E. Waring, price 10s. 6d.; "House Sanitation," by G. W. Stanger, price 1s.; "House Drainage and Sanitary Plumbing," by W. Paul Gerhard, price 2s.; "How to Drain a House," by G. E. Waring, price 6s., published by Spon, 125, Strand. As you live in London, you could see them, and decide which is most suitable for your requirements before purchasing.—M.

**Electric Incandescent Lamps.**—J. M. (*Halifax*).—Electric incandescent lamps of 10 candle-power, or of any candle-power, have no chimney of any kind, nor any wick, flat, round, or otherwise, as in paraffin lamps. They are simply little globes of glass, made quite air-tight, with a thread or wire of carbon sealed in each globe. When the electric current goes through this wire it gets white hot, like iron at a welding heat, and this gives out the light. The wire does not burn away. You must have a battery or a machine, as well as a lamp. Read my articles on "Model Electric Lights" in Vol. II. of WORK.—G. E. B.

**Accumulator.**—E. G. (*Erdington*).—I do not know a 6 c.p. lamp. The Edison-Swan lamps are made of 5 and 8 c.p., but nothing between. The 8-volt 5 c.p. lamps take about 3 ampères of current, and the 16-volt 8 c.p. lamps take about 2·7 ampères of current to light them. They would thus need an accumulator having a capacity of from fifteen to eighteen ampère hours to light the lamps up from five to six hours. You would find a four-celled V type E.P.S. accumulator enough for the 5 c.p. lamp, and an eight-celled V type E.P.S. accumulator suitable to the 8 c.p. lamp. There are three plates in each cell, and four or eight cells respectively in each box. The external dimensions of the boxes are given at 6 and 7 in the table on page 791, Vol. II. of WORK, but the number of plates differ. Instructions are also given there for making and charging accumulators.—G. E. B.

**Measuring Glass.**—J. J. F. (*Shaftesbury*).—The following apparatus are required to estimate the hardness of water by Dr. Clark's method:—Mohr's burette with pinchcock, 25 c.c., in 250 divisions, 2s. 6d.; stand for ditto, 1s. 9d.; 70 c.c. pipette, to measure out the water, 11d.; 1,000 c.c. flask, with mark on neck, 1s. 6d.; and a stoppered bottle to hold 7 or 8 ozs., 4d. For alcohol, get ½ pint methylated spirits (3d.), and dilute it by putting 350 c.c. (measured out by taking 70 c.c. five times) into the 1,000 c.c. flask, filling the flask up to the mark with distilled water, and shaking well. If your chemist has not these things, he will get them for you, and you might ask him to show you how to use them. There is no need to convert the quantities given into English measures, as the apparatus are sold as above. 1,000 c.c. flasks often have "1 litre" ground on them; 1 litre is 1,000 c.c. Get "Wanklyn's Water Analysis," published by Trübner & Co., Ludgate Hill, for 5s.: it is written so plainly that you will understand it.—F. B. C.

**Ship Model.**—R. 'J. (*Rawtenstall*).—You had better get someone in the neighbourhood to furnish you with the design you require of a ship stationed, as you say, at Leith.

**Fire Smoking.**—H.S. (*Milnsbridge*).—If you refer back to the answer to F. W. B., on page 46, No. 55, Vol. II., you will there see some of the difficulties in dealing with smoky chimneys pointed out. In that instance there was some doubt as to why the smoking occurred, but in your case it is pretty plain. For example, in the first place, it leaves off smoking when you open the sash, which clearly shows that the fire is not sufficiently supplied with fresh air: the remedy for this you will find explained in the answer spoken of above. If this was the only defect, the matter would be simple enough; but when you say it also smokes when the fire in this particular room is *not* alight, and other fires (or fire) are, the matter at once becomes complicated. This may arise from a variety of causes, a few of which are:—Firstly, if the "withs" or partitions between the flues have been improperly built, and holes or cracks left in them, the smoke from the flue in use may penetrate the one complained of, and from that enter the room in which the fire is not burning. This in particular might be noticed if the doors communicating between the two rooms are left open so that the fire could draw air down the unused flue, and with it smoke. This very often occurs, although there are passages and staircase between them, providing there is no fresh air inlet along the route. Secondly, if the two fireplaces communicate in one flue. Thirdly, if the top of the chimney pot of the smoky chimney is below the level (or even level) of those next or near it, the smoke will sometimes be drawn or driven down, especially if there is not a good up-draught, and by your showing there is certainly not. Now for the remedy. If from my suggestions you fancy the first or second is the cause, it is a very difficult and expensive matter, especially the latter, and a simple way to obviate it is to see that the register of your stove fits close, and close it when you do not require a fire. If you have no register, fit a piece of zinc or other material in the opening. The great objection to this plan is that it robs you of the ventilation you get from your chimney, but that can be got over in a variety of ways. If you think the third suggestion is the cause, put a lengthening piece to the chimney pot, or, better still, a cowl. I think, from what you say, that by putting a cowl on the top of your flue, and supplying it with fresh air at the bottom, you will get over the difficulty. I can give you no idea as to the cost; but if you show this to any good tradesman, he will at once tell you about what it would be. The cost of these little jobs vary so much with circumstances.—E. D.

**Harmonium Reeds.**—A. P. (*Renfrew*).—Harmonium and organ reeds are similar in construction; they consist of a plate of metal (zinc) with a slot in the middle, over which a tongue of brass or steel is rivetod in such a manner that it can vibrate easily with a pressure of air applied to it. In harmoniums the wind is *forced* through the reeds, and in American organs it is *sucked* through. The difference in pitch is obtained by varying length and thickness. No one would make either organ or harmonium reeds themselves when they can be bought at such very low prices as at present. It would be a needless waste of time and trouble, and very questionable if the results would be equal to those bought ready made. The voicing and tuning of course are different, and might well be attempted and accomplished by an amateur.—R. A.

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—L. P. B. (*Kew Gardens*); A. F. E. (*London, S.E.*); R. W. A. (*Gray's Inn, W.C.*); H. J. H. (*Hackney, E.*); ONE IN TROUBLE; A NEW READER; W. H. R. (*London, E.*); F. W. S. (*Heathfield*); FAITHFUL READER; R. C. (*Tipton*); AMATEUR; A. B. (*Manchester*); A. J. H. (*Manchester*); C. B.; T. M. (*Southampton*); L. L. H. (*Falmouth*); R. A. (*Sheerness*); IMPORTANT; W. R. (*Manchester*); P. F. (*India*); NAP; J. W. (*Blackpool*); G. H. (*Bacup*; M. W. C. (*Newnham*); J. C. (*Cheadle*); C. P. (*Manchester*); J. D. (*London, E.C.*); SOMERSET; SLEEPY; UT SPES NOX FRACTA; F. C. (*Londonderry*); RICHARD III.; F. B. H. (*Wolverhampton*); M. H. (*Dorset*); P. L. H.; J. H. M. (*Bean Parc*); F. H. (*Birmingham*); PIP; E. J. S. (*Maidstone*); BRAMAH; J. R. B. (*Sheffield*); BRASS WORK; J. J. A. (*Wandsworth*); BARFF; W. A. (*Maidenhead*); J. S.; POLYITE JOINER; W. H. R. (*St. John's Wood*); PUZZLED; STAND STILL; WEEKLY READER; SIDEBOARDS; IRONMONGER; WHEELBARROW; HARD-UP; VERGE; R. B. (*Edinburgh*); F. W. W. (*Sheffield*); G. P. (*Elgin, N.B.*); J. R. T. (*Perth*); B. N. (*North Seaton*); A. H. (*Bolton*); LEARNER; W. B. E. (*Walsall*); W. W. C. (*Kelso*); F. K. (*Oldham*); SUBSCRIBER (*South Africa*); GILDER; T. T. (*York*); BYKER; M. M. (*Liverpool*); P. P. & Co. (*Manchester*); F. V.; H. J. (*Bradford*); T. W (*Sleekburn*); T. P. S.; H. B. S. (*Liverpool*); J. G. L. (*Aberdare*); W. D. (*London, W.*); F. E. H. (*Lancaster*); J. J. B. (*Twickenham*); HOLLY-READER; CANOP; A. W. T. (*Willesden Junction*); SILK BANNER; W. H. (*Prince Edward Island*); X. Y. Z.; J. H. F.; T. A. G. (*Stratford*); R. B. (*Durham*); F. S. S. (*Leicester*); J. B. (*Wallington*); S. A. W. (*Liscard*); H. H. L. (*Cheshire*); J. B. (*Lancashire*); A. H. (*Oldham*); S. W. R. (*Brixton, S.W.*).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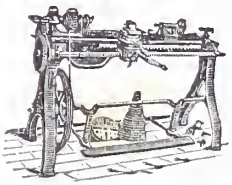

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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### SOME ODDS AND ENDS MADE DECORATIVE FOR GARDEN PURPOSES.

BY ARTHUR YORKE.

TUBS AND BOXES FOR PLANTS — UTILISING A PARAFFIN CASK—A LARD PAIL—A RAISIN BOX—A SOAP BOX.

THERE is to the properly constituted mind a pleasure in finding a use for things otherwise useless, and in rendering ornamental things otherwise unsightly. I have a few "wrinkles" to offer to those who have a turn for rough outdoor carpentry, which may, perhaps, help them to this state of virtuous satisfaction, and enable them to provide decorative receptacles for plants at a nominal cost. Possibly it may appear to some that more explanation as regards material and methods of working may be desirable; and if so, I must refer such readers to my former articles on "Rustic Carpentry," at p. 247, Vol. I., and succeeding numbers.

*A Paraffin Cask.*—Among the objects suited to our purpose—objects which we shall require to be practically good as new, but to be less costly than the materials of which they are made—the paraffin cask may be mentioned. An ordinary forty gallon cask, standing roughly some 3 ft. high, having a diameter of some 2 ft., and made of good stout oak, costs usually 2s. 6d. I have bought such casks for less money. Sawn through the middle, the paraffin barrel makes two admirable tubs for our work. One such half is shown in Fig. 1. This it is proposed to render suitable for some large bushy plant, so it will have to be mounted on legs. The legs shown are simply so many pieces cut from rough branches. From a heap of stuff one can generally choose pieces sufficiently adapted to the purpose, though their exact contours will, of course, vary. Oak branches, technically known as "bangles," from which the bark has been taken to make tan, will do well; or if the bark is liked, apple-tree or elm boughs will be suitable. That these sticks should be rough, and gnarled, and knotted adds to their effect.

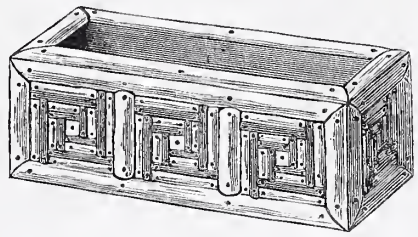


Fig. 4.—Window Box made from Raisin Box.

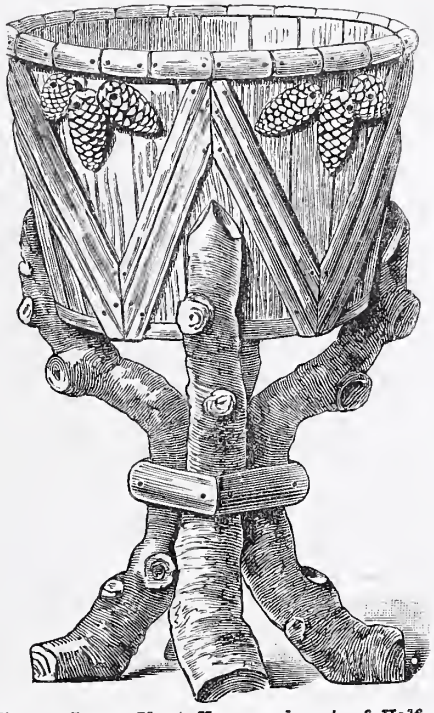


Fig. 1.—Large Plant Vase made out of Half a Paraffin Cask.

But as the tub will be only partly covered with rustic mosaic work, it will be well before nailing anything upon it to paint it. A good dark brown or chocolate will go well with the natural bark; and, after painting, we can fix on our decoration of split rods. These will have to be cut through with the saw, the lengths being too great to be safely split with the hatchet—that is, with the exception of those round the lip, which are of thicker rod than the zig-zags; say, 1½ in. as compared with 1 in. In the zig-zags the light central strip is supposed to be of peeled withy, the darker ones on each side having the bark on, and being probably of hazel. Generally speaking, wrought brads are to be recommended for fixing rustic mosaic, but where, as in the present case, the strips have to be bent over a curved surface, small wire nails will be found more secure. Groups of fir cones, as shown, will prettily ornament the triangular spaces.

Fig. 2 gives the other half of the cask arranged for, say, a dwarf shrub, an orange-tree, or the like. In small town or suburban premises, such tubs are specially useful where there is a back court into which anything green cannot otherwise be introduced. In this, it will be seen that by way of variety the tops of the staves have been sawn to a zig-zag line, which is followed a little below by a moulding of split rods. Half-way between this and the bottom a band of mosaic is arranged in light and dark strips—withy, that is—and hazel. The bits filling the diamond-shaped centres of this pattern are cut from thicker stuff than the rest, that they may project as

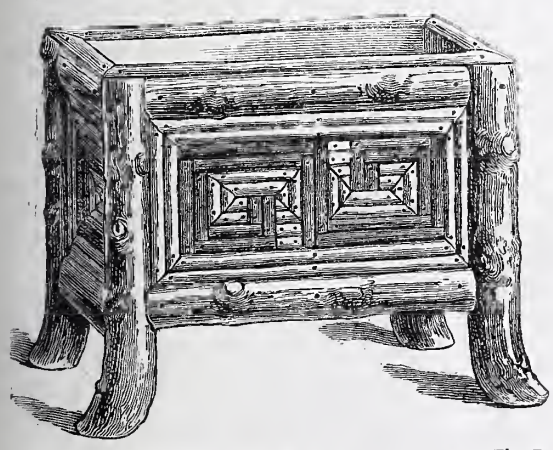


Fig. 3.—Large Garden Plant Stand made from a Soap Box or any other Strong Box.

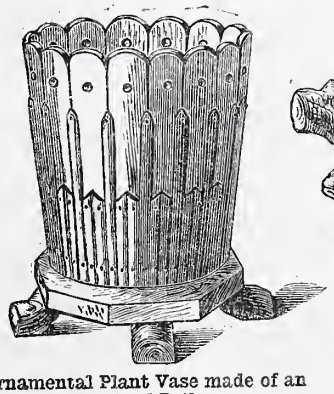


Fig. 5.—Ornamental Plant Vase made of an American Lard Pail.

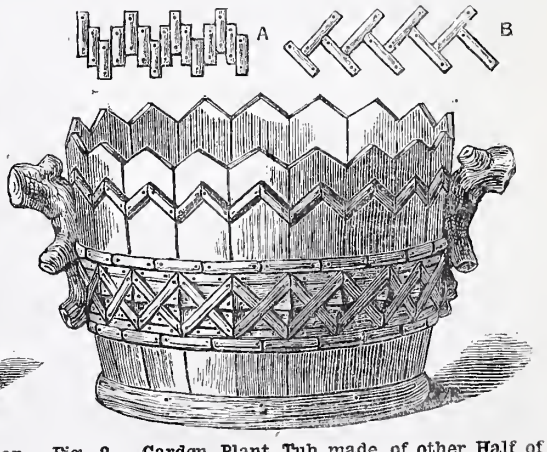



Fig. 2.—Garden Plant Tub made of other Half of Paraffin Cask—A, B, Alternative Modes of Moulding.

bosses beyond the general level. Over the unavoidable iron hoop at bottom, from which place short strips would, if nailed, be often detached, a rough "dry-cask" wooden hoop has been fixed. At the sides two pieces of rough branch stuff have been placed to serve as handles, and to resist strain these should be secured from within by strong screws.

*A Lard Pail.*—Fig. 5 is intended for a somewhat low-growing flowering plant—say, a large bushy geranium. In its original character this was nothing more dignified than an American lard pail, value 9d. to 1s. As in the last tub, the staves have been sawn to a more ornamental outline; they have also been perforated.

On this the ornamental strips of split rod have been arranged in straight vertical lines, to avoid the difficulty of bending and keeping them in place if bent round so small a vessel. The bottom of the pail is screwed down to an octagonal slab of wood, to the under side of which four short bits of rough bough are nailed as feet. As neither this nor the last tub are wholly covered with mosaic, they should, of course, first be painted. The slab at bottom will look very well left rough, as shown, but if painted it will be improved by strips of split rod nailed round its edges.

*A Raisin Box.*—Nor are some of the boxes which we can get from the grocer badly suited to our purposes. Such boxes are not costly, and to buy and knock these up for rough uses is often more economical than buying new material. A box, being straight-sided, is more easily ornamented with rustic work than the curved sides of a tub, but we must take care that the boards are stout enough to hold the brads firmly. Fig. 4 is a raisin box. That before us is about 21 in. by 7 in. by 7 in.—dimensions which lend themselves well to decoration. Two or three of these ranged side by side are not bad for the window-ledge. This box will be seen to be wholly covered with mosaic of dark and light strips in panels. Strips are also nailed on the upper edges.

*A Soap Box.*—In Fig. 3 we have a larger box, probably, a soap box. This, besides being completely covered with rustic work, has been mounted on legs. The easiest way to fix one of these legs on is to saw the piece of stuff in half to a distance from top equal to the depth of the box, and then to cross-cut and remove one half. The corner of the box will be brought to the middle of the cross-cut, and the leg nailed on to the *side* of the box. The piece which has been sawn off will then be cut through (quartered), and the proper quarter replaced and nailed to the *end* of the box. Frets, such as those shown in these two examples, are patterns of a kind well adapted to be worked out in rustic mosaic.

## XYLONITE AS A MATERIAL FOR FRET-SAWYERS.

BY D. DENNING.

Ease of Working Xylonite—Plain Open Fret-work—Laying Patterns—Polishing—Glue and Cement—Making up—Overlays—Thick Inlays—Inlaying in Xylonite Veneers—Preparing the Sheets—Making up Inlays—Cleaning — Finishing — Mounting Transparent Xylonite.

In page 787, Vol. II. of Work (No. 101), is an article directing the attention of readers to the wonderful material known as Xylonite. In it mention is made of its use to fret- and marquetry-cutters, and as there is good reason to know that a very large number of readers of Work are interested either professionally or as amateurs in fretwork, no doubt a few practical suggestions on the use of xylonite for their special craft will be welcome. I have purposely not referred to our readers as marquetry-cutters, for the fact is this beautiful and artistic art is not practised to the extent it might be by amateurs who are proficient in manipulating the fret-saw. That many try inlaying with one or even two colours cannot be denied, but this kind of work is by no means on an equality with marquetry. One reason that may operate against the popularity of this art as a pastime not only for men, but for women, is probably due to the scanty information of a practical kind which has been published. Another, and the one which is more immediately connected with the subject of this paper, is the difficulty in working with the materials used. These, as is well known, are wood veneers, and those fret-sawyers or would-be marquetry-cutters know equally well that if they have tried to make inlays with them according to the instructions generally given in handbooks on the subject—viz., by gluing alternate sheets of paper and vencer—that they have signally failed. Even if the veneers, being brittle, have not broken while they are being sawn, they have done so when an attempt has been made to separate the various layers. I am far from saying that ordinary veneers cannot be used with success for inlays of two or three colours, but still they require tender handling, for there is no getting away from the fact that they are easily broken, and it is almost a matter of impossibility without considerable skill to manipulate small pieces, perhaps not $\frac{1}{16}$ in. wide, without breaking them. In any case, with the ordinary treadle machine, even with such a good one as the Britannia Company's No. 8, it is difficult to cut them without annoying fractures happening. This must be the case with any material which has a grain like wood or is brittle.

Now xylonite is free from these objections, or rather, I should say, from these properties, of wood. It therefore offers an excellent material for the amateur or occasional marquetry-cutter, as little beyond capacity to saw accurately and to a line is necessary. For similar reasons the inlayer using only two colours will find it an admirable material.

Before, however, proceeding to give any hints to these more advanced workers, the plain fret-cutter must not be forgotten or overlooked.

As stated in the article already alluded to, xylonite is to be had in a great variety of appearances, so that the fret-worker can take his choice as to colour, etc. In the actual working there is no practical difference between any of them. Malachite, ivory, amber, etc., etc., are all cut and manipulated with equal ease, so that the appearance of the material has nothing to do with its treatment.

On a No. 8 machine of the Britannia Company I have cut xylonite of the greatest thickness in which sheets are made—viz., 1 in.—with ease, so that any thickness may be considered workable. Of course, few will care to use it so thick as this for fretwork. Indeed, for this purpose a thickness of $\frac{1}{8}$ in. is probably the most suitable, as, owing to its value, only small things are likely to be made from it. When little things are made of fretwork, we all know how liable they are to get broken; but if made of thin xylonite, they are even more durable than if made of comparatively thick wood.

The material requires no special treatment in sawing, and is bored and worked in the usual way. It is, however, so soft that those who are accustomed to work in hard wood must be on their guard that their work does not "run away" with them, which simply means that xylonite must be treated with a light hand and fed gently to the saw. I am assuming that this is worked with a machine, but the same broad rules apply with a frame. Those who are accustomed to fret-sawing will understand me when I say that two sheets of, say, $\frac{1}{8}$ in. thick can be cut together as easily as one; in fact, I am not sure that I do not prefer to cut through a thickness of $\frac{1}{4}$ in., as this is more rigid. This thickness can easily be cut with a No. 1 blade, but there is no reason why a larger should not be used, as the material cuts so cleanly that even a No. 5 or No. 6 will leave smooth edges, without any rugged "burr," of which there can be none.

If edges want trimming at all afterwards to remove irregularities caused by faulty sawing, the ordinary small files may be used, but they are not necessary, as the blade of a penknife may be used with almost greater ease and advantage either to cut or to scrape.

Perhaps something should be said about laying the patterns on xylonite. I find the best way is to stick them on with ordinary flour paste—at least, this is as good an adhesive for the purpose as any, though I sometimes use glue. The paper remaining can easily be washed off without the trouble of rubbing with glass-paper, as water does not affect xylonite. A piece of fret can therefore be laid in some till the paper comes away without trouble.

As the sheets are not polished, nor yet perfectly smooth, when supplied, the frets must be finished off afterwards—first by smoothing, and then by polishing. To make the surface uniformly smooth, glass-paper of varying degrees of coarseness may be used, the finest, of course, being last. The polishing is best managed by means of a calico wheel or buff, with pumice powder and oil in the first place, and then finely powdered whiting with just enough oil to prevent the dust flying about. Unless a good deal of the surface has to be removed, it will be seen that the pumice powder renders the use of glass-paper or scraper unnecessary. It is not, however, every amateur who has a suitable wheel, and even if he has a lathe to which one might be attached, he may not care to run the risk of damaging it with the pumice. Those who cannot do their own polishing will be glad to know that the Xylonite Company will do what is necessary at a very moderate charge, and, from having experienced assistants at this kind of work, they certainly put a better finish on than could be managed by those who are inexperienced. I certainly recommend those who have made anything they value to send to the manufacturers, as the small cost incurred is neither here nor there when the improved appearance of the work is taken into account. Fretwork articles should be sent in pieces, and not made up.

Those who do not care to go to this trouble or expense may be glad to know that small pieces of xylonite may be polished fairly well by rubbing them on a piece of cloth stretched over a board instead of a calico wheel. The labour, however, is somewhat considerable, and the result not altogether satisfactory.

It will be noted that the polish is got by

friction only, and not by the application of a varnish of any kind. In connection with this, I may say that French polish should not be used on xylonite, the manufacturers of which make a special varnish which is sometimes used on common articles by themselves. They inform me, however, that they are willing to supply it in small quantities to myself and friends, who for present purposes may be regarded as including all readers of WORK. The varnish can be applied by anyone, and to forestall inquirers in "Shop" as to its ingredients and the way it is made, I may as well say that I cannot tell, for it is a trade secret which, in the interest of the manufacturers, it would be unfair to divulge. Readers who are acquainted with me know my opinion generally on "trade secrets," but to explain this one would be a breach of confidence; therefore nothing more need be said in excuse for my reticence in the present instance. Possibly some readers may be able to concoct or find some varnish suitable for the purpose; but if they take much trouble in doing so, they will be "penny wise, pound foolish."

When making up articles of fretwork, it will be well to note that though soft edges, etc., cannot easily be shot in the ordinary way with the plane, if this is very finely set they may be, but ordinarily it is easier to do what is necessary by filing or grinding. Another important matter that must not be overlooked is that glue is not suitable for joining pieces of xylonite. Possibly india-rubber cement might do, but the best adhesive is undoubtedly that used by the manufacturers themselves. It is a liquid, and is applied like ordinary glue, but care should be taken not to apply it too thickly if a neat joint is required, nor yet to let it get on any polished surface. It is made in two forms—opaque white for white material, and clear for others—and may best be described as a liquid xylonite. It will be supplied in small quantities to my "friends," and the remarks in connection with the varnish may be applied also to the cement. It seems to act rather by partially dissolving surfaces to which it is applied, and so causing union, than mere adhesion. On this point I cannot, however, be certain; but the stuff is most tenacious, whatever its precise action; it dries very quickly.

Overlays of fretwork are not very easily laid with glue alone; though, if only a slight hold on the wood is required, glue may answer, especially if aided by a few needle-points. Glue, however, is apt to flake off from xylonite, so that the adhesion cannot be depended on. A better way is to coat the back of the fret with the special cement and to touch the wood here and there with glue, and for this purpose I prefer Le Page's to the ordinary kind. A still better plan is to coat both the back of the fret and the surface of the wood with the cement, and then bring them together under pressure. The appearance of the wood is very little altered by the cement, which goes further if size has been previously used.

As $\frac{1}{4}$ in. can be cut easily, I have fastened two pieces together to make this thickness with small wire nails in the waste, a piece of thick paper being between the xylonite. This has been fretted in the usual way, so that the paper gives a perfect pattern. By sticking this afterwards on another piece of xylonite it has been used to cut the pieces for inlaying into the other. This is approaching very closely to the method of marquetry cutting, inasmuch as the pieces to be inlaid are cut separately, so that objectionable drill-holes are not observable, all points and corners being preserved in their integrity. When sticking the cut-through paper pattern, care must be taken that it is not stretched, as, if it were, the pieces, however accurately cut, could not fit properly without a good deal of filing and cutting. If the glue be applied to the xylonite, and the paper laid flat down on it, I have not found any difficulty from the paper stretching as would be the case were glue or paste to be rubbed on the paper. May I remind readers that the width of the saw kerf must be allowed for when cutting the inlay pieces, so that it would not do to saw within the paper on the bare material? The saw should cut through the paper just at the edge, so that none of it is on the inlay pieces. By this means the saw-cut or kerf is entirely in the waste, which in this case is the reverse to what it was in the original. Of course, to manage this plan, it is presupposed that the sawyer has considerable skill in cutting accurately to a line. For the beginner to attempt it would simply mean a waste of good material, and he had better adhere to the time-honoured plan of cutting both pieces through at once. By the plan advocated many little nicknacks in which both sides show, such as paper-knives, can be made in duplicate, not only so far as pattern is concerned, but also in colour of material, with the smallest possible amount of waste. With such inlays, it is not necessary to stick them on paper while inlaying. It is sufficient to touch the edges with the xylonite cement. As it may happen that the two materials, say ivory and tortoiseshell—of course, I refer to the imitations of the substances—which have been combined as an inlaid piece of work are not of exactly the same thickness, the surface must be made level. This may be done with glass-paper, but it is a tedious job, and I have found nothing better for the purpose than an ordinary cabinet-maker's scraper, well sharpened. If it is blunt, it is bad enough on wood, but on xylonite it is worse.

For ordinary inlaying in only thin stuff which has to be mounted on a backing of solid wood, xylonite of about $\frac{1}{25}$th in. does as well as anything. By the way, I may here state that this thickness would be expressed by the manufacturers as $\frac{4}{100}$ths of an inch, as they have in this respect adopted the decimal system, with the inch as the standard unit.

This thin or veneer xylonite may be cut in the manner common to marquetry-cutters, or it may be simply cut through several sheets at a time, after the plan usually practised by amateurs. In either case, the great advantage xylonite has over wood is that the finest fret can be done in it without danger of breaking. I am now engaged on an elaborate piece of work, consisting of tortoiseshell and ivory alternately, and, as a description of my plan may be useful, here it is. I have no "trade secrets," and my methods are at the disposal of all readers of WORK. If they can find better, perhaps they will be good enough to send on explanations to the Editor. I am using the thin material mentioned above, with a No. 8 Britannia machine and No. 1 saws of the ordinary kind. Five thicknesses are cut through at a time, so that for each set of panels prepared there are two of tortoiseshell inlaid with ivory, and two "counters" of ivory inlaid with tortoiseshell. The fifth sheet is waste, unless I afterwards use it as an overlay. It should perhaps be mentioned that for the article in question I require two panels of each pattern, otherwise only three sheets would be cut through at a time.

The panels having straight edges are cut from the large sheet of xylonite, by scoring it with the point of a penknife, guided by a straight-edge. When partly cut through, the stuff can be split at the cut. By this means the trouble of sawing is avoided, and straight, clean-edged pieces are got at once. The sheets are then glued together alternately, the top and bottom one being of the same material, which, in this instance, is ivory. Between each two is a sheet of paper, as I find they hold better than when glued directly to each other, and the paper allows the small pieces to be separated more easily than they otherwise would be when they are to be inlaid. The glue is put all over, and not merely in patches, so that when the sheets have been kept together by pressure till the glue is dry, which takes some time, they form a good solid block which is very pleasant to cut. In sawing, the "tilting table" is made use of to a slight extent, and though many parts of the pattern are little, if any, more than $\frac{1}{16}$th in. wide, while some are less, I have not had a single mishap in the way of the material breaking or tearing with about a dozen panels, each containing from fifty to seventy holes. This could not be said if ordinary wood veneers had been used, for if some of them had not been broken while sawing, they certainly would at some subsequent part of the process, such as when separating the sheets. This I do by putting the block in water till the sheets come apart, or by inserting the blade of a knife between them, and afterwards washing the paper off.

They are then ready for inlaying. The little pieces, of course, are all in their proper order and in blocks of five thicknesses just as they were sawn out. On a sheet of paper in front of me are the four frets, the top one having been discarded by now, as it has served its purpose, which is merely to allow of the small pieces to be let into the sheet next in order being cut from it. As each block of the small inlay pieces is taken up, the corresponding opening for it has some glue daubed down in it, and each small piece, easily separated from the others either with the thumb-nail or a penknife blade, is pressed down in its place. A quantity of glue oozes out, and by the time the inlays are done the sheets present anything but an inviting appearance. This, however, is of no consequence, and the next thing to be done is to clean off all the glue and waste paper. This is managed by putting the sheets on a smooth, flat surface, with the papered sides downwards, and then washing them with a rag or nail-brush. This, of course, not only removes the glue, etc., from the surface, but also from between the pieces, and some care must be exercised not to wash away small pieces. If any do get accidentally displaced, they are easily put back. Although thoroughly wet, the inlaid panel with the paper under it can easily be raised and turned over without injury, when the other side can be washed in the same manner. Superfluous moisture is now removed, and a sheet of glued paper is stuck down on the panel. It can now be handled with impunity, and be laid aside to dry to be mounted on solid wood. This is done in the usual way, the only slight differences with xylonite being that it is not necessary to go over it with the toothed plane. It is stuck down with the cement or solution already referred to applied to the inlay, and ordinary glue to the wood. To ensure perfect contact, the sheets of

xylonite should be laid with a caul. After adhesion is perfect, the paper may be removed with a damp rag, but, to prevent the glue being injured, the quantity of water should not be so great as before. After this has been done, the inlay can be finished off by polishing, with perhaps a preliminary touch or two with the scraper to level it thoroughly. If any small bits get accidentally lost, as they sometimes will, the ordinary stopping of resin and wax does admirably for deficiencies in the tortoiseshell, while plaster of Paris or whiting answers the same purpose for the ivory.

The reason why it is recommended that the sheets should be stuck together all over while being sawn, and not merely fastened here and there, is that the burr caused by the drill on the under surface of each is objectionable, and, altogether, loose sheets are not so pleasant to cut as when they form a solid block.

By adopting the simple means described, any tolerably skilful fret-cutter may aspire to make things of greater beauty and artistic value than he has probably had any idea of when working in wood alone.

It may be a useful hint to the inlayer or marquetry-cutter using xylonite that the beauty of tortoiseshell, amber, and other transparent or semi-transparent substances, is partly lost unless they are laid on white background. As it is not always convenient nor suitable to the article to mount them on white wood, the desired result may be obtained by having a piece of white paper between the ground and the inlaid sheet of xylonite, which, of course, has thus a white backing given to it.

I trust these remarks may have not only the effect of inducing fret- and marquetry-cutters to try a charming material which seems specially adapted to their requirements, but also of enabling them to use it with some degree of certainty, instead of having to find out the best treatment by experiment. That the subject is exhausted I do not pretend, but the points on which the amateur or professional worker is likely to require information have, I think, all been attended to. If anything essential has been omitted, I shall be happy to answer inquiries in "Shop"; but please do not ask me to explain how you can make your own xylonite at home, for it cannot be done.

## A FOLDING PLATE DRAINING RACK FOR PHOTOGRAPHERS.

BY CHARLES A. PARKER.

SIZE OF PLATE DRAINING RACK — PREPARATION OF THE LEGS—CUTTING THE REBATES TO TAKE BARS AND STAYS—CROSS BARS—PUTTING TOGETHER TWO HALVES OF RACK—HINGEING RACK TOGETHER—CUTTING AND ATTACHING V-SHAPED GROOVING TO COMPLETED RACK.

AN amateur who has attained some little proficiency in the art of wood-working, and can manage to put together simple framing, generally experiences a desire to lessen the cost of his photographic requisites by constructing some of the less important items himself, as there are many articles that constitute the paraphernalia of a photographer that are not only expensive when their simplicity of construction is taken into consideration, but which come well within the scope of the amateur workman, without involving such manual labour as would be apt to lead to failure. A folding plate rack, which is shown in Fig. 1, is an indispensable dark room accessory that can readily be made by any amateur woodworker in a very short space of time. The size described below is such as is usually employed for 3¼ by 4¼ in. or 5 in. by 4 in. plates, but it may best be said that a rack suitable for half or whole plate negatives can be constructed by simply adding a couple of inches to the length of the legs below described. From an ½ in. board—preferably a piece of straight-grained yellow pine—cut off four narrow strips ¾ in. wide and 7 in. long, with one end of each strip sawn off to an angle of 45°, this latter being done on a mitre-cutting board. The other end of each strip will now require to be rebated, as shown in Fig. 2, the length of the rebate being 1¼ in., and the depth ¼ in. The simplest method of cutting this rebate is to make a saw cut, ¼ in. deep, at the above distance from the end, as shown at A to B, Fig. 3, and another from C to B, which will thus remove the requisite amount of wood. These pieces, which are intended to form the legs, may then be placed aside while a couple of cross bars are being prepared to fit across the rebated portions of the legs for the purpose of uniting them. These may be cut from a strip of ¼ in. board 1½ in. wide, one of them being 9 in. and the other 10 in. in length. When ready, take two of the legs first prepared, and glue one of them at each end of the 10 in. strip, using a couple of ½ in. brass screws to each leg, and after these have been fixed in position, glue and screw a thin strip of wood, ½ in. wide, across from side to side, in the position shown in Fig. 4, placing this stay at 4⅜ in. from the upper end of the limb. The other cross piece and the two remaining legs are then screwed together in a similar manner, except that this limb will not require a stay to be placed across, as in the case of the other. The two limbs are now placed together in the position they are intended to occupy when the rack is closed; after which they are hinged in the middle by driving a ¾ in. round-headed brass screw through the side of each outer limb, at a distance of 4 in. from the top of the rack, as will be understood by reference to Fig. 5, which represents the rack when closed. Upon opening the rack, it will be found that the strip of wood placed across the lower portion of the outer limb forms a stay which prevents it from being opened too wide, and likewise renders it rigid when in use. When the rack has been fitted together in the manner above described, the upper portion of each limb must be furnished with the grooves to hold the plates. Suitable grooving wood can be purchased from most photographic dealers at 10d. per foot for 11 in. wide. Should any difficulty be experienced in obtaining the grooving, it will be found an easy matter for the reader to cut sufficient for this rack. In short, the reader is strongly advised to adopt this course, as the grooving supplied by the dealers being specially intended for plate boxes, is therefore scarcely suitable for our purpose, owing to the grooves being formed thus: U, instead of the V shape recommended; consequently, a freshly-developed negative in careless hands would stand a good chance of getting the thin edges torn or damaged. Take a piece of ⅞ in. board 8 in. wide, and saw off a couple of 1¼ in. strips across the grain, afterwards gluing these into the upper portions of each limb of the rack; and when the glue has set, proceed to cut a series of twenty-four V-shaped grooves by means of a sharp 1½ in. chisel, a saw, or a knife, having previously marked out the exact position of each groove on the edge of the wood, so that they may exactly correspond. The grooves for the inner limb of the rack occupy the full length of the space, which is 8 in.; but for the outer limb, which measures an inch more in length, there will be ½ in. plain space at each end before the grooves commence, as is clearly shown in Figs. 1, 4, and 6. When the grooving has been provided, the rack will be finished, thus completing a very useful article on which to place negatives out of harm's reach after the operations of washing or varnishing.

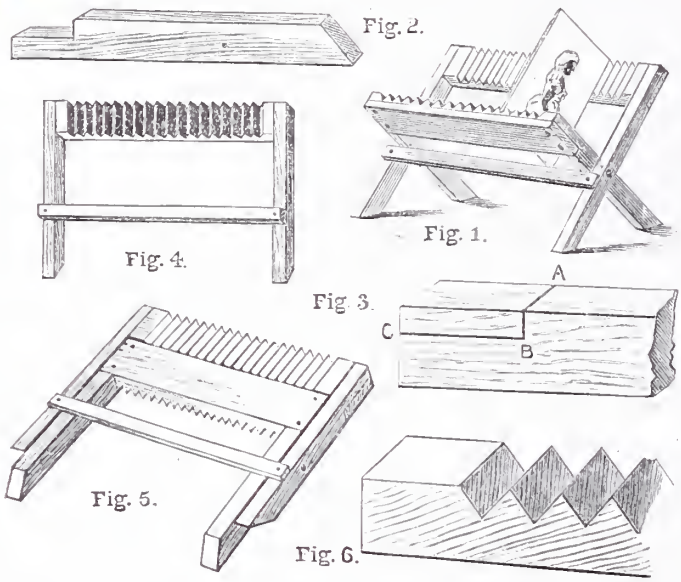



Fig. 1.—Folding Plate Draining Rack complete. Fig. 2.—Leg of Rack rebated. Fig. 3.—Mode of cutting Rebate. Fig. 4.—Grooved Strip at top of Side. Fig. 5.—Rack when folded. Fig. 6.—Mode of grooving Strips.

## THE ACCURATE DRAWING OF SCREWS.

BY P. B. H.

HOW TO DRAW A SINGLE V-THREADED SCREW, A DOUBLE V-THREADED SCREW, A SINGLE SQUARE-THREADED SCREW, A DOUBLE SQUARE-THREADED SCREW, A DOUBLE SQUARE-THREADED NUT (IN SECTION).

IN WORK, No. 109, I finished by showing how a spiral line was drawn round a cylinder, and with a promise to show how the threads of a screw are drawn accurately.

As a first example, Fig. 14 shows the ordinary single V-threaded screw, 1½ in. diameter. Now, if we turn to a table of Whitworth threads, we find that a screw of the above diameter has six threads to the inch—that is to say, the pitch, or the distance between two threads, will be ⅙th of an inch.

Draw a horizontal line, A B, as a base from which to commence. On this line, slightly to one side (the left hand preferably) of where the screw is to be drawn, set up a vertical line 1½ in. long (this height

depends altogether on the length of bolt to be drawn), and, commencing below, set off distances on it equal to the pitch—that is, $\frac{1}{8}$th of an inch, which will exactly divide the line into nine equal parts. Subdivide these divisions into $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{8}$, as shown, making a small vertical scale. The number of divisions the pitch is divided into is not arbitrary, but always let them be even in number. For this pitch of screw, eight divisions are ample, more being scarcely distinguishable. Number the pitch divisions on the scale 1, 2, 3, etc., as shown.

Now, a short distance to the right of scale, and following instructions given in describing Fig. 3 (p. 70), design the outlines of a V-thread $\frac{1}{8}$th of an inch pitch, commencing with the exterior angle (*c*) of the thread on the line A B. Of course the points *d*, *f*, etc., can be projected by the T-square from the scale. Having done this, from the line *a a*, passing through the extreme rounded portion of the thread, set off $1\frac{1}{2}$ in. to the right. This will be the diameter of the bolt. Construct here the outlines of the V-thread similar to the one on the left; but care must be taken that the exterior angles do not come *opposite* those on the left side, but *midway* between them. This can be easily done by projecting lines across from the $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, etc., divisions of the scale on to the line $a^2$ $a^2$—these will give the vertical position of the angle points of the threads. The reason is, that in single-threaded screws, in winding once round the body, the V rises from *c* to *e*, therefore, when it gets half-way round (that is, to *d*), it will have risen half the distance *c e*—that is, one-half the pitch.

Having drawn the outlines of the thread on both sides, it is now necessary to obtain the path of the line joining them. To do this, we must proceed almost in the same manner as we did in Fig. 1. Below A B draw two concentric semicircles centrally below the bolt, one being the same diameter as the bolt, the other as the bolt at the bottom of the threads. Divide these into four equal parts—the divisions of the outer circle being numbered *a*, $a^1$, $a^2$, etc.; those of the inner one, *b*, $b^1$, $b^2$, etc. From all these points set up perpendiculars, *a a*, $a^1$ $a^1$, *b b*, $b^1$ $b^1$, etc. As all the lines, *c d*, *e f*, *h i*, *k l*, etc., follow one and the same curve, I have shown the construction lines for *k l* only. I have done this to prevent confusion, as in the lower part of the figure I show the path of the spiral, which is unseen. To proceed, then: the point *k* is

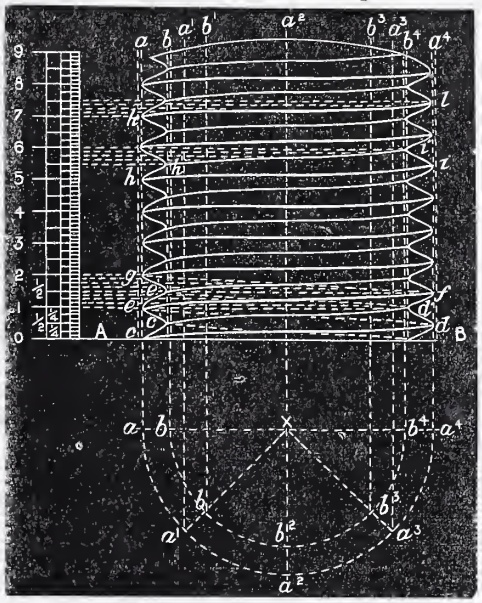


Fig. 14.—Single-Thread V-Screw ($1\frac{1}{2}$ in. diam.).

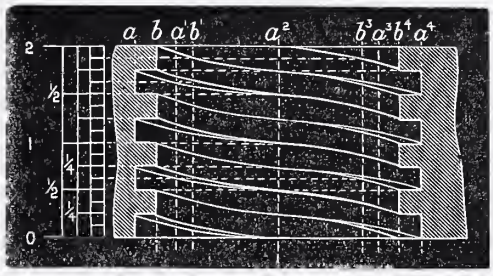


Fig. 18.—Nut for Double Square Thread Screw.

$a^2$ $a^2$, will give another; and from $7\frac{3}{8}$, cutting $a^3$ $a^3$, will be another. A line drawn by hand from *k* to *l* through these points will give the path of the thread at the circumference of the screw. The same method can be followed for the bottom of the thread, $h^1$ $i^1$, but in this case the horizontal lines from the pitch must cut the vertical lines drawn from the points of division on the smaller semicircle, which is equal to the diameter of the bolt at the bottom of the thread—that is, wherever the horizontal lines from 6, $5\frac{7}{8}$, $5\frac{3}{4}$, $5\frac{5}{8}$, and $5\frac{1}{2}$ cut the vertical lines $b^4$ $b^4$, $b^3$ $b^3$, $b^2$ $a^2$, $b^1$ $b^1$, *b b*; these are the points through which the spiral line must be drawn from $h^1$ to $i^1$.

I also show the construction lines for obtaining the spirals as they wind behind the screw from *f* to *g* and $d^1$ to $e^1$ respectively. I shall not describe these; I shall presume that my readers will be able to understand them with a little thought.

Fig. 15 shows a double-threaded V-screw, to draw which we proceed as in Fig. 14. A scale similar to that one will be found convenient, but as a second thread now winds round between the first, the pitch of the thread must be doubled to allow of this, and as each thread will now rise double what it did at first while travelling the same distance, the pitch must be doubled too. Therefore, draw the pitch on the scale equal to $\frac{1}{4}$ of an inch, and divide it into eight equal parts as before. Now, though we have doubled the pitch, we must still keep the size of the thread the same as in the preceding figure; we must not design it again from the increased pitch, according to Fig. 3 (p. 69). Draw the left-hand side of the screw exactly the same as in Fig. 14, commencing with the angle of the thread, *c*, on the line A B. Now, as there are two threads, one will always be half the pitch in advance of the other—or, we will say, half a revolution; therefore, the point *l* will represent the commencement of the second thread, being half the circumference from *e*. It will thus be seen that, contrary to the preceding Fig. 14, the exterior angles of the threads come exactly *opposite* each other in this case, and not *midway*, as in the last case. Having drawn all the outlines of the threads, draw all the construction lines and semicircles as before, lettering them the

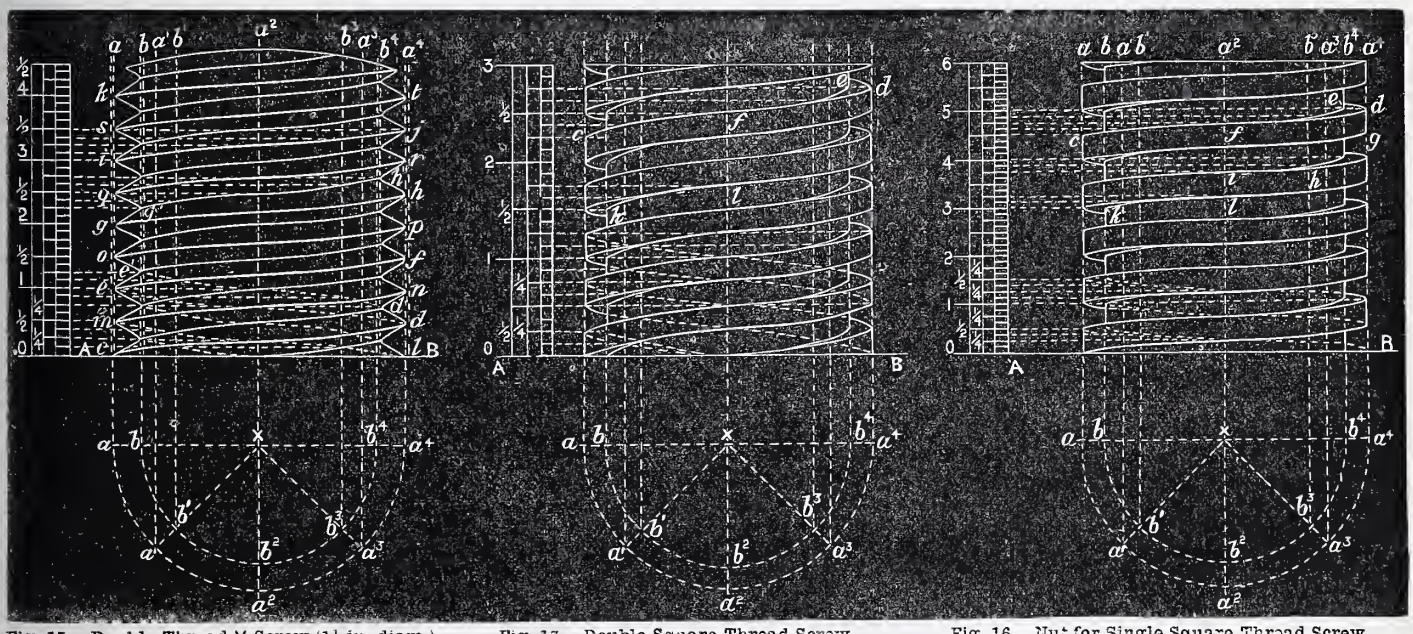


Fig. 15.—Double-Thread V-Screw ($1\frac{1}{2}$ in. diam.).

Fig. 17.—Double Square Thread Screw.

Fig. 16.—Nut for Single Square Thread Screw.

opposite 7 on the scale; the point *l*, half the circumference of bolt, is opposite $7\frac{1}{2}$, which is half the pitch. Draw dotted lines from those points to *k* and *l* respectively. A line from $7\frac{1}{4}$, cutting the line $a^1$ $a^1$, which is drawn from the point $a^1$, $\frac{1}{8}$ of the circumference of the bolt, will be a point in the curve wanted; a line from $7\frac{1}{4}$, cutting

same. I have marked the one thread commencing at *c* by the consecutive letters of the alphabet at the exterior angles, as—*c*, *d*, *e*, *f*, *g*, etc.; the other, commencing at *l*, as *l*, *m*, *n*, *o*, *p*, etc., so that the reader will not get confused. I have shown construction lines for obtaining the spirals, and I think no further explanation of Fig. 15 will be necessary.

I might here remark that, having once obtained by construction the spiral line, *k l*, the other similar lines might be drawn by the aid of a French curve, if a part thereof could be found to exactly coincide with the line. If a piece could not be found to coincide with the whole of the curve, there would be no difficulty in finding a part for the half of the spiral. In this case it would only be necessary to mark the point on the centre line, $a^2$ $a^2$, where the spirals cut it; when, after drawing the halves of the similar spirals down one side, turn the drawing round, and reproduce the others by the same piece of the curve, as they are the same, only reversed. This applies to the spiral, $h'$ $i'$, Fig. 14, and all the similar lines, as well as the spirals in Figs. 15, 16, 17, and 18. This, of course, reduces the labour vastly, and where time is short, it is a necessity to use this method. But for a beginner, I should advise drawing them all out by the construction lines for practice, and also to a bigger scale, with more divisions in the pitch and semicircle.

We now come to Fig. 16, which shows a single square-threaded screw of the same diameter as the preceding ones. Generally, the pitch of a square-threaded screw is double that of a V-thread of the same diameter. In this case I have, however, only taken it at ¼ of an inch, so that there will be more threads to draw, which will, I hope, be of some benefit to readers.

Set up the scale on A B, as usual, dividing the line into six equal parts, or ¼ of an inch each, equal to the pitch. Divide each of these again into eighths as before. Now, slightly to the right, set up two lines, *a a* and $a^1$ $a^1$, 1½ in. apart, which is the outside diameter of the bolt. If we now return to Fig. 4 (p. 69), we shall see that the depth of a square-threaded screw is $\frac{1}{40}$, or rather less than one-half the pitch. This, as stated, is ¼ of an inch, therefore, the half will be ⅛ of an inch: so now draw two vertical lines, *b b* and $b^1$ $b^1$, within the first two, and distant from them a shade less than ⅛ of an inch. These two lines will give us the body of the screw.

Draw two semicircles below the line A B—one equal to the outside diameter, the other to the body of the screw. Divide these as in the two preceding cases, and also the construction lines.

Now, as half the pitch is for the thread and half for the space, divide the lines *a a* and $a^1$ $a^1$, commencing on A B, into eighths of an inch. Take notice that on the left-hand side a thread is at the bottom, whilst on the right-hand there is a space; the reason has been explained in Fig. 14.

We will now proceed to draw the spiral line joining *c*, *d*, which points have already been obtained by projecting lines from 4½ and 5 on the scale, to cut the lines *a a* and $a^1$ $a^1$ respectively. The points where the lines from $4\frac{5}{8}$, $4\frac{3}{4}$, and $4\frac{7}{8}$ cut, the vertical lines, $a^1$ $a^1$, $a^2$ $a^2$, and $a^3$ $a^3$, will give the intermediate points through which the spiral line joining *c* and *d* must pass. This can be drawn by hand, and at *d*, and any other similar places where the spiral can be seen turning upward or downward, there should be a small curve—or, I might say, there should not be an angle. The line should follow round in a short curve.

It will be seen that as the thread is always vertical to the centre line of the screw, the point *e*, where the spiral winds round the body of the screw, will be exactly opposite *d*—that is to say, where the line drawn from 5 on the scale to *d* cuts $b^1$ $b^1$ will give the point E, and the spiral drawn from it will gradually merge into the spiral *c d*, till at *f* it appears as the same line. To show this more clearly, take the lower thread; draw a line from 4 till it cuts $b^1$ $b^1$: this gives the point *g*; draw also from $3\frac{7}{8}$ to cut $b^3$ $b^3$, which it does in *h*; the line from $3\frac{3}{4}$ cuts $a^2$ $a^2$ in *i*—this latter point is the same as for the exterior spiral as well. This can now be drawn by hand. Now draw *k l* in the same manner as *g i*. Either in this way, or by means of a French curve, all the spirals can be drawn. I have shown the construction lines for the different spirals running at the back of the screw. No description will be necessary, I think.

Fig. 17 shows a double square-threaded screw of the same diameter as the last, the size of the thread being the same. The only difficulty is that the pitch is now double, and that a second thread now runs between the first one. The pitch, as will be seen, is from the bottom of one thread to the bottom of the next but one. I have shown the construction lines for each different curve, and lettered them as before, so I shall leave the reader to make it out for himself: which I think he will be well able to do by a careful study of the two preceding figures.

Fig. 18 shows the *section* of a nut to work on the screw, Fig. 17. This will, no doubt, strike the reader at first sight as looking rather peculiar: the threads here rising from the right to the left hand, instead of from the left to the right, as in the bolt; and this gives a deceptive appearance to it, and leads us to believe that it has been drawn wrong. The reason is that the nut being in section, the threads in it really fit the dotted threads, or those at the back of the bolt. These threads are drawn with the same pitch and construction lines as the last figure—in fact, with the exception of a new scale, the same construction lines produced serve for the nut as well as bolt.

Being double-threaded, the pitch is greater than in Fig. 16, so that the lines for obtaining the spirals corresponding to *e f*, *g i*, and *k l* in that figure come out more distinctly both in the nut and bolt. Another peculiarity is that in the nut the longer spirals now vanish behind, or merge into the shorter ones. I shall again draw the construction lines for the spirals, and leave them to explain themselves by the aid of a small amount of thought.

I may here state that a V-threaded nut will be obtained by the use of the same principles. From these last five figures, if well grasped, there will be no difficulty in fixing the points necessary for drawing the screws in Figs. 10, 11, 12, and 13 (p. 69).

I shall make no apology to my readers for the length of this paper, as I have intended it for beginners in machine drawing, who need a little more explanation than the more proficient ones; and I hope it will prove of some use to rising young mechanics.

It should, indeed, prove useful to all, whether workers in wood or workers in iron, to study papers of this kind, for the sake of the expositiou of theory contained therein, which, when duly comprehended, cannot fail to be helpful in actual practical work.

## TOY BALLOONS: HOW TO MAKE THEM.

BY T. S.

PREPARATION OF MODEL—CUTTING GORES—JOINING GORES—WIRE HOOP AND LOOP—SUSPENSION OF SPONGE CHARGED WITH SPIRIT—STARTING BALLOON.

I HAVE had considerable experience in the construction of fire balloons, but none in gas balloons, but with the instructions in Vol. II., page 762, there should be no difficulty in making gas balloons also.

Obtain twelve sheets of common tissue-paper, any colour; but I find that the sizes differ, and allowance should be made for this. Cut a sheet of plain paper the same size as the tissue, and commence by drawing a pattern or model. Draw a circle, as shown in Fig. 1, 12 in. in diameter; divide it vertically by a straight line, and at the lower end set off 2 in. each side, and join by curved lines to your taste. Divide the semicircle on one side of the model into any number of equal parts, as shown in Fig. 1, and

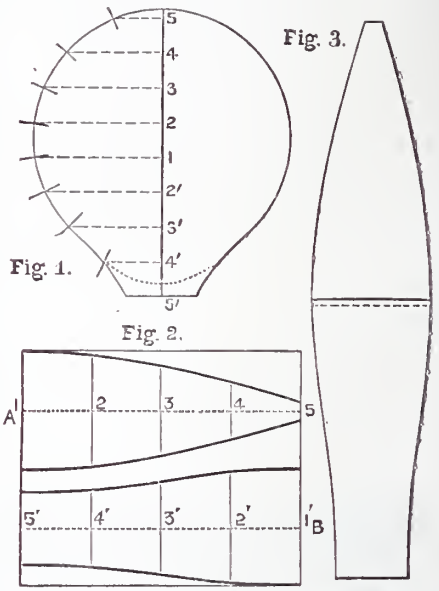



**Fig. 1.—Pattern or Model for Toy Balloon. Fig. 2.—Gore set out in Two Parts on Tissue Paper. Fig. 3.—Parts cut out and joined to form Gore.**

from each point of division draw horizontal lines or ordinates at right angles to the vertical line, and number them, as indicated in the diagram. Next take a sheet of plain paper, and draw a line 6 in. from each edge, shown in Fig. 2 by dotted lines, A, B. These will be the centre lines of each of twelve gores. Take the centre ordinate, No. 1, as an equator, and set the distance on each side of the dotted lines at A and B. Set off along A and B as many parts as there are ordinates, draw lines 1, 2, 3, etc., and set off the ordinates on each side as shown. Cut out at these points, and you will have a pattern gore in two pieces of the largest size that will cut out of a sheet of tissue paper, and will make a balloon 12 ft. round the equator, and about 4 ft. high. You will notice that the ordinates, 5 and 5′, should be set off on the edges of the paper, the larger one, 5′, being the mouth of the balloon, which should be about 16 in. diameter. The top, 5, is left, so as to make a hole in the finished balloon about 6 in. diameter, to be covered with a circular piece of paper when all the other joins are dry. Having cut out the pattern, lay it on the twelve sheets of paper, and carefully cut round through the lot with a strong sharp pair of

scissors. Some weights are to be placed on the paper to keep all in place while cutting, and the whole moved about so as to cut without any disturbing the paper.

To join the gores together, take them in pairs, and lay the upper one carefully smooth, and place the lower part on it, so that the under part projects ¼ in. beyond; then another upper part and another lower part, each ¼ in. lap, and so on, until all the twenty-four pieces are laid out. Be very careful that the centre lines are over each other, or the gore will not be straight. Now, after placing on some weights, paste gum or thin glue over all the ¼ in. laps, and at once turn over each on its proper part, and the twelve joints will be made. Dab down with a cloth to ensure a close joint, and before drying open out each, and let it dry open, hanging on a line. You will now have twelve well-shaped gores, as in Fig. 3, which, when dry, should be laid in pairs, and joined together as before, taking care what you do join. Having finished five joins on one side, turn over, and do six on the other. Open out as soon as possible, or the paste will make a double joint by soaking through the paper to the next sheet; and make the final joint in the same manner by folding back the inner sheets until the top and bottom sheets only are left. You will find some lead or other heavy weights very useful to keep all in place. Be careful to keep the equators opposite each other; never mind the top and bottom. When dry, open carefully out. Cut out a circular piece to close the top opening. Pass a circular flat tray or small work-table into the mouth of balloon (I have used a dinner plate), and after carefully spreading out, close the top opening.

Obtain some common iron wire, rather thicker than a common pin, measure the opening or mouth, and make a neat hoop same size, with neatly twisted join; pass it into the mouth, and turn up the edge over the wire ½ in.; paste, and dry. Take another piece of wire, about 1 in. or so longer than the diameter of mouth, form a loop in centre, and hook the looped wire on to the hoop at each side, of course selecting opposite gores to fix the hook to. This will carry the fire, which should be a piece of sponge of the size of an egg when dry. Lightly twist a piece of wire round it with a hook as close as possible, so that, when hooked into the loop across the mouth, it will hang close to it. To send the balloon up, select a situation against a building out of the wind. Avoid *trees*, *wood buildings*, and *thatched roofs*. Put your sponge to soak in some methylated spirit of wine. Have ready some torches made of loosely twisted newspaper. Get someone to hold out the balloon, and having lighted the torch, carefully pass it up into the balloon, which will soon expand and try to rise. Someone should now hook on the wet sponge, and with a little care the torch should be withdrawn and the sponge lighted at the same time. Do not be in too great a hurry to let go, but hold it by the edge of the mouth, and when it seems inclined to rise, let go with a twist, so that it spins as it rises, and does not swing about. I have successfully let off scores, no matter how the wind blew. Of course, you can have coloured gores, and can colour your fire to taste.

These balloons give great pleasure, and cost nothing but a few hours' work; but at the shops a balloon of the kind described above would cost from 3s. 6d. to 5s., which is a long price to pay for an article of this sort.

## APPLIANCES FOR WORK TO BE MADE BY THE WORKER.

BY B. A. BAXTER.

GUIDES FOR MITRE-BOX—GUIDES FOR GROOVING AND STEP LADDER MAKING—MITRES FOR NEWEL CAPS—CUTTING LENGTHS FOR BOXES—SAWING DOVETAILS—BENCH HOOK—STOPS ON SHOOTING-BOARD—"DONKEY'S EAR"—OCTAGON STRIPS—SASH BARS—WOODEN COGS.

RECENTLY I advised the amateur to imitate the professional in making appliances to aid him in his work, on the ground that it would improve his work and add to his resourcefulness. The workman who, above all else, seeks to do his work with the least trouble to himself; the manufacturer (who does not generally make with his *own* hands) who desires the greatest output; and the amateur, who requires every aid that he can obtain in order to surmount the difficulties of unaccustomed operations—all alike can make profitable use of any helps that are suggested or provided.

Only mechanical purists can object to these helps; and as such people are few, and probably will not read this little article, I shall ignore them, and proceed.

In order to preserve something like order, we will discuss appliances for sawing, planing, chiselling, and boring, in the order I have placed them.

Everyone knows the difficulty of sawing—that is, everyone who has tried to use a saw knows, first, that it is difficult to make the tool cut, and when that is accomplished, that it is not at all easy to cut *accurately*.

The most widely known appliance to assist in accurate sawing is, perhaps, the mitre-box (Fig. 1), used for cutting mouldings, picture framing, etc., to the proper angle. I shall not describe it, as a drawing has already appeared in WORK; but would only say that its usefulness can often be increased by making it longer, and having a stop fixed on it to gauge the length of the moulding to be cut; and also that square cuts, as well as at other angles than 45°, can be made with its assistance. If several pieces are to be cut to similar size, it is profitable to make a rough appliance of this kind.

Further, if a hexagon card-tray in fretwork is to be put together, it is less trouble to make a cut at the angle of 60°, and then fix a strip on the board (Fig. 2) corresponding to the elevation angle of the sides, than to find the angle and set bevels, and mark and cut in the most careful and scientific manner.

In grooving across thin boards for partitions, beginners often find a difficulty in sawing truly. If a strip of thin wood, having its edge straight and square, is laid upon the work exactly to the line, and the left hand placed firmly upon it, a great help is at once obtained in cutting for the grooves. The saw will work close to the strip, and no fear of the saw wandering from the line causes a nervous indecision in the worker. Immediately the saw has made for itself a path, the strip may be removed.

A similar assistance can be obtained in making step ladders, or anything in which a repetition of the same distance is required. (Fig. 3.) A piece of wood cut to the correct length and angle has on its edge a stop, whereby it may be held, always at the proper angle, on the material. It becomes then, in effect, a gauge, a bevel, and a set-square combined. (Fig. 4.)

In making such articles as seats for lecture-rooms, etc., gauges for the recesses, mortises, curves, and scribings can easily be cut in sheet zinc, and right and left ends can be marked with equal facility by simply turning the pattern. (Fig. 5.) This, of course, applies not only to sawing, but also to other operations.

There is also a contrivance for sawing mitres in newel caps, which I will try to explain. It is obvious, on consideration, that any straight line drawn from the circumference of a circle towards the centre must be either a radius or parallel to a radius of the circle; and if some contrivance can be made to ensure the right width and proper angle—especially keeping the opposite angles the same—we can make a useful help for cutting mitres to newel caps. (Fig. 6.)

If, therefore, a centre line is drawn on a piece of wood, upon which line the centre of the turned cap is applied and fixed, two saw cuts, equally distant and parallel to the centre line, will give guidance to the saw in cutting the V-cut for the insertion of the handrail.

A very simple help towards cutting off lengths for boxes, trays, or similar small work of which a number are required, consists merely of a piece of wood a trifle longer than the length of the pieces required, and on the under side fix a stop. Then, by placing the gauge on the work, neither square, rule, or pencil is required to cut off many pieces of uniform length. (Fig. 7.) This has been very useful to the writer of this in making partitions for what are termed pigeon-holes, and the plan is also capable of being used as an assistance in planing. (See also Fig. 8.)

For sawing dovetails so that they have the uniformity that adds so much to the appearance of the work, there is an easily-made appliance. All that is required is a small piece of wood rebated at the end, and the dovetail saw used to make a model dovetail in the reduced thickness, care being taken to preserve similar angles; or the dovetails may be uniform in size, but the pins will look misshapen. (Figs. 9, 10.)

For the circular saw many dodges are used, but they mostly resolve themselves into templates of various forms (Figs. 11, 12), and can be divided into appliances for cutting at various angles on plan, as picture-frames or elevation, as cutting strips of a wedge-shaped section, such as bottom sticks for roller blinds, and cutting off arrisses from pieces of square section, such as octagon blind-rollers. This last, however, needs a trough rather than a template, and will be mentioned among the appliances for planing which follow this (similar to Fig. 21). The applianee for cutting dovetails on a circular saw by the Britannia Company is a clever instance of the same simple expedient, which many have used in part, though not, perhaps, so fully. There is also a well-known contrivance called a bench hook. This, sketched in Fig. 13, is very useful in sawing small work, shoulders of tenons, etc. If made about 11 in. or 12 in. long, it may be used instead of a shooting-board; and for holding wood under the operation of chiselling it is of value. Its great use is, however, for cutting shoulders to tenons, forming an excellent stop, and greatly aiding the worker.

For planing, the great assistance of home-made contrivances is obvious in the number which exist, and which, perhaps, we may, as the result of this article, increase.

The ordinary shooting-board is exceedingly useful for planing edges of boards too thin or flexible to treat in the bench screw; but it is too well known to need a lengthy description. There are, however, additions to the ordinary shooting-board which will

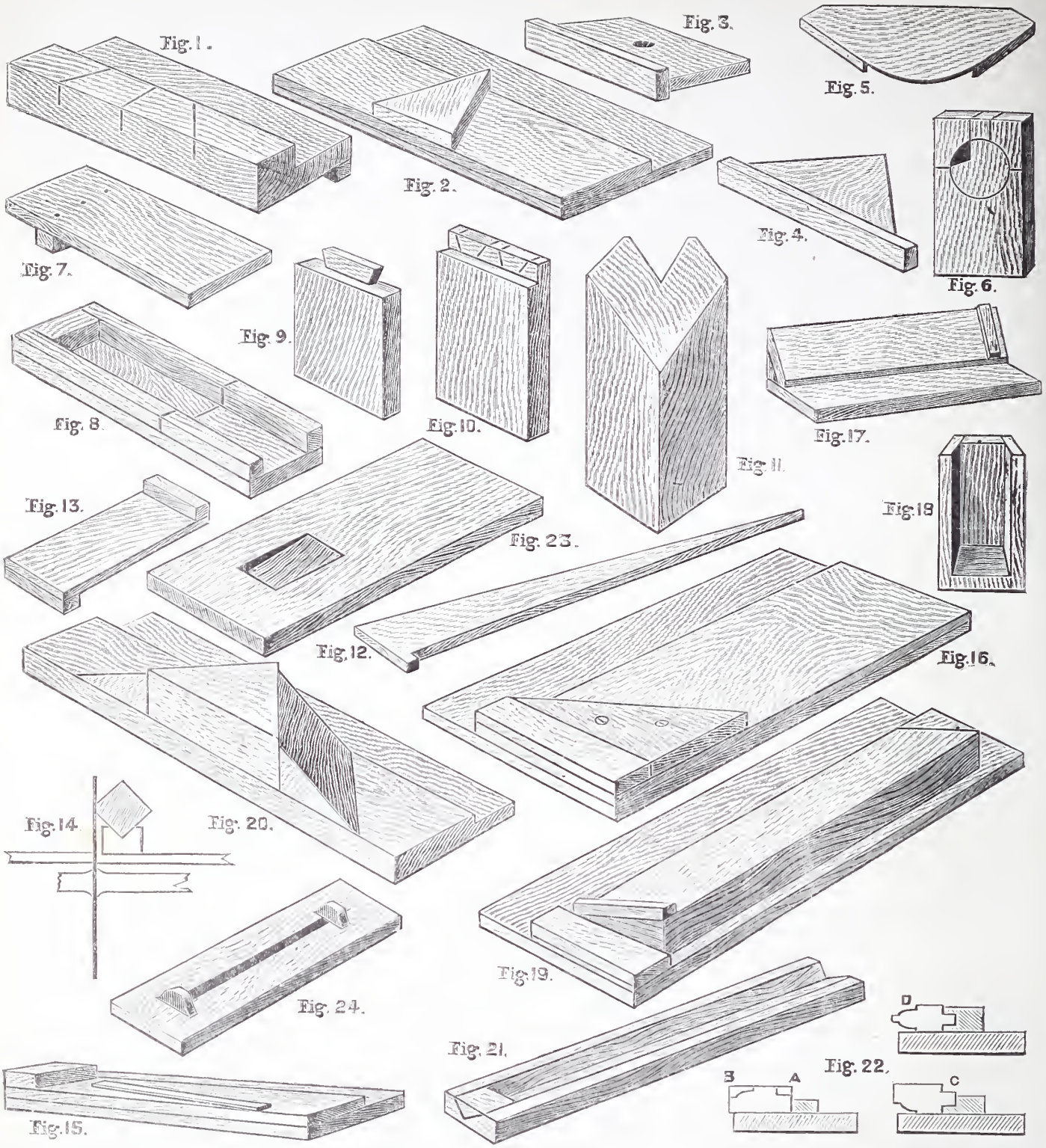



Fig. 1.—Mitre cut for sawing Mitres. Fig. 2.—Mitre for Hexagon. Fig. 3.—Gauge for Step Making. Fig. 4.—Pitch Board, also applicable to Circular Sawing. Fig. 5.—Gauge for Corners. Fig. 6.—Contrivance for cutting Mitres in Newel Caps. Fig. 7.—Gauge for rebating a Dado Groove or cutting off Stuff. Fig. 8.—Trough to cut to a Length. Figs. 9, 10.—Models for making Dovetails uniformly. Fig. 11.—Template for Stop Chamfer. Fig. 12.—Template for Circular Saw, suitable for tapering Legs. Fig. 13.—Bench Hook for Sawing. Fig. 14.—Trough for Circular Sawing. Fig. 15.—Shooting-Board with Taper Attachment. Fig. 16.—Shooting-Board altered for Occasional Use. Fig. 17.—Mitre-Board for Partitions of Trays, etc., "Donkey's Ear." Fig. 18.—Upright Trough for planing to a Length, front removed. Fig. 19.—Shooting-Board with Movable Angle Strip for Pedestals. Fig. 20.—Mitre-Board with Angle Blocks. Fig. 21.—Trough for Rollers, suitable, with slight alterations, for Circular Sawing or Planing. Fig. 22.—Sticking-Board for Sash Bars with Strips: begin by making Rebate A, then Moulding B, then Rebate C, and finish with Moulding D. Fig. 23.—Board for Wedges. Fig. 24.—Template for Wheel Cogs.

add to its usefulness for special purposes. Of these, a temporary stop, fixed parallel to the edge traversed by the plane, is the simplest. This will be found of great assistance in planing a number of pieces of wood to uniform width. After the required number have been prepared, the stop can be removed from the board. Another addition, useful at times, resembles the parallel ruler, with this exception—that it is for securing a uniform taper to the pieces of wood in course of preparation. There is also the adjustable stop to make angles other than 90°, which ought to be mentioned. If the centre on which the stop turns is as near the corner of the stop as possible, the work will be facilitated, and the usefulness of the shooting-board be less hindered. A wing nut and bolt working in a slot would fix the whole to the desired angle; or a movable piece might be fixed on the shooting-board, as Fig. 19 suggests.

Leaving the shooting-board for mitres of picture-frames and cabinet-work out of the

question, as being universally known to the readers of WORK, there are modifications which may not be so familiar. There is the mitre-board, commonly called the "donkey's ear," which is used for mitred partitions and small mitred boxes (see Fig. 17); there is also the trough-like box which so materially helps plane makers to get bead and rebate planes so square at the ends and uniform in length; modifications of the shooting-board for making pedestals for statues or for loo tables, or such purposes as require angles other than right angles to be made with ease and uniformity. This, of course, may be only an attachment to the ordinary shooting-board. In a similar way, an addition to the ordinary mitre-board will enable the worker to mitre bevelled picture-frame linings, which would, to some pictures, form a pleasing change to the flat gilt mount so often seen.

Then for the purpose of making octagon strips from square lengths of wood, preparatory sometimes to rounding them, a help may be afforded by an appliance made by cutting down a square strip diagonally, and fixing the two strips made thereby on a flat piece of wood. Any suitable stop will then hold a strip in the right position for planing off the angles. (See Fig. 21.)

The preparation of sash bars (Fig. 22) almost necessitates some appliance to hold the piece of wood while being converted into a sash bar.

The rebates should first be made, to do which with ease, a board, having at a convenient distance a strip to resist the pressure of the sash fillister, a few steel points driven into the board, leaving about ⅛ in. standing out and pointed, so placed that they will stick into the bar where the other rebate will remove the marks, will do for the first rebate, A. For the rebate on the other side, it needs a piece of wood, as in C, equal in thickness to that which has been planed away, to support the bar while the second rebate is being made; and for moulding the bar, a piece of wood equal in thickness to the bar, and having a groove into which the rebated bar can now fit, as in D, will be found most convenient. It will seem simple to some to point out that anyone who wants to make some wedges of uniform size can find much assistance by making a suitable mortise in a piece of hard wood, deepening one end as required, and plane the wedges while they rest in such a receptacle, as in Fig. 23.

Pattern-makers can shape wooden cogs to affix to their wheel patterns by planing to the outline of a template at each end of the strip. (Fig. 24.) The same agreement of outline in brackets or other shaped work can be obtained by sawing and shaping several together on the same principle.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### EYE KNOTS.

RUNNING KNOT OR SLIP KNOT—FISHERMAN'S EYE—OPENHAND EYE—FLEMISH EYE—CRABBER'S EYE—BOWLINE KNOT—RUNNING BOWLINE ON A BIGHT—HANGMAN'S KNOT—RUNNING KNOT WITH TWO ENDS—RUNNING KNOT WITH TWO ENDS FASTENED.

ONE of the simplest of these is shown in Fig. 15. It is the "Running" or "Slip Knot." A bight is first formed, and an overhand knot made with the ends round the standing part. The standing part may be drawn through the knot, and the eye made to any size required. There is less chance of the knot coming undone if an overhand knot is made on the end A. This is the knot with which a sailor ties his neck-handkerchief, and it is therefore sometimes called a sailor's knot.

Fig. 16 is the "Fisherman's Eye Knot." A bight is first made of sufficient length, and an overhand knot formed with the standing part round the other strand; the end is now passed round the standing part, and knotted as before. We now have a running knot A, with a check knot B, which, when hauled upon, jam tight against one another, and hold securely. This is one of the best knots I know of for making an eye in fishing, as the strain is equally divided between the two knots. Fig. 17 shows a very common way of making an eye on the end of a piece of cord—indeed, you will often find those who know no other mode of doing so. It is practically the same knot as Fig. 8, only, instead of being made with two ropes, one only is used. The end is brought back along the rope to form the eye, and an overhand knot made with the two parts. This knot, from being so easily made, is often used, but as it lacks strength, like the openhand knot (Fig. 8), it is not advisable to use it where it is required to bear much strain. My readers will by this time doubtless have noticed how very often openhand knots come into requisition as component parts of other knots.

Fig. 18 is an eye made with a "Flemish" knot. It is worked just the same as a single Flemish knot, the only difference being that two parts are used instead of one. It is stronger, but clumsier, than the one just described. It is not very often used.

The "Crabber's Knot" (Fig. 19) is a curious and not very well-known knot. I learnt it one day coming home from fishing in a friend's yacht. His captain was an old crabber, and we had been discussing the best form of eye knot for fishing gear, when he recommended me this one as being very secure, and less likely to part at the knot when a strain was put on it, than any knot he knew. To make it, bring the end back to form a loop, taking it first under and then over the standing part, up through the main loop, over the standing part again, and up through its own bight. Before the turns are hauled into their places, the knot will slip on the part A, as in an ordinary slip knot; but if the part B is hauled upon, the strand A, which passes through the centre of the knot, rises, and the coil which goes round it jams, making the knot secure: so that it may be used as a running knot or otherwise, as desired. This is also called a running knot with crossed ends.

Fig. 20—the "Bowline Knot"—is one of the most useful knots we have. It is impossible for it to slip, and it is therefore always used for a man to sit in when he is slung, for the purpose of doing some particular piece of work. The end is first laid back over the standing part, so as to form a

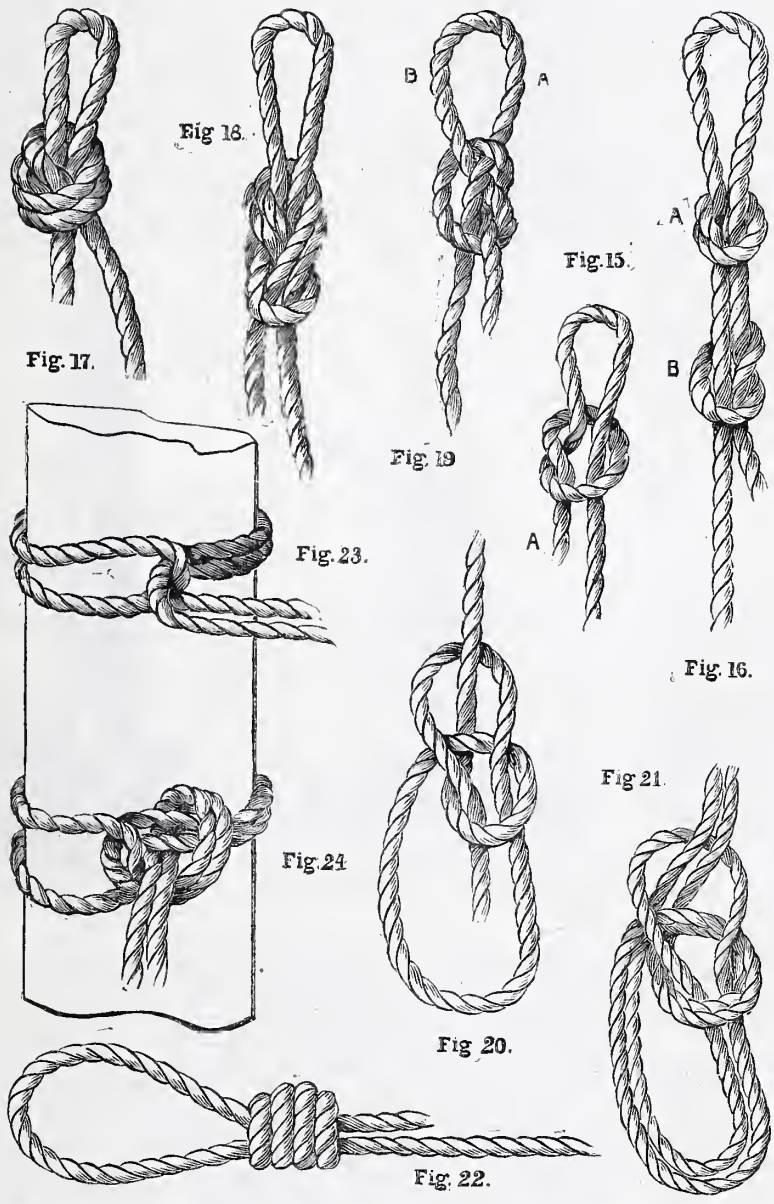



**Fig. 15.—Running Knot. Fig. 16.—Fisherman's Eye. Fig. 17.—Openhand Eye. Fig. 18.—Flemish Eye. Fig. 19.—Crabber's Eye. Fig. 20.—Bowline. Fig. 21.—Running Bowline on Bight. Fig. 22.—Hangman's Knot. Fig. 23.—Running Knot with Two Ends. Fig. 24.—Ditto fastened.**

loop; the end is then passed up through the loop, round the back of the standing part, and down through the loop again. Hauling on the end and the standing part makes the knot taut.

Fig. 21 is a modification of this knot, called a "Bowline on a Bight." The loop is made as in the previous knot, only with the two parts of a doubled rope; the bight is then passed up through the loop, opened, and turned backwards over the rest of the knot, when it appears as in the figure. To untie it, draw the bight of the rope up until it is slack enough, and bring the whole of the other parts of the knot up through it, when it will readily come adrift. If the standing parts of the rope are held fast, it puzzles the uninitiated to undo it. I remember hearing of a mischievous person who used to amuse himself by going round to the country inns, and making this knot on the bridles of any farmers' horses he could find tied up outside; the result being that the old farmer, whose wits probably were not sharpened by his recent potations, had generally to cut the reins before he could get them over his horse's head. A "Running Bowline" has the knot made on the end after it has been passed round the standing part, thus forming a loop through which the main rope will run. Two ropes may be joined together by making a bowline in the end of one of them, and putting the end of the other through the bight, and forming with it another bowline on its own part. This is often used to join hawsers together.

Fig. 22 is the "Hangman's Knot." A bight is first formed in a rope, which is held in the left hand; the end is then coiled several times backwards—that is, from right to left round the standing part—and then passed forwards through the coils. It is made more easily if, in the case of small stuff, the first finger of the left hand be laid along the standing part, and the coils made round them both. This keeps the coils open, so that the end passes through them readily. In the case of larger cordage, a piece of stick may be used. The advantages of this knot for its particular purpose are that when well greased it runs very readily, and that, from its large size, it presses on the veins of the neck, and thus extinguishes life more rapidly than a smaller knot would do. I believe our modern executioners instead of this knot use a thimble—that is, a grooved ring of metal spliced into the end of a rope, and the main part passed through it to form the fatal noose.

Fig. 23 shows a method of making a rope fast to a post or pillar. The rope is doubled and passed round the post, and the ends put through the loop. If it is required to make this fastening secure, the ends may be passed round the standing part and through the bight thus formed, as in Fig. 24; or, instead of passing the cords through the bight, a loop may be formed by doubling the ends, and this loop put through the bight, thus forming a slippery hitch. This knot has the advantage of being more readily undone than the other one, as we have only to pull at the ends, and the rope is released at once. We may also secure the ends by making a Flemish knot on them, instead of an overhand knot.

This brings us to an end of the consideration of the various knots that are in use, classified as simple knots, knots for joining ropes, and eye knots. In my next paper I shall endeavour, by means of description and illustration, to make the reader acquainted with the modes of making hitches and bends.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 17.—Pope's Improved Carriage Jack.

In Fig. 1 an illustration is given of the "Improved Carriage Jack" recently introduced by Messrs. W. Pope & Co., Engineers, etc., Barley Fields Iron Works, St. Philip's, Bristol, and manufactured by them in two sizes, sold respectively at 12s. 6d. and 15s. 6d. each, the smaller size being sufficiently high for all ordinary carts and carriages, from very low phaetons to the ordinary dog-cart, and the larger size intended to meet the requirements of axles of very high carriages and dog-carts and breaks that are equally high. The working is very simple. The jack is merely placed under the axle, and the handle A is lowered to the position A′, as shown by the dotted lines; the plunger B then rises to the position B′, and handle and plunger remain locked in position. The jack may be altered for high or low axles by placing the link or bridle C under one of the notches or teeth, shown in the part D to the left of the illustration. Both sizes will lift carriages up to a weight of about 30 cwt. The jack does not depend on any frictional grip, and may therefore be painted all over to prevent rust and corrosion. It is made entirely of good malleable iron, and consequently is not liable to get broken through a fall or any other accident. The head is capped with wood to prevent damage to the paint of carriage axles, etc. The advantages of the Improved Carriage Jack are automatic locking when up, extreme lightness and strength, cheapness, and capability of being carried conveniently in the boot of a carriage for immediate use in case of need or accident.

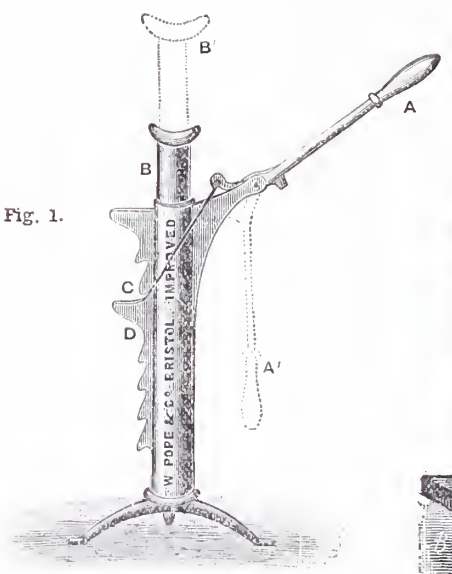



Fig. 1.

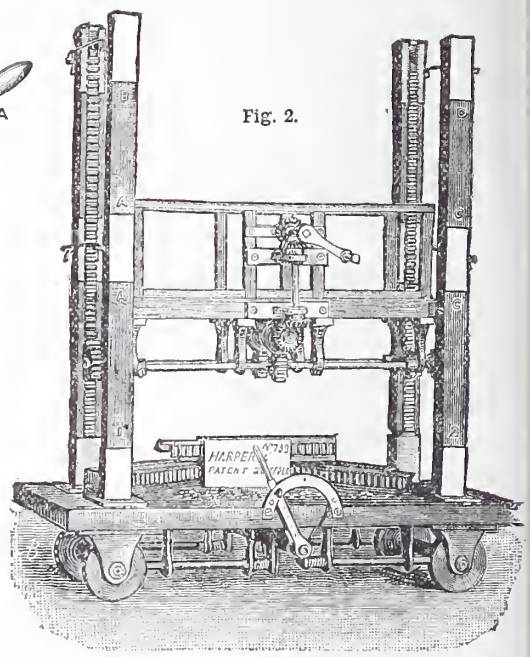



Fig. 2.

Fig. 1.—Pope's Improved Carriage Jack.
Fig. 2.—Harper's Patent Scaffold and Hoist.

### 18.—Harper's Patent Scaffold and Hoist.

The Patent Scaffold and Hoist, invented and made to suit any requirement by the patentee, Mr. J. Harper, 129, King's Road, Camden Town, London, N.W., can be used for every description of building and decorative work, internal or external, as well as for building purposes, instead of the ordinary cumbersome and expensive fixed scaffolding. All inquiries as to price should be sent to Mr. Harper and not to me, and as I have not seen the scaffold and hoist at work, I must content myself with giving to a certain extent Mr. Harper's description of it. I may, however, add that, from what I can gather from the description and illustration supplied in Fig. 2, there is no doubt whatever in my own mind as to its utility for the purposes for which it has been specially designed. The scaffold, which is portable and self-contained, comprises an upright framing constructed in sections, so that it may be readily raised to the height required by the work, and a platform fitted to move up and down in the framing, with gear worked from the platform itself, whereby it may be raised to, and maintained at, the elevation required. The scaffold is mounted on wheels so that it may be easily moved from place to place. The framing comprises a bottom fixed platform mounted on wheels, and four corner posts or columns fixed in shoes and constructed in sections bolted together, the four columns being braced together by diagonal tye rods furnished with screw couplings. On one of the inner faces of each of the four posts is a rack, and with these racks are gear-pinions on a pair of shafts mounted beneath the rising platform, these shafts being geared with a worm gear common to both and operated through bevel gear from a winch handle mounted at convenient height above the platform. On the other inner face of each corner post is a guide of dovetail or T-section, with which engages a shoe on the end of the platform whereby all outward defection of the corner post is prevented and the wheels are held in gear with the racks. The travelling wheels on which the apparatus is mounted have peripheral holes in which engage locking bolts mounted beneath the base platform and coupled to a common lock shaft operated by a lever for the purpose of holding the scaffold stationary when in use. The whole apparatus can be put up or taken to pieces in a short space of time by any ordinary workman, who cannot make any mistake in the work, every section being marked as shown in Fig. 2. The advantages possessed by the Patent Scaffold and Hoist over the old system of scaffolding are numerous. Firstly, no ropes, poles, putlogs, ladders, or scaffolders are required. Secondly, it is far more useful for interior work than the old scaffolding, which cannot be removed until the work is completed, a matter attended with much inconvenience in large places of business in which cleansing, repairs, decoration, electric lighting, etc., are chiefly done in the night, and the patent scaffold can be

uickly put up at nightfall and as quickly removed a the morning. Thirdly, the workmen employed an put the material required into the cradle nd wind themselves up to the height required vhen at work, thereby saving time and labour. Fourthly, it is perfectly safe, and cannot by any neans work down unless worked by the men in he cradle; further, being self-eontained it can e stopped at any point, and affords sure safe-guards against accidents that often arise from the se of temporary scaffolding composed of planks, adders, etc. Lastly, for electric lighting it is pecially valuable, as the wire and wood casing an be conveyed to the height at which they are o be fixed, carrying the wire-runner and car-enter so that they can complete their work as hey run along. THE EDITOR.

## SHOP:

### A CORNER FOR THOSE WHO WANT TO TALK IT.

*** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTER FROM A CORRESPONDENT.

**Saw Buckling.**—W. H. R. (*London, N.W.*) writes:—"Having seen in No. 106, Vol. III. of WORK, a method of trueing buckled circular saw, I send you another method, often used in saw mills. When the saw begins to run wild, take the piece of wood you were sawing off the bench, and let the saw run; and while it is warm, get a mug of cold water and let it run on the saw, and it will very soon run true again."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**WORK Advertising and Addresses.**—We cannot give our contributors' addresses, but will attend to any stamped, directed letter. The rates for advertisements in WORK have been printed in every issue since No. 1 of the Magazine.

**Model Electric Lights.**—W.E.B.(*Birmingham*).—The articles on "Model Electric Lights" were published in WORK, No. 76, August 30; No. 82, October 11; No. 89, November 29; No. 92, December 20, 1890; No. 94, January 3; No. 97, January 24; No. 99, February 7; No. 101, February 21; and No. 104, March 14, 1891: nine numbers in all, forming part of Vol. II. All back numbers are in print.—G. E. B.

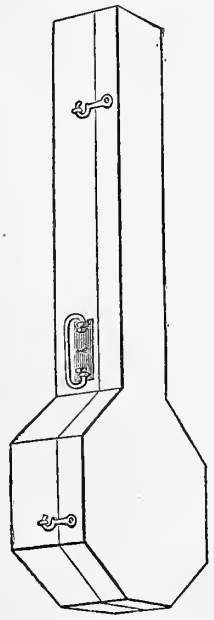
**Battery Zincs.**—SELF HELPER.—Battery zincs always work better when amalgamated, but it is not absolutely necessary to have them amalgamated for use in the Bennett caustic potash cell, since there is no waste of zinc when the circuit is open. Dilute acid cannot be employed in this cell, as the acid would dissolve the iron borings and the tinned iron sides of the cell.—G. E. B.

**Glass Working.**—SELF HELPER.—I do not know of a book at the price of 3s. 6d. There are two chapters on the manipulation of glass for laboratory purposes in "Practical Chemistry," Vol. I., by Harcourt and Modan; price 7s. 6d. The lessons are illustrated with sketches of the apparatus, and method of making them.—G. E. B.

**Cost of Electric Light.**—A. T. (*Hampton Wick*).—It is not advisable to have an electric light installation of only one 25 c.p. lamp, and one dynamo to light it, as the arrangement would involve a waste of power and material all around. If you must have a light of 25 c.p., get five 5 c.p. lamps, or two 10 c.p. and one 5 c.p. lamps, and divide the current between them. It would be even better to get either three 10 c.p. lamps or four 8 c.p. lamps. The lamps will cost you, at retail price, 5s. each, and holders for each from 1s. to 2s., according to quality. The dynamo will cost from £4 to £5 if bought new and complete. If you care to make the dynamo yourself, you will save half the cost, as the castings can be had in the rough for 16s., and the wire will cost about 2s. per lb. Switch, cut-outs, and leads or line wires will cost from 10s. to 15s. more, so that the whole installation will cost from £6 to £7, apart from cost of engine. I do not see why you must have a set of accumulators. These will only increase the cost, as each cell will involve an additional outlay of from 15s. to £1.—G. E. B.

**Fretwork Cornice.**—H. J. (*Kidderminster*).—It is not at all necessary that your fretwork cornice should be backed up with anything, though, of course, you may finish it by doing so if you wish. If you want a transparent, or rather a translucent, material, you cannot do better than use sarsanet, which may be the stuff you describe as being something like satin and unsuitable, because it is not transparent enough. The other material about which you inquire is gelatine in the form of thin sheets. It is transparent, but quite useless for the purpose, and no better than thin oiled tissue-paper would be. If you want to drape or, as you say, hang something below the wood to give a finish, I cannot suggest anything better than festoons of velvet or other suitable stuff, of which you will be able to get a large choice at any good house-furnisher's in your town. Loop the festoons with fancy cord, and trim edges with a ball fringe. Unless you have had practical experience in upholstery draping, you are not likely to make a success with the work, which requires not only skill but considerable taste, if the materials are to be used to advantage.—D. A.

**Banjo Case.**—LIVERPOOL.—You must make your case as light as possible if you make it of wood. If your wood is very thick, and you have to carry the banjo and case any distance, you will find that it will begin to weigh rather heavy before you get to your destination. The lightest cases are those made of cardboard and covered with American cloth, which answer very well for ordinary wear. You could rebate the sides of case to receive top and bottom, which could be glued and bradded (or sprigged) in. You can get the size from your banjo and make to fit it. Make the sides in one piece, and after the top and bottom are fixed, cut all round with saw, say 1 in. from top. Having done so, you will have your lid ready made, and, of course, the exact size and shape of the body of case. You could cut out the bottom to size, and then fit your sides round it, mitreing them together, and screwing or bradding, and not forgetting the glue. You could butt the ends of each section together, but it would not be such a good job as mitreing them. Line the inside with baize or plush, and paint or stain the outside to your own fancy. Put the hinges on extreme ends of case: if you do not attend to this you will find your case will not open and shut properly. You will see where to put them if you lay the lid on case and then lift it (the lid) up as if you were opening the case. You will see the shape by referring to illustration.—J. G. W.



Banjo Case.

**American Clock.**—P. W. W. (*North Shields*).—Neither from your sketch nor letter can I make out the arrangement of wires. I think that the centre wire is used merely to let off striking by a piece of wire hanging from it, in the event of running down, to obviate turning the hands; and as you say the clockmakers there do not understand it, having the whole affair before them, I feel more at a loss with only two wires to look at.—A. B. C.

**Inlaid Tops, etc.**—A. J. G.—If you want a quantity of these, any marquetry cutter will do them for you. Probably the most likely place to meet with them in London (you do not give your place of residence) is at D. Witt & Palmer's, Drummond Street, N.W.; or you might try some of the fancy veneer dealers in and about Curtain Road. There is a book called the "Practical Cabinet Maker," which might help you; though, unless you are what its name indicates, it is not likely to be of much use to you. You will find more valuable information in the volumes of WORK already issued in all that pertains to cabinet making than in any work I know of.—D. A.

**Varnish.**—J. S. (*Govan*).—The shellac spirit varnish to which you refer is, in reality, French polish. It will dry hard, with a good and lasting gloss, but is generally, indeed I may say invariably, applied with a rubber, and not with a brush. I know of no way in which it can be made transparent or limpid, like water, when in bulk. When applied to work, the film is so thin that it is transparent. The proportions required to make half a gallon, or any other quantity, must depend on what thickness you want it to be. Good ordinary French polish may be made by dissolving about 1½ lbs. shellac in half a gallon of methylated spirit; if you want it thicker, add shellac to suit yourself, or add resin instead. It is a pity you did not state what purpose you want to use the varnish for, as I might then have advised you something more suitable. In any case, console yourself with the reflection that varnish of most kinds can be bought more cheaply and of better quality than it can be made by amateurs. As you are so near Glasgow, you will be able to get the kind best adapted to your purpose, whatever it may be, without difficulty.—D. D.

**Weight of Cordage.**—R. J. S. (*Wolverhampton*).—The method of finding the weight of rope given by me on page 6, column 3, of WORK, No. 135, Vol. III., is from a book published by Routledge & Co. It is there stated to be "a good formula by Robison." Of course I had no means of testing the accuracy of it; but as apparently a good authority was given for it, I considered I was justified in adopting it. Your correspondent does not say absolutely that this formula is *wrong*, but merely that another authority—which, he states, is generally accepted by the trade as correct—gives a different result for the size of rope in question. My only connection with cordage is from having used and worked it for a full half century; and I must, therefore, admit my ignorance of the matter from a "trade" point of view, and, consequently, that I have never seen "Rabson's Tables." As the matter stands, it seems to me a case of Rabson *v.* Robison; and, as I take it, neither your correspondent nor myself is in a position to say *positively* which is in the right.—L. L. H.

**Piano Panel.**—INQUIRER.—Those most likely to have what you want are J. H. Skinner & Co., East Dereham, and Harger Bros., Settle. You might also write to Zilles. If you cannot meet with what you want, you may be able to adapt some of the published designs. There will be no difficulty in getting the wood you want, either in your own town or in Shrewsbury; but if you cannot meet with any, you can get it from the dealers above named, or from Busschott's, Park Lane, Liverpool, where I saw some very fine stuff lately. I am assuming you want plain or American walnut. If you want the Italian or burr walnut, you must get it in veneers, and either lay or have it laid for you.—D. A.

**Polishing Marble.**—W. B. (*Camberwell*).—Grind down first with coarse sand and water, then with finer, and finish off with putty-powder on felt mounted on a thick board. See details on p. 742, No. 98, Vol. II. of WORK.—D. A.

**Box Battery.**—J. H. (*Leicester*).—I suspect the cause of failure in your box battery to be due to corrosion of the connections by acid fumes arising from the cells. There may be an imperfect contact of carbon plates and the lead ring in which they were cast. Try the battery with a new solution. If this fails to light the lamp, you may determine on the fault being in the connections. If the battery lights the lamp when charged with the new solution, then the old solution was at fault. You adopted the right proportions—namely, 3 oz. of chromic acid and 3 oz. of sulphuric acid in each pint of water. The cost is rather high, 3d. per pint being quite enough. Good commercial acid is quite good enough. Let the solution cool before placing it in the cells, and see that the zinc plates are well amalgamated. The lead collars and the tops of the carbons should be painted with Brunswick black to keep the acids from creeping up and corroding the connections.—G. E. B.

**Coupling Battery Cells in Parallel.**—DENNY.—The resistance of a circuit is not increased by coupling up battery cells in parallel. On the contrary, each cell added to the circuit adds its own current to the general volume, without adding extra resistance to the circuit. Suppose we wish to convey water from one cistern to another, and put in two 1 in. pipes between the two cisterns in parallel. These will convey a certain quantity of water. We now put in an additional ½ in. pipe parallel to the two others. Although this in itself offers a higher resistance to the water than the 1 in. pipes, it does not in any way affect the resistance of the other pipes. It is much the same with cells. The partly exhausted Leclanché cell will not increase the resistance of the circuit when connected in parallel.—G. E. B.

**Cabinet.**—T. L. (*Balham*).—In due time there will appear a paper on how to make a canted-sides cabinet.—J. S.

**Banjo Rim.**—J. H. (*Everton*).—You ask for the best way to make a banjo rim, but you do not say if it is to be wood or metal. Supposing you wish to bend a piece of wood for a hoop, you must make a mould to size of diameter of hoop—an iron ring would be the best; or if you could find a pulley about the right size, you could bend it round the outside of that, using eight cramps to keep it to shape of pulley until you get it bent round in a circle, then drive in about three wire brads to keep it in shape. Failing the iron ring or pulley, you could cut a mould out of a piece of hard wood, turning it up to size or cutting it out with a band saw, boring holes round it or cutting out inside to allow the cramps to fix on. Prepare your wood, making it 2½ in. deep and ⅜ in. thick, cutting it to length according to the size you want the hoop, allowing for the ends to lap over each other about 3 in.; taper each end for splicing before you bend it; then steam or boil it well, and bend round the mould, using the cramps, and not forgetting to drive three or four wire brads into the ends lapping over one another, to keep it in shape when taken from the mould. The longer you can let it stand to dry, the better. Then take out the brads. See that the ends lapping over each other fit. Tooth them—you could do this by holding a tenon saw crossways on hoop, and drawing along with a

scraping motion, failing a proper tool—glue together, using hand-screws; then when glue is set, dress up the joint with spokeshave, which will make the hoop round enough for all practical purposes. Round the edge that the vellum stretches over carefully, so that there is no danger of wood cutting the vellum; then fit the band for pulling the vellum tight. The best bands are fitted to the hoops, and ends brazed together, and then are mounted in the lathe and have a recess or rebate turned in them; the object of the recess being to keep the nose of the bracket wires from cutting the vellum, which they would most certainly do if you used only a thin piece of brass for the band. Instead of making a recess in the band, get a piece of brass ⅛ in. wide and ⅛ in. thick, and bend it round to size of hoop: braze the ends together or halve and rivet them. Mark off and drill holes for brackets; fix ditto (using not less than twenty or twenty-four for an 11 in. or 12 in. hoop); put the band on hoop, and mark the exact place of each bracket on the band; then fill notches in band deep enough to sink the bracket wires into, and so prevent them from cutting the vellum. You will then have a band good enough for anything. If the information you require is how to make a metal hoop, I must refer you to what I have written in the back numbers. I have given the numbers in answer to a query by another correspondent, which has not appeared up to the time of writing this, but which, no doubt, you will have seen before this is printed. I forgot to say that you could use two drain pipes, one stuck on top of the other, the joint made good with clay, filling with water, and lighting a fire round bottom of pipe, to steam and bend your wood. This method was suggested by a correspondent in a contemporary of "ours."—J. G. W.

**Banjo Making.**—F. W. (*Southsea*).—I should advise you to use pegs in place of machine if you intend to put gut strings on your banjo. A machine is simply a nuisance for using with gut strings, but is very necessary for wire strings. For instance, a zither banjo having all wire strings would require a machine—wire strings being difficult to tune with pegs. For the latter part of your query see advertising columns. See also WORK, No. 88, Vol. II. —J. G. W.

**Pine Harp.**—S. E. (*Chelmsford*).—I can give no reliable information on this instrument. It is probably one of the home-made tribe used by "variety artists," and as a musical instrument has not come under my notice.—R. F.

**Clock Cleaning.**—VULCAN No. 2.—I am not sure I quite understand your difficulty about the striking, but in most French clocks the fly is pivoted, on the pinion end, in a movable eccentric bush. By turning this to throw the fly-pinion deeper in the warning-wheel, it will strike slower. To make it go faster, turn it shallower. As regards the German clocks, if not provided with a movable bush, see that the fly is tight on the pinion, as sometimes the pinion rushes round without the fly or fan piece; and sometimes the pinions are worn and the holes are wide. If so, put new holes to the fly and new wires to the pinion of the fly, and I think you will have no further difficulty. I can recommend Britten's "Watch and Clock Makers' Handbook."—A. B. C.

**WORK Paging.**—The numbering of the Advertisement pages of WORK must continue. Thank you, however, for your suggestion.

**Pattern-Making Book.**—G. S. (*Headington*).—There is a book on "Pattern Making" published by Crosby Lockwood, 7, Stationers' Hall Court, at 7s. 6d. That is a practical work, and might suit you.—J.

**Cleaning Tools.**—H. W. (*Rochester*).—Rub any rust off with emery-cloth; and if the tools are in occasional use, rub with sweet oil. If they are to be put away for a considerable time, rub with mutton fat.—J.

**Testing Paint.**—A. F. (*St. Leonards*).—The most practical way of testing oxide paint would be an examination as to colour and degree of fineness in grinding. I assume you mean the oxide in paste form, and not diluted with oils for use; as, in the latter case, the oil would be a factor of importance—whether good "honest linseed" or "fishy" oil, in the twofold sense. Oxide is so cheap, there is no need to adulterate it, although there are several qualities of colour (brightness) and fineness. In actual use the oil is more the preservative than the oxide, which is rather a *cheap* body pigment with affinity to ironwork.—F. P.

**Graining and Painted Inlays.** — THE SCRATCHER writes:—"In WORK, No. 100, is a paper on Graining. I beg to differ with the writer with respect to treatment of panels Nos. 7 and 8. I agree with him so far as he treats the maple up to the varnishing; but I fail to see how he can get a good imitation of walnut by the way he suggests, seeing that he has not laid down a proper ground for walnut: and it is impossible to get a good imitation on maple. In my opinion, the manner given in this paper, 'How to Treat Panels,' Nos. 7 and 8, are somewhat roundabout, and I am afraid the finish would not be as satisfactory in practice as it is set forth in theory. If I may suggest a method, it is this: maple your panel as stated, then pounce on the design, and fill in the design with a walnut *ground in oil;* let same dry, then grain over with walnut in distemper, as stated in your paper. Then take a fine pencil and go over the design with a little mixed turpentine and varnish; you will find very little difficulty in following the design you wish to fasten with this mixture of turps and varnish, as the walnut ground, being so much darker than the maple, will be perceptible through the graining. When dry, rub over with sponge and warm water, which will remove all the graining colour not required, and leave your design intact. To work your ebony ornaments, mix some lamp-black in beer, and coat over the panel where the ebony is required; then pounce the design on this black, and with the mixture of turps and varnish trace over the design to fasten: when dry, take sponge and water, and treat the same as the walnut. When these directions have been followed, go over the whole of the panel with a light-coloured varnish, so as not to darken the maple. In the article on Graining, I suppose the writer took it for granted that the amateur was capable of laying in and finishing a maple panel, as he fails to explain to him how to do either. When I took up my paper and saw the article above referred to, I thought that it would contain some useful information respecting graining, but found it simply treated with the decorative art proper, without giving a single method of how to imitate grained wood. I would like to point out that the decorator and the grainer are two distinct workmen."—[Notwithstanding the main portion of your criticism is based upon its writer's own misconceptions, it is but fair that your well-intentioned letter should be fully answered, if only from the fact that it is the only occasion of any directions contained in the "Art of Graining" having been questioned as to their practical reliability. Taking your points *seriatim*, which refer to the instructions on pages 772 and 774 (No. 100, Vol. II.), you "fail to see how he can get a good imitation of walnut by the way he suggests, seeing that he has not laid down a proper ground for walnut, and it is impossible to get a good imitation on maple." In answer to this, I would ask you—presuming you are a practical grainer—how much walnut figure it would be worth one's while to imitate on the dark ornament of panel No. 7? Scarcely any, I say, and therefore the main point of inlay work—real or imitation—is worked on the principal of contrast, of colour, or of shade. But here your practical knowledge of painted inlays must be very limited, since you say that to get a good imitation, the fine ornament of panel 7 must "be grounded for walnut." It is a matter of mere general comprehension that such an opaque coating of body-paint cannot be pencilled on or stencilled without showing a perceptible thickness, and which, when varnished, would have as much claim to imitation carving—wood in relief—as it would have to being inlaid—"let into." I say it most emphatically, that for purposes of ornamental inlaying, walnut, rosewood, etc., are best worked upon the "ground" of the lightest wood, and that in no case can good work be done by grounding each wood in its own special colour. I assume that "inlay imitation" is interpreted by my readers in accordance with the appearance of real marquetry, and not simply as one kind of wood colour painted partly over the surface of another. Further on you question the value of the "stopping-out" process as "being roundabout." Compared to pencilling in the ground for the ornament of panel 7, as you advise, stopping-out is simplicity itself. That it appears odd to you, and many grainers who may never have attempted anything out of the ordinary groove of graining, is very probable; but it declares at once that your criticism is based solely upon a limited practice and effort. The concluding article in No. 103 doubtless made things plainer to you, but it may be interesting to mention that one variation of the principle of "stopping-out," as applied to *stained imitation inlays*, was patented by a prominent metropolitan decorative artist, Mr. Andrew F. Brophy, about twenty years ago, examples of which work were shown by the eminent London firm, Messrs. Trollope, in the 1871 Exhibition. Further on, your ideas as to ebony, or black stencilling, on maple are scarcely more than items of very ordinary knowledge, to which a plain stencil of gold size and ivory-black (ground in turps) would be superior. Finally, you say that the writer took it for granted that the reader knew all about grounds and graining all varieties of wood, as I "fail to explain how to do either," and that you would like to inform me "that the decorator and grainer are two distinct workmen." I hope by the time this is published you will have gathered that the two inlay papers were the last of a *series of fifteen*, dealing on each and every practical aspect and process of imitating woods, preparation, grounds, graining colours, and manipulative treatment. As to the "distinct workman," such is, in many instances, the case, *unfortunately* for decorative art in general and the ordinary grainer in particular. Had the grainers of "the old school" possessed a better understanding of how far graining is a branch of decorative work, it would never have fallen to its present debased standing as an industrial or decorative art. For the individual grainer who is not a decorator in a fair sense of the word, there is yet some hope. If, as we earnestly hope, the Painter-Stainers Company call the proposed conference of the trade in the autumn, to consider the Technical Education of the Painting Trade, it is within the bounds of possibility that many more scratchers may acquire a practical knowledge, not only of graining and inlaying, but of designing, decorating, and the control of colour, such as many able judges to-day can credit to LONDON DECORATOR.]

**Paint, etc.**—F. L. B. (*No Address*).—(1) One of the most useful and reliable spirit lamps for burning off old paint is the patent "Paquelin." Its price is 12s. complete, and it is a simple contrivance, of which any parts may be renewed. Its chief advantages are: burning in any position, its great heat, simplicity of use and lightness. The cost of working it is about a halfpenny per hour. (2) For silvered plate, G. Farmiloe & Sons, Rochester Row, London; or Cashmore & Sons, Bristol, might suit you. This firm make up a quantity of their own small sizes into very cheap overmantles, thus saving waste or loss on small sizes in their stock. Remember the quantity bought has much to do with the price to the trade buyer. (3) The sashes which, after being painted, do not run well, are probably overloaded with paint in the runners. Remedy: clean off with a plumber's shave-hook and then repaint with two bare coats of *hard-drying* paint.—F. P.

**Paint, etc.**—No. 305.—Respecting your cement wall-skirting—or "boards," as you term them—you do not say how long intervened between finishing the skirting with Parian cement and painting it; "at once" is rather an elastic term. If the Parian was painted on the same day, that is an error of judgment, I think. Moisture is certainly the cause of the paint not drying, and probably of the roughness "at the edges;" this again is not sufficiently plain for the purpose. Notwithstanding all that plasterers may say to the contrary, I should not, as a practical decorator, like to paint Parian until three days after finishing. If the "roughing in" mortar be thoroughly dry and hard, and a thin coating of Parian only skimmed over it, a day might be long enough before painting. I should say in your case the Portland was either not dry and the moisture effected the finish, or else that the moisture of the Parian, instead of drying inwards, was prevented by the nature of the Portland from so doing, and the damp, therefore, came out on the face of the work. Roughness is often caused, after a time, by chemical action of paint and wall.—F. P.

**Painter.**—MIGRATORY.—The South Wales ports, Swansea, Cardiff, and Newport, have good seasons of your trade, whilst the northern ports of Liverpool, etc., are large centres of work also. The wages paid to house-painters in these large towns is about 7d. per hour in the south, and 7½d. in the north. As to time of year, March and thereabouts is a good date anywhere, and, of course, between October and February is the worst period for a stranger. The most important factor of the whole question is the amount of your own trade ability, steadiness, energy, and common sense.—F. P.

**Repairing Waterproof.**—W. H. (*Rawden*).—In order for you to repair a mackintosh in which the seams are giving out, it is necessary to provide some naphtha spirit—such as is used by makers of india-rubber waterproofs—and a small tin of pure rubber solution, which is generally to be purchased at the waterproofer's. Having got these, spread out the mackintosh on a firm table, and with a small brush anoint the two surfaces of the seam, where it has come apart, with naphtha, which will soften the old rubber and dissolve the dirt and grease. Care must be taken not to let the naphtha extend beyond the lap of the seams; and after it has been on the surface for some ten minutes or so, you may then apply the solution, taking care not to smear it on the surface of the mackintosh, or to let it extend further than the lap of the seams. Now match the lap carefully and evenly along, and then with a heavy flat-iron press down, and bring the two surfaces into close contact, so as to squeeze out any air that may be between them; and when this has been neatly done, go on with the rest of the seam in a similar manner, until the repairs are completed, when the mackintosh should be spread out so as to allow the naphtha to evaporate and the joints to harden. It should be borne in mind that it is a very wrong plan to fold or bundle up a mackintosh after wearing, and put it away in that state until it is wanted again. So soon as it is taken off after use it should be hung up or spread out, so that the *inside* is exposed to the air; and thus the condensed moisture from the heat of the body is allowed to evaporate, and the damp or moist surface dries. One night of this treatment will ensure its being dry and fit for use the next day; and by practising this system the durability of such apparel will be largely increased, and the liability to the softening of the seams greatly reduced.—C. E.

**Electric Light.**—W. J. (*London, N.W.*).—To light up a room 12 ft. square, you should have three 10 c.p. lamps; these will absorb ½ h.p., and can be fed with current from a small dynamo or from a large battery; you would find the battery an intolerable nuisance. From your letter I should think that you have no idea of the cost and trouble of laying down a small electric light plant with batteries. I therefore advise you to read carefully the series of articles on "Model Electric Lights," published in WORK, Vol. II., Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104. This will tell you all about the batteries: how to make them, what acids to use, and how to arrange the lights. The whole set of numbers can be had from a newsvendor for 9d.—G. E. B.

**American Clocks.**—I. X. W. (*Glasgow*).—Do you mean American clocks with electric self-winding or clocks actuated by electricity? as I know nothing of the latter, whether any are made or no; but the former is, I know, and I daresay you can get them from J. J. Stockall, 6 and 8, Clerkenwell Road, London, as he is an importer of American clocks of every description. Write and ask him.

nd no doubt he will forward his price list.—A. B. C.

**Model Alliance Dynamo.**—H. O. B. (*Manchester*).—You have omitted to give full dimensions with the drawing of the carcase of your dynamo, so I must guess at parts of the measurements. You have omitted the armature altogether. Supposing this to be a solid shuttle or H girder of 3 in. in length by 2 in. in diameter, you might get on it from 27 yds. to 28 yds. of No. 20 silk-covered copper wire. Supposing you have a wire space of 2 in. above and below the core (this having a diameter of 1¾ in. and a length of 4 in.), you might get on it about 6 lbs. of No. 26 silk-covered copper wire. Then, if the armature is driven at a speed of 3,000 revolutions per minute, you should get a current of from 2 to 2½ ampères at a pressure of from 18 to 20 volts; and this would be enough to light up a 20 volt 8 or 10 c.p. lamp.—G. E. B.

**Model Manchester Dynamo.**—J. McA. (*Glasgow*).—The drawing of your model toy dynamo is very good, and enables me to judge exactly its merits. It will make a very pretty toy, but nothing more. You could get no practical results from a Manchester dynamo having field-magnet cores ⅝ in. by 1¾ in., and a wire space of only ¾ in. between the cores and the armature channel. I do not think you would get laminations so thin in the web as those shown in your sketch; and if you got them they would be useless, because they would not admit a sufficiently strong spindle. If this could be managed, you might get 25 yds. of No. 20 silk-covered wire on the armature. This would be equal to 16 yds. of active wire, and would develop a current of 14 volts with the machine driven at a speed of 3,000 revolutions per minute. But to balance this for any useful purpose, you should be able to wind the field-magnet cores with at least three times as much No. 26 silk-covered wire as they will now hold. With a solid wrought-iron armature wound with No. 20 wire, and No. 20 on the fields, you might make the machine into a motor.—G. E. B.

**Geneva Watch.**—R. I. (*Horsforth*).—Cylinder pivots are turned in the ordinary turns with a graver, and are then generally finished with a conical file and burnisher. The file and burnisher is like an ordinary flat one, but with just the corner rounded off; one corner being cut as the rest of the file, and the burnisher left smooth. These answer well enough for general work or jobbing, but for best work the pivots should be polished in with oil-stone dust, then rouge or red stuff, and finished with conical burnisher. Some pivots are made square, same as any other pivot, and then the shoulder turned off conical or at an angle of about 45° after the pivot is fitted and finished off. The ferrule generally used is simply a piece of brass with a hole in the centre slightly larger than the body of the cylinder and a groove turned in its edge to take the horse-hair of the bow. Take a bit of sealing-wax, and let a drop fall on the cylinder and fill it; this will make it stiffer and stand turning better. Then take the ferrule, make it hot enough to melt the wax, and slide it on the body of the cylinder. Clean the wax off the centre, and turn your pivots. When done, drop the cylinder and ferrule in a drop of methylated spirit, and gently boil it till all the wax is dissolved; then clean with pith and peg, and see that none is left inside it.—A. B. C.

**"How to Make a Dynamo."**—Messrs. Crosby Lockwood & Son, 7, Stationers' Hall Court, Ludgate Hill, E.C., request me to state that they are the publishers of the work under this title, to which reference is made in WORK, Vol. II., page 726.—ED.

**Violin Making.**—J. S. R. (*Glasgow*).—As you will have seen by this time, the Violin Making articles commenced in No. 105, the first number of Vol. III.

**Enlarging Drawings.**—J. W. (*Edinburgh*).—Considerable mystification seems to prevail on this subject. When a drawing is said to be *half* size, it is considered to be half full size; and the drawing will be placed on and within an area *half the length* and *half the width* of the area on which a full-size working drawing is placed, and so on for other sizes. You say you wish to know how to raise or enlarge a drawing from full to half size, and you instance a certain drawing in page 760, Vol. II. of WORK, enclosed in a square 6 in. by 4 in. Supposing this to be half size, and you wish to enlarge it to full size: divide the area into ½ in. squares, and prepare another sheet of paper by dividing it into 1 in. squares. As the length and breadth of your *half-size* diagram are 6 in. and 4 in., the length and breadth of the *full-size* diagram will be 12 in. and 8 in. "Ah," you will say, "but the *area* of the full-size drawing will be *four* times that of the original." Precisely so: but in enlarging and reducing, the length and breadth only are taken into account, and not the area. Again, if you wish to reduce your 6 in. by 4 in. diagram to half size, divide your paper into ¼ in. squares, and the length and breadth of the half size will be 3 in. and 2 in. respectively. For ¾ size, take ¼ of length and ¼ of breadth of original size for reduction. In this case the area will be ⅜th of original area; but, as I have said, in these cases you have only to deal with *length* and *breadth*.—ED.

**Hammering Hand Saws.**—ANXIOUS.—Purchase the Indexes to Vols. I. and II. of WORK. Much valuable information has already appeared upon the subject in WORK.

**Watch-Cleaning Tools.**—W. K. (*Heptonstall*).—You cannot do better than follow the instructions lately given in a series of articles in WORK. The tools you will require are really very few: a couple of watch brushes, a couple of small screwdrivers, an eye-glass to see the small holes, etc., are clean, and a piece of deal to make a small peg or two for cleaning the holes. The brushes, eye-glass, and screwdrivers may be got from the tool shops for about half a crown. You will want a bottle of watch oil for oiling it after it is cleaned. I find Ezra Kelley's is very good, and seldom use any other, either for watch or clock; also a little tissue paper to hold the pieces while brushing and cleaning. When cleaned, put under a glass, say a wine-glass, to keep the dust from them. When the brush gets dirty, rub it on a piece of chalk, then on a dry piece of bread. Use a stiff brush first, and finish off with a smooth one. Should you require any further instructions, write again.—A. B. C.

**Piano Stool.**—W. J. (*Portsea*).—As you do not wish your prospective piano stool to be of the screw species, I gather that you do not want an adjustable article. If my surmise be correct, you must select the height, etc., of the stool for yourself, taking an ordinary small chair as a guide. While preparing this reply, an "idea struck me," which idea, or the outcome of it, is shown in the adjustable back in Figs. 1 and 2. I give it as being useful by offering accommodation to anyone desirous of

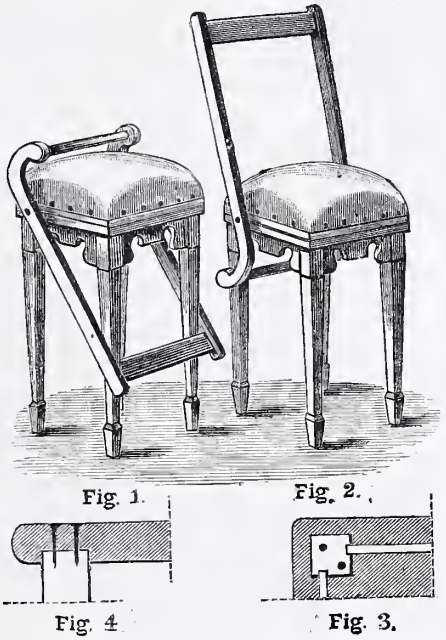


Fig. 1. Fig. 2.



Fig. 4 Fig. 3.

Piano Stool. Figs. 1 and 2.—Stool with Back down and adjusted respectively. Figs. 3 and 4.—Elevation and Plan of One Corner respectively.

obtaining further support than music stools generally afford. The back might be a fixture, but it will be convenient in more ways than one if made as I suggest. First, decide upon its most suitable height. Then hold it over the stool, as in Fig. 2, and shift it to various angles, keeping the pivot hole always on a level with the seat, to arrive at the inclination most likely to be appreciated as comfortable. The bottom spindle affords all necessary resistance when the back is being leaned against. I advise you to have a tolerably stout board, and mortise it within and adjacent to its four corners to receive the tops of the legs, which could then be screwed in position from the top of the seat-board (as in Figs. 3 and 4). Previously, slightly mortise the inner surface of each leg-block to receive the ends of the shaped pieces shown between the legs. Whether you omit a stuffed seat or use one, I recommend you to do as I say. Mr. Adamson's "An Armchair," lately published in WORK, will give you all necessary details relative to upholstery. Have a very wide framing to which the stuffing may be attached, and secure it to the solid seat-board by screwing from underneath and through the latter. Write again, with fuller particulars, if you want a stool with a more presentable appearance than this possesses.—J. S.

**Fret Machine.**—A. McC. (*Holywood*).—Ask your questions, and the author of the paper on the fret machine will answer you through "Shop."

**Enlarging Drawings.**—J. W. B. (*Huddersfield*). I am obliged to you for your reply to J. W. (*Edinburgh*) on this subject, but it is not the kind of reply that will be helpful to him. He has, moreover, been answered by myself, and the *modus operandi* made clear to him.—ED.

**Bass Bar, etc.**—B. T. E. (*Carlisle*).—The functions of the bass bar are both mechanical *and* acoustic. If the bass bar has been so much trouble to you, how have you gone on about the sound-post? as this little article performs functions equally as important as the bass bar.—B.

**Violoncello.**—J. D. (*Glasgow*).—The distances you desire to know are regulated, in the first place, by the length of the upper portion of the instrument: and secondly, by the position of the sound-holes. The length of string from "nut" to bridge should be about 27 in. Thicknesses depend not only on the area, but also on the quality of the wood. State which outline you intend to follow. Taken roughly, the length of the bass bar should be three-fourths of the length of the belly.—B.

**Violin Matters.**—L. F. (*Plymouth*).—The "figure" of the wood is natural, not, as you suppose, artificial. I do not know where Helmholtz's resonators can be purchased. I think the best way would be to take off the finger-board, and make the butt of the neck hot, say with a piece of hot iron. This would soften the glue; and by working the neck slightly from side to side, it would ultimately come loose. You should, before doing this, insert a sharp knife between the ends of the ribs and the neck, and also between the "tab" and the back of the "butt." Perhaps strong ammonia would remove the oil you complain of; but my idea is that the instrument is ruined.—B.

**Harmonium—Wood—Lubricant.**—W. W. (*Chelsea*).—Your numerous and varied questions should be written upon separate pieces of paper. Instructions on building an American organ will shortly appear.

**Scene Painting.**—J. M. N. (*Newcastle-on-Tyne*).—To become a professional "scenic artist" requires proper tuition, for which you have to pay a premium. The sum mentioned—viz., fifteen pounds—would indeed be low. There must also be the artistic taste, or all tuition is useless.—W. C.

**Earth.**—AUCKLAND.—We are unable, without making a qualitative chemical analysis, to give AUCKLAND any definite information as to the composition of the "yellow substance" contained in the sample of earth forwarded. If so disposed, you can have either a qualitative or quantitative analysis made. Analysts' fees vary; say one and a half guineas for a qualitative analysis, and two and a half guineas for a quantitative. We decline to recommend an analyst.—CHEMICUS.

**Incubator.**—W. S. (*Cambridge*).—A tray of water placed above the eggs, as suggested by you, would certainly be an improvement, were it not for the fact that the said tray would prevent the heat from tank being radiated on to the eggs. This being so, your plan will not answer. I would suggest a piece of sponge charged with hot water (replenished twice a day when airing the eggs) placed in a shallow cup in centre of egg drawer. Water would probably slop, hence the sponge.—LEGHORN.

**Clock.**—LOOKER ON asks, "What is the best clock for one to buy—either old grandfather or American, or any other make? price no object; a really good substantial article. How to know a good one when shown of any make?" It would have been more satisfactory if LOOKER ON had stated for what position and purpose he desires a clock, as that makes a great difference as to size and construction. But as he appears to put a general question, I will answer it in a general way. It may be taken as undeniable that high-water mark as regards time-keeping qualities is reached by clocks having the shape of the grandfather type. The best results are to be obtained from clocks with weights and long pendulums, as distinguished from those with springs and short pendulums. A common grandfather clock, if placed in a steady position and well regulated, should be made to keep better time than an expensive mantelpiece or bracket clock with springs and short pendulums. The most accurate style of clock is that used by watchmakers for "timing" purposes, and generally known as a "regulator." The best regulators have comparatively light weights—their mechanism being so delicate as to require little driving—and long mercurial pendulums. A first-class regulator may cost as high as £100. But LOOKER ON, unless he is an astronomer, can scarcely require anything so fine as this. I would advise him to try and pick up a second-hand watchmaker's regulator. A good one can often be had for from £10 to £20. Many good watchmakers have two, and even three, regulators, in which case one of the clocks will be that which they began with in their early days, and which, though not quite up to the mark from a scientific point of view, would be more than first-class for ordinary private purposes. Watchmakers are often disposed to part with a clock of this sort. As regards the last query, "How to know a good one when shown of any make?"—the obvious reply is that the way to know a good clock is to thoroughly understand the mechanism of clocks. Without such technical knowledge, neither LOOKER ON nor anyone else can tell a good clock from a bad one, except as far as the case and the outside appearance are concerned. The only general advice I can give him is that he should select a clock with weights and long pendulum. For the rest, he must either rely on his own technical knowledge or on the honesty of some reliable person in the trade.—HERR SPRING.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Window Flower Boxes.**—J. K. T. (*Perth*) writes:—"Could any reader give me some designs for window flower boxes in WORK? The season is now coming on for flowers to be put in the windows."

**Teasing Hair.**—A. A. (*Edinburgh*) writes:—"Will any reader give me information in regard to a machine for teasing hair by motive power, or, if they can be bought ready made, the maker's name and address? I would not like a very large machine—one capable of teasing 80 lbs. to 100 lbs. per hour. I would prefer to make the machine, if not too intricate."

**Pen.**—J. R. (*Walton-le-Dale*) writes:—"Will any reader tell me how to make pens that require no ink? I have seen one, and should like to know all the materials for making them."

**Air-Proofing.**—F. G. B. (*Brixton*) writes:—"Can any reader inform me how to render calico or linen perfectly and permanently air-proof?"

**Wood and Ivory Balls.**—F. G. B. (*Brixton*) writes:—"I shall be obliged if any reader can tell me if turned wood balls can be used for playing billiards (as ivory balls are so expensive), what kind of wood is suitable, and where could I get them?"

**Black Lead.**—F. P. (*Leeds*) wants to know if any of our readers can tell him how manufacturers put such a polish on blocks of black lead? He has made black lead into blocks, but cannot get a polish on the outside. A recipe for a good stove polish would be esteemed.

**Gas Engine.**—H. R. P. (*Nottingham*) writes:—"I shall be glad to know where I can obtain castings, instructions, and working drawings for making small gas engine."

**Fountain Pen.**—A. B. (*London, S.E.*) writes:—"I would like to construct a fountain pen; if you or your readers could give me sketches and particulars, you would much oblige."

**Brass Whistle.**—CLARIONETTE PLAYER writes:—"Would a correspondent kindly tell me how to make a brass whistle in as deep a tone as it is possible to make it, giving accurate size and pitch of holes? I have several pieces of good tubing, and every size up to ¾ in. internal measurement."

**Setting out Teeth and Cogs.**—X. (*Liverpool*) writes:—"I would consider it a great favour if you would give a plain method of setting out and proportioning the teeth of wheels, bevel cogs, and wooden cogs; and if any figures are wanted, let them be plain."

**Combined Bench and Tool Chest.**—T. R. B. (*Wandsworth*) writes:—"Will any reader kindly give me a design and instructions how to make a simple bench and tool chest combined, about 5 ft. 6 in. long, and 1 ft. 6 in. wide, to stand in corner of room, one side and one end against wall, but cased in and constructed to take apart easily if required?"

**Brush Making.**—B. S. (*Acton*) writes:—"Would any reader kindly inform me in 'Shop' where I could procure the wooden backs or handles for clothes brushes ready bored for receiving hair? Also the wire for pulling in same? I have a quantity of horse-hair I would like to make into brushes if the backs are procurable."

**Cattle Marks.**—J. H. M. (*Meath*) writes:—"I will feel obliged to be informed if there is any dye which would answer for marking cattle—a substitute for the tar brand, which does not last once the hair grows; if it would mark the skin, all the better. As there are so many cattle now that have had their horns taken off, it is hard to know how to mark them so that the mark will last for any length of time."

**Fire-Lighters.**—PHŒNIX writes:—"I shall be grateful if any reader can give full instructions for making tire-lighters (composition)."

**Colouring Photographs.**—A. F. M. (*Glasgow*) writes:—"I employ a good deal of my spare time in colouring photographs by the crystoleum process; and my experience (a pretty long one) is that the fixing on the glass with starch is not satisfactory. No matter how carefully done, glistening specks appear; it takes up a great deal of time; you are very liable to break the glass or tear the picture; and in rubbing down, if you intend to wax the picture, the photo is liable to lift in places, or, if you use a cleaning medium, it lifts in places at the edges. Although I have done many successful pictures, this is my experience; and I would be obliged if some of your numerous subscribers could favour me with a recipe for a cement which will fix the picture firm, quite transparent, without speck, and will not require the trouble and danger of rubbing out spots or air bubbles for any length of time, like starch."

**Checkering.**—CHECKERED writes:—"I should feel obliged to be informed how best to checker leather; also the tools or appliances requisite for the purpose."

**Petroleum Motors.**—CONSTANT READER writes:—"I should feel obliged if any of our readers would give me information on the above—their working, and the advantages they have over gas motors."

**Mandrel Head.**—M. H. (*Maiden Newton*) writes:—"I have just completed a mandrel head, the mandrel running through one brass bearing, and supported by a back centre. I now wish to make a 5 in. head, with the mandrel running through both front and rear of the head. Can any correspondent tell me if borings through the solid cast iron will prove a sufficiently permanent bearing, or had I better have brass bearings? I also think of adopting the parallel bored collars of traversing mandrels, though it is not my intention to add guide screws. Is this plan or a back centre best for a lathe for general use?"

**Photo-Lithography.**—PEN AND INK writes:—"I shall feel much obliged to any reader who will give me information on any branch of lithography or zincography."

**Bass.**—E. B. M. (*Tunbridge Wells*) would be obliged to any reader of WORK for information as to where he could purchase a small quantity of bass (I think it is called), the same as brooms are made of; it is also used for sweeps' machine brush-heads.

**Briar Wood.**—J. R. N. (*London, N.*) writes:—"Will any reader kindly inform me of a dealer in London from whom I can obtain briar root for pipe making?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Leclanché Battery.**—F. S. (*Carlisle*) writes, in reply to C. F. W. N. (*Forest Gate*) (see page 78, Vol. III.):—"You will be able to get a Leclanché battery of two cells, all complete, of J. Halhead, chemist, Carlisle, for 3s., which will answer the purpose for which you require it."

**Preserving Ice.**—M. (*Bishop Auckland*) writes, in reply to J. K. (*Middlesbro'*) (see page 78, Vol. III.):—"Make a box narrower at the bottom than the top, and bore holes in the bottom to allow water to run out. Set this on 1 ft. in thickness of faggots or reeds, over a trapped drain in the cellar. Line the inside 1 ft. thick with straw, and pack the ice in, broken into small pieces, adding a little water to make it freeze into a mass. Some advocate the addition of a little salt to form a freezing mixture. Cover with 1 ft. thick of straw; then cover box at least 2 ft. thick all round with non-conducting material (chaff or sawdust). You want to exclude all air, and allow any water to drain off at once."

**Tin Labels.**—THOMAS STEPHENS (*Paradise Street, West Bromwich*) writes, in answer to LABEL (see page 830, Vol. II.):—"We are in a position to supply any kind of stamped tin labels very cheaply."

**Tin Labels.**—W. NEEVES (*Southgate Street, Leicester*) writes, in reply to TIN LABELS (see page 830, Vol. II.), that "he makes a specialty of tin labels."

**Enamelling Slates.**—M. (*Bishop Auckland*) writes, in reply to J. D. (*Holyhead*) (see page 46, Vol. III.):—"The slate is polished smooth, then japanned or painted till of the required colour; the japan is hardened by stoving or baking. It is then smoothed with pumice-stone, and polished with rotten-stone. You might procure a book on the subject from Spon, 125, Strand; or Batsford, 54, High Holborn."

**Enlarging Drawings.**—G. M. (*Brixton*) writes, in answer to J. W. (*Edinburgh*) (see page 14, Vol. III.):—"The following rule will give the dimensions required: If a drawing is wanted half as large again, 'square each side, add half, and extract the square root.' Thus, suppose the original is 4 in. by 6 in.; the square of 4 is 16. To this add half (8), and this will give 24; the square root of this is 4·898 in., which is the measure of the shorter side. The longer side can be found in the same way, and will be found to be 7·348 in. If the drawing is wanted to be reduced, say to half the size, 'square each side; halve each, and extract the square root.' The sizes will be found to be 2·828 in. and 4·242 in. Both the above give the exact surface within a hundredth part of a square inch. Of course, they can be got nearer than this by carrying out the decimals farther. If J. W. wishes to know how the above rule is obtained, it can be demonstrated thus: In the case of enlarging, let $x$ represent the size we want for the smaller side; then $x + \frac{x}{2}$ (because 6 is 4 and half of 4) represents the longer side; and then $x \times (x + \frac{x}{2}) = 36$. This, worked out, gives $x$ equal to the square root of 24, which is the same as above."

**Stain.**—DOWN writes, in reply to S. S. (*Salford*) (see page 44, Vol. III.):—"To stain birch a mahogany colour, there is no simpler plan than dissolving some Bismarck brown in hot water and rubbing it into the wood with a rag. If the colour is too red, he can add a little vandyke brown to darken. It can then be polished in the usual way. I have often used the Bismarck brown alone with good results."

**Castings.**—H. E. (*London, N.W.*) writes, in reply to K. M. (*No Address*) (see page 14, Vol. III.):—"If you can get castings at 7s. per cwt., don't attempt to cast them yourself in such small lots as 1 cwt. or 2 cwt. per day, as they will then cost you half as much again. If you were casting tons instead of cwts. you could not do them much cheaper."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. D. (*Hull*); A WORKING MAN; P. Q.; THE VICTOR CYCLE CO; H. W. (*London, S.W.*); SOCRATES; W. S. S. (*Bristol*); T. M. (*Southampton*); A. H. W. (*Newcastle*); A. B. & Co. (*Belfast*); J. B. (*Leicester*); E. C. O. (*London, S.W.*); S. H. (*Rochdale*); LETTER CUTTER; H. S. (*Ipswich*); A. B. C. (*Newton Abbot*); INCUBATOR; H. H. L. (*Higher Bebington*); LITHO; G. S. (*Craven*); NEW READER; W. H. O. P. (*London, N.E.*); A. W. (*Aberdeen*); CYLINDER; J. W. E. (*South Darenth*); T. N. (*Halifax*); W. H. (*Penzance*); L. W. L. (*Wolverhampton*); PORTABLE HARMONIUM; A. R. (*Blackburn*); WUEDDLE; F. E. B. (*Hull*); R. V. B. (*Peckham, S.E.*); RULER; G. H. S. (*Kensington*), Z. Z. Z. (*Wednesbury*); T. A. (*London, S.E.*); J. S. (*Amsterdam*); T. F. (*Tamworth*); W. G. M. (*Limpharan*); A REGULAR SUBSCRIBER; H. S. (*Oxford*); W. B. R. (*Westbury*); S. R. (*Withington*); T. R. L. (*Hulme*); (W. B. (*London, N.*); SOLDAT; A. A. M. (*Clapton*); J. A. B. (*Leicester*); S. O. R. (*Nuneaton*); J. D. (*London, N.*); F. J. C. (*London, E.C.*); M. O. D. (*Hackney*); A SUBSCRIBER FROM THE FIRST; FRENCH POLISHER; NEVER DESPAIR; AJAX.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**Second-hand Lathes and Tools.**—Send for list; one stamp.—SYER & Co., 45, Wilson St., London. [3

**Complete Set of Materials** for making a Crippe Tricycle; partly finished; write for particulars.—ENGINEER, 133, Coronation Road, Bristol. [4

**Violin Wood.**—Seasoned, fine quality; ready for use; best tools; oil varnish.—HESKETH, 57, Lower Mosley St., Manchester. [5

**To Parents and Guardians.**—Drawing and Engraving on Wood.—HILL & Co., of 45, Essex Street, Strand, W.C., have a few vacancies for Pupils. Premium required, which will be returned in salary. [6

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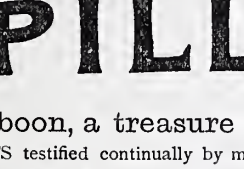


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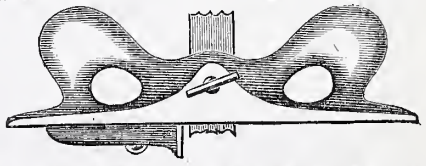

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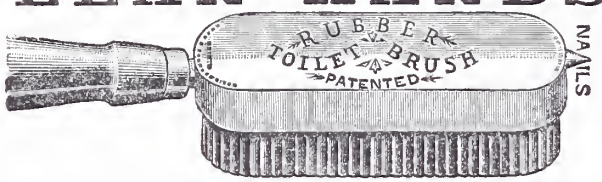


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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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### A CORNER CLOSET FOR THE HALL.

BY MISS F. M. GARDINER.

A VERY fair estimate may generally be formed of the powers of administration of the mistress of a household by the first glance we obtain as soon as the front door is opened. And it will be readily granted that the hall of an ordinary middle-class house can be rarely considered

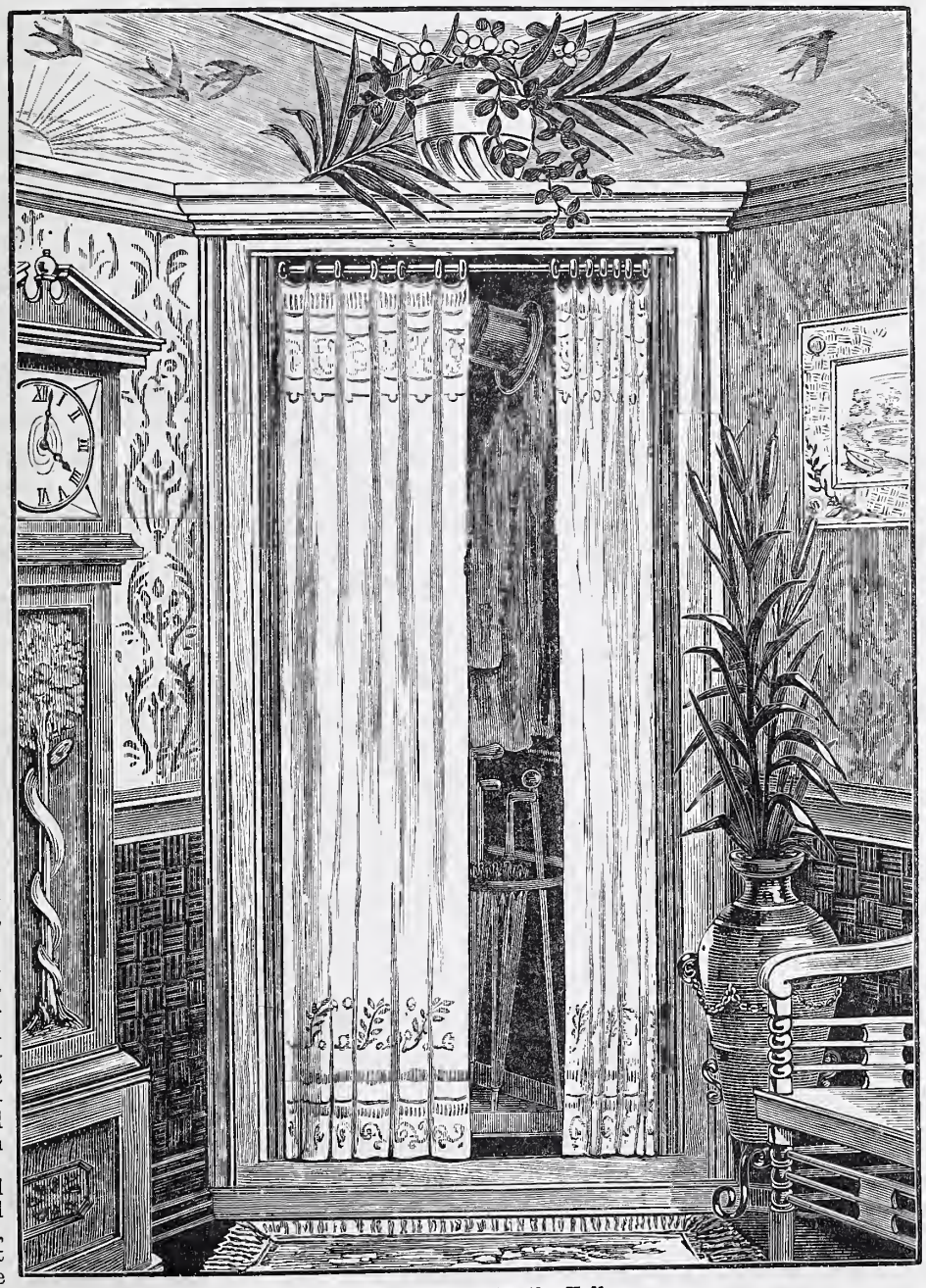
"A thing of beauty, and a joy for ever."

On the contrary, if the family is large, it often becomes a receptacle for the cast-off wearing apparel of its different members, and the repository for dripping umbrellas, tennis rackets, cricket bats, and various articles too numerous to mention, which might with advantage be transferred to a more suitable position.

To avoid the row of coats and hats, in a more or less dusty condition, as a rule found here, a small wardrobe, like the one illustrated, might be easily substituted, even in a hall of limited dimensions, for the pegs which one invariably finds there.

This might be placed in a corner, if the hall be large enough, or against a side wall, when it is not of sufficient size to admit of such a structure as I have suggested in the accompanying illustration. The framework and top could be made of any appropriate wood, or, where cost was a consideration, simply stained or painted to match the other fittings.

The interior should be liberally supplied with hooks and pegs, and the lower part with a rail and movable tray for umbrellas, also a small drawer for brushes, etc. These would be effectually hidden by curtains, attached to a brass pole by rings, yet, at the same time, be easily accessible. Such a piece of furniture would be welcome in any house, and is so simple in construction that it would be well within the power of even an amateur workman to execute.



A Corner Closet for the Hall.

From what has been said above, as well as from the illustration itself, it will doubtless be understood that the form of the closet must depend entirely on the size and shape of the hall, and that for the corner closet the hall must bear the semblance and proportions of a room of fair width, rather than those of the narrow passages that are too often misnamed by the application of this dignified title. Yet even in the passage itself, properly so called, it is often possible to introduce an arrangement of this kind, by affixing side frames of stained wood, with panels of cretonne stretched over thin board, or even millboard, on either side of the row of hat pegs and coat hooks to be found on the wall, covered in with boarding at the top and kept in position at the bottom by a slip of wood extending from frame to frame, and fixed to them at each end. A cornice should connect the frames at the top, and within the cornice should be a rod to carry the curtains that screen the hats and coats from view after the manner of the Portable Wardrobe, figured and described in page 150. Here is a rough outline for a useful article of house furniture, and it is assumed that those intending to make it will have a sufficient knowledge of carpentry to enable them to proceed without my giving step by step details. To those who are without this knowledge, a careful perusal of much that can be found in WORK concerning the elementary stages of carpentry will soon fit them for making this simple closet. For its decoration the enamels of the Foochoo Co., Aspinall, and others, will be invaluable.

## THE TAMBOURINE, AND HOW TO MAKE IT.

BY OMADAUN.

A Pretty Article for Decoration—Its Construction—The Hoop—Cheap Jingles to be avoided—Brass Nails of Two Kinds—Choosing a Vellum—How Stretched—Utilising a Cheese Tub for Making Hoop—Suggestion for Decoration in Water Colours.

This is an article which of late years has soared high, and attained to an eminence for decorative purposes never dreamed of in its humbler days, when—so far, at all events, I believe, as this country is concerned—it was the almost exclusive monopoly of the black cork fraternity. Now, a good tambourine, well painted, is a really pretty object, but the so-called art tambourine supplied by the fancy shop is an abomination, not worth bestowing good work upon; whilst the genuine article is rather costly—at least, in proportion; and it is so easy of construction, that I hope a few hints upon the subject may not be considered out of place in these pages.

I will first deal with the tambourine proper, if I may so call it. It is evident that this must be stoutly made, or it will not hold together long, seeing the arduous duty that it has to perform; and, although I have made one from an old cheese tub, and used it too, I do not advise that material, except for one intended for ornament only, when it may be used if economy is a consideration; of which, more anon.

A good solid hoop of oak or ash, steamed and bent to a circle, ready for joining and finishing, can be bought at many instrument makers' for about one shilling, and it will be far better to buy one of these than to attempt to bend one from the straight piece, which is hardly practicable for an amateur to accomplish satisfactorily. Choose a hoop of as near a true circle as possible, and a convenient size will be 11 in. diameter and 2 in. deep. The two ends should be tapered, and overlap for about 4 in.; they are then glued, and firmly cramped together. When set, this joint is smoothed off with plane and rasp, and the hoop nicely finished with sandpaper; the joint should then be hardly perceptible. The top edge may now be slightly rounded, and six slots cut at equal distances for the jingles; this is easily done with a fret saw, or they can be drilled out and finished with a file; they should not be cut quite in the centre of the hoop, but a little nearer to the bottom edge. With regard to the jingles, avoid cheap ones; the cost of the best is so little, a few pence only per pair, and the look of the tambourine is so materially enhanced by them, that they are well worth the trifling extra outlay. For my own part, I like an ebonised hoop, and plated jingles, but this perhaps is a matter of taste; if preferred, the hoop can be either stained or left its natural colour, and polished. Mark a line round the top, about ¼ in. from the edge, and drill a row of holes all round, about 1 in. apart: these are for the nails to be pushed through when stretching the vellum. There are two sorts of these nails to be had—some with brass heads and iron shanks, about the thickness of a panel pin, the others being entirely of brass; the former are better finished, but the latter sort are easier to clench, and are the ones generally used.

In purchasing a vellum, choose a good stout one, which is of an even thickness throughout; it should be about 3 in. wider in diameter than the hoop, to allow for turning over and finishing. Place it in a basin of water for a minute or two, not more; then take out, and allow the superfluous water to drain off. Pierce a hole in it with a stout needle or awl, about 1 in. from the edge, push one of the nails through, and then through one of the holes in the hoop, and clench it on the inside; pull the vellum tightly across, and put in a nail on the other side; now put one in on each side again, between the first two, and proceed in the same way until all the nails are inserted. The vellum must be stretched well before each nail is put in, and perhaps the easiest way to do this is to pull it with a pair of pincers. If the holes have not been drilled too large, and the nails fit tightly, it will not be necessary to clench each one as it is put in, but they will hold quite well by being simply pushed through, and can be clenched when they have all been inserted. Cut away the superfluous vellum to an even margin with a sharp-pointed pocket-knife, and when dry, it should be as tight as a board, making as good a tambourine as you can wish for. I need hardly say that the jingles are fixed by a wire or pin running through them. If, however, one is wanted for ornament only, there is no need to make it of quite such solid materials; and here, if, as I have said before, economy is a desideratum, a cheese tub may be utilised. The grocer will supply one probably for the asking: it must not be too thin, or it is likely to buckle and come out of shape when stretching the vellum, so choose as stout an one as you can get; there will be no difficulty in forming a circle of the required size from this material. The vellum, also, need not be so stout as our former one, and if the whole is to be painted over, an old parchment deed may be used if there is one side not written upon, which I need hardly say must be uppermost; but a clear vellum will look better if it is intended to let it show as a background for the painting. Put in six pairs of jingles, good ones, the same as before; they go a very long way towards giving a genuine look to the tambourine. The hoop can be either painted black or in colours, or left natural, according to taste. If a cheese tub has been the material used, it will probably look best painted, and as this wood is likely to be rough and coarse in the grain, it may have to be filled in with plaster of Paris, mixed with water to the consistency of thick cream; rub this in with a rag, and when dry, clean off with sandpaper. This tambourine will have to be painted upon in oils, but I would suggest that instead of a vellum being used, a piece of good paper—such as "Whatman's"—could be substituted, upon which a water-colour drawing could be executed. I have not myself tried this plan, but I think there would be no difficulty in stretching the paper on when damp, and perhaps a little glue round the edge would be advisable, the nails, of course, being used, but chiefly for ornament.

This would not perhaps be so durable as the usual style, but it would at all events be a variety, which has a certain amount of charm in itself always, and a little water-colour sketch can be so easily and quickly executed that it would not be a matter of great difficulty to renew the painting. The nails should not, in this case, be clenched, so that they could easily be withdrawn, and a fresh piece of paper stretched when required.

Although I have used a tambourine made out of a cheese tub and stout drawing paper, as I have said, it must be borne in mind that this form of the instrument, though serviceable enough for decorative display, is by no means so useful for musical purposes as one made of vellum.

## THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

Purfling—Carving-Block—Modelling—Grooving for Purfling—Purfling Waists—Mitres in Purfling—Scraping and Sandpapering—Ribs—Removal of Ribs from Inside to Outside Model—Waists—Hollowing Back—Sandpapering Back, etc.—Cutting Sound-Holes in Belly—Hollowing Belly—Fitting Bass-Bar—Rounding Top, etc.—Gluing Ribs to Back—Gluing on Belly.

**Purfling.**—Having got thus far, we may now turn our attention to the ornamentation of the instrument, known as "purfling."

*Carving-Block.*—A carving-block is now required, and as they are inexpensive and you can get on so much better, you had better make two. Get two pieces of deal 15 in. by 9 in. by 1 in. or 1½ in., plane one side of each piece true, and mark the outline of the ribs on each planed side, and have the shapes cut out by a band saw. In both rough sides bore a small hole central of length and width, and "tap" or make a thread in it with the point of the carver's screw, using the square hole in the wing nut as a wrench. The back and belly should each be glued on one of these carving-blocks, by putting a dab of glue about 3 in. from each end, and cramping them to the blocks with iron cramps or with hand-screws. In a few hours these will be set, and you can proceed with the rough modelling and purfling.

*Modelling.*—Turn the carving screw firmly into the block on which the back is glued, put the screw through the bench, and turn the nut up to the under side of the bench. It is better to work the back first, as it will be first required. Now with smooth plane, *across the grain*, give the arching, roughly, of Fig. 9. Afterwards, with No. 4 gouge take off the thick parts of the wood, and aim to give a curve from the ⅜ in. line to the centre joint.

*Grooving for Purfling.*—The purfling tool must now be set with one blade $\frac{5}{32}$ in. from the brass roller, and the other exactly $\frac{1}{16}$ in. further away, and screw it firmly up. A double line must now be traced all round, distinct, but not too deep; the lines must then be cut deeper with one of the fine, keen-pointed knives (B, Fig. 5, p. 85), always cutting off the end of the grain. The grooves should be cut to a depth of $\frac{1}{12}$th of an inch, which is the depth the purfling should be.

*Purfling Waists.*—The piece of wood between the lines in the *waists only* should now be taken out with a router (C, Fig. 5), the greatest care being taken neither to go through or split any pieces from the edge of the groove. The dark line in Fig. 11 is intended to represent the way in which the groove should be cut when ready to receive the purfling. A piece of purfling should be cut to completely fill this groove; when fitted, run glue all through the groove, and tap the purfling into its place with a small hammer. With a sponge dipped in hot water remove the glue, and rub the purfling more perfectly down with the tail end of the hammer. When both waists are purfled, lay the back aside to dry, and proceed in like manner with the belly. It will be remembered that the "tab" prevented the gauge from going completely round the back. The lines must therefore be joined with the compasses, care being taken to preserve the sweep or curve.

*Mitres in Purfling.*—The entire grooves will now be ready for cutting, and the utmost care will be necessary in making

the mitres at each corner, as also the joints in the pieces of purfling. The purfling already in the waists will require to be cut down in the direction shown by line *a a* (Fig. 11). Your next business is to make the mitres on the pieces of purfling, which must be done so well that the points of both inner and outer blacks as well as the whites finish together at a very acute angle. It is said that in the Cremonese purfling, the outer black is run a little beyond the meeting point; the delicacy of this apparently trifling process will be best appreciated by those who try to do it. After all the mitres are fitted to their places, make bevels at the other end of each piece in such a manner that when glued in no joint will be perceptible. I find it more convenient to put the upper and lower rounds of purfling in, each in two pieces, as the mitres can be made much safer and better than when only one length is used. When purfling the belly, do not attempt to make joints at either top or bottom; the insertion of the neck in one case, and of the bottom nut in the other, will obviate all necessity for doing so. When all the purfling is laid and rubbed down, sponge the edges all over with hot water; this will not only take off all glue from the surface, but will make the purfling fit better. Now put aside to dry while purfling the belly, which being accomplished, take the back in hand again. Open the compasses to $\frac{5}{16}$th of an inch, and trace a line round the back that distance from the edge. Fix the screw through the bench as before, and, following direction of arrows in Fig. 2 (p. 5), with No. 6 gouge cut a hollow between the compass line and outer edge of purfling all round, leaving the corners B, B, until last. If by mischance you happen to make the edge of the hollow irregular, go round again with the gouge, this time a little over the purfling, and cut in opposite direction to the arrows. When the hollow is satisfactorily carved, complete the lengthways arching (Fig. 9) with flat gouge and oval plane. Then give (at A, Fig. 9) the requisite form across the waist with No. 4 gouge; after having done this, with gouge No. 2 and small planes gradually "melt" the archings into the hollow all round, taking care that the hollow be not damaged; if your wood cuts rough, reverse your cutting. Never attempt to carve the wrong way of the wood.

*Scraping and Sandpapering.*—With the scrapers, very sharp, take out all plane marks, and with sandpaper No. 1½, used on cork rubbers, sandpaper all over, but do not spoil the modelling in doing this. Brush off all the dust, and sponge all over with cold water; and whilst the back is drying, model the belly in the way described. By the time this is finished the back will be ready for another scraping and sandpapering—this time with finer paper. Should any inequalities be shown up by the wetting, these must be adjusted with the scrapers before papering. After this operation is performed, again sponge the work over, as ultimately by doing so you will obtain greater solidity, and less liability of the grain rising when the varnish is laid on. The belly should now be attended to in the same way.

**Ribs.**—The next step will be the manipulation of the ribs and their attachment to back and belly.

*Removal of Ribs from Inside to Outside Model.*—The ribs should now be taken off the model by inserting a knife between each block and the model, and giving the knife a tap with the hammer. In this way break the glue which holds the blocks and the model together. When all are loose, gradually ("*poco a poco*," as a fiddler would say) press the blocks in turn out of the model, but mind not to loose any of the ribs in doing so. The ribs should at once be placed in the outside model or frame, and have the linings put in them. Take the lining strips and file one edge to a nice round or bevel, whichever you fancy is the prettier, and cut them to fit in between the blocks; make each end which touches either top or bottom blocks a little wedge-shaped, so that when glued and pressed into position they will fit tight; leave them a little "proud" of the ribs.

*Waists.*—When all the eight upper and lower bout linings are in place, sponge all glue off, and attend to the waists. Of course, the linings of these will require to be bent in the opposite direction to those already put in, and may be run into or only just made to fit between the blocks 2 and 3, 5 and 6. If you adopt the latter method, the ribs should, when all linings are fitted, be drawn a ¼ of an inch out of the model, and the linings fastened at each end until set with a cramp (P, Fig. 5). When these are set, press the ribs through the other side of the model, and fix the other two linings. Another way to fix waist linings is to make blocks to fit all over the linings of each waist, and cramp them to the model. Still another way, is to cut a groove in each block with a $\frac{1}{16}$ in. chisel, and run the linings into these grooves. You may use your own discretion as to which method you select. When dry, plane the linings level with the ribs, reduce the top block to ¾ of an inch, the bottom one to ⅞ths, and round the corners off with No. 3 or No. 4 gouge. Next with flat gouge carve remaining blocks level with the linings, giving the inside the guitar shape, and sandpaper all round the insides, using a rubber, to prevent the sharp corners of the gluing edge of the linings being taken off. A great deal of taste may be displayed in lining and in carving the blocks. I have put linings in and carved the blocks in a variety of ways, some of which make the inside of the ribs look very pretty, but these are only "fads," and "utility" is the order of the day.

*Hollowing Back.*—Now give the back a final sandpapering, and then take it off the carving-block by forcing a knife between them from each end; you may now mark the back from inside the ribs. With fiddle cramps fasten the ribs into the position originally traced from the outsides, and mark round the insides with thick lead-pencil; now remove the ribs and replace them in the frame. This done, cut two pieces of deal 5½ in. long by 1 in. by 1¼ in., and glue on them the three pieces of wood, ⅛ in. thick, marked at A, A, A (Fig. 13). Instead of gluing these pieces on, the blocks may be recessed ⅛th of an inch, but the first way is simpler. As soon as your hollowing blocks are ready, lay them on the bench, put the back upon them in the position obviously laid out for it, and through a hole in the bench at each end pass one of the iron cramps, and with a protecting piece of wood, about 2 in. long, on the back, and under each cramp, screw the latter up tight. Next put pieces of cork, 3 in. long, 1 in. wide, and depth to fit under and across each corner; also a small piece under the joint midway of its length. Do not put these pieces in too tight, just sufficiently so to make the back solid. With No. 4 gouge now carefully proceed to hollow, working very steadily, and cutting from inside the pencil mark to the joint. Take only small cuts, constantly trying the thicknesses with the gauge until you have half the back hollowed to $\frac{1}{32}$ in. more than those given in Fig. 14. This is to allow for toothing, scraping, and papering. One side being roughly hollowed, turn the back round, and work the other half in the same way. The thicknesses given in Figs. 14 and 15 are not, of course, absolute; the varying qualities of wood will necessitate slight modifications. The gouging being finished, with tooth plane reduce to a *shade* above the proper thickness, at which you must arrive with the scrapers. *Do not be afraid of using the gauge too frequently.*

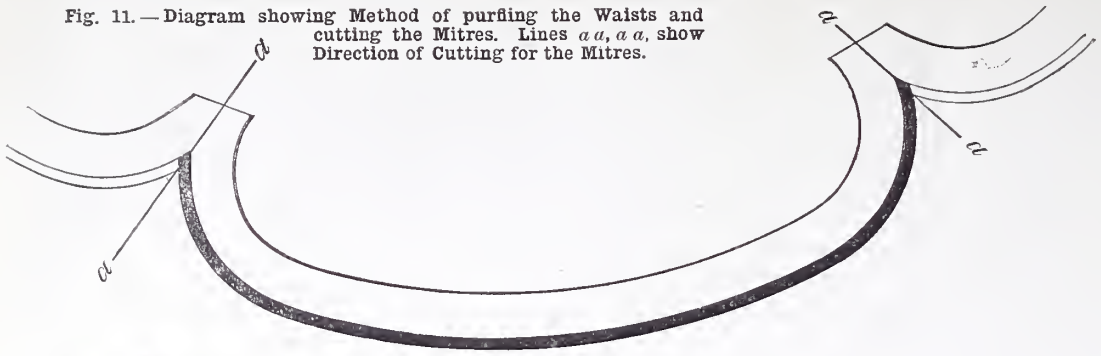
*Sandpapering Back, etc.*—After scraping and finally adjusting the thickness, sandpaper all the inside to a good face. The edges may now be rounded. This is done with a round side of a rather fine file, taking off the square edges, and making the entire projection from purfling to rib-line a beautiful roll. Then paper up without destroying the roundness of the edge, wrap it up, and put it out of the way. Do not attempt to do anything with the tab yet.

*Cutting Sound-Holes in Belly.*—The belly, still on the carving-block, will now require fine sandpapering, and the sound-holes to be marked on it. Place the pattern (Fig. 16) parallel with the joint (which will, if all has been carried out as described, be exactly central), with its centre mark, A, 6¼ in. from the bottom of centre joint. Then with a very fine pencil, and with the greatest care, trace inside the pattern. Now reverse the pattern in exactly corresponding position, and mark in the same manner. The circular holes must now be cut out with punches or centre-bits. With the first-named the position is easily determined: press the punch, and at the same time give a circular motion to it. Cut a clean hole—if right through, so much the better; but if you use the centre-bit, take care that you are absolutely central, and do not lay on too hard, or points B, B, will be *shaken* and afterwards *taken* off. You may now follow the pencil line with a knife, cutting in the direction of the arrows. The straight lines, C, C, must be cut from the points. Sound-holes may also be cut out with a fret saw.

*Hollowing Belly.*—The belly should now be taken off the carving-block and hollowed in the way described for the back, or nearly so, as, being different wood, it will require a little different treatment. When you have finished the hollowing, scraping, and papering, the sound-holes may be trimmed with the knife and small files, and the V's cut.

*Fitting Bass-Bar.*—The bass-bar should next be fitted as follows: first plane it down to $\frac{3}{16}$ in., and cut it square off at 10½ in. Now make a pencil line parallel with the joint, but $\frac{5}{16}$ in. distant from it, down the right-hand side, and 1¾ in. from both top and bottom outside edges; make ½ in. marks at right angles with the pencil mark. The position of the bar is now fully marked out. With the flat gouge roughly fit the bar to its place, keeping it perfectly upright. Chalk the bar position well over with a piece of chalk similar to that used for billiard cues, as it is more free from grit than common chalk, and putting the bar close outside the pencil mark, draw it slightly backwards and forwards, pressing gently downwards all the time. With flat oval plane carefully take off the chalk marks which appear on the bar, and repeat the process until the chalk shows all over the fitting edge of the bar, when it

Fig. 11.—Diagram showing Method of purfling the Waists and cutting the Mitres. Lines *a a*, *a a*, show Direction of Cutting for the Mitres.



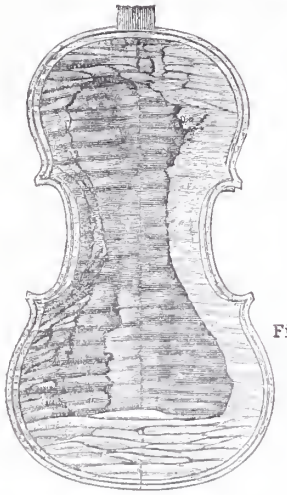



Fig. 8.—Back with Edge reduced ready for Purfling.

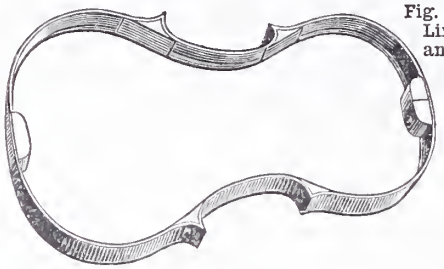


Fig. 12.—Set of Ribs with Linings in; Blocks carved and finished.

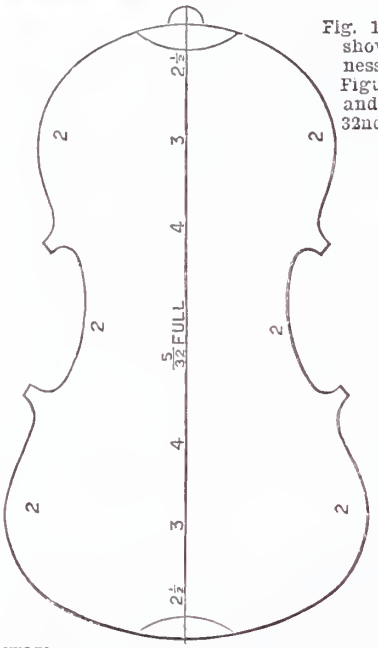



Fig. 14.—Diagram showing Thickness of Back. Figures in Figs. 14 and 15 refer to 32nds of an inch.

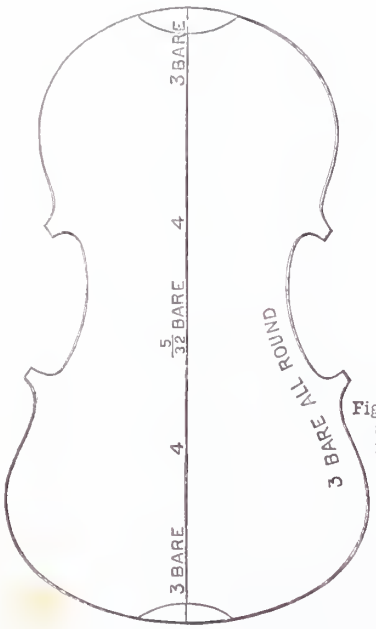



Fig. 15.—Diagram showing Thickness of Belly.

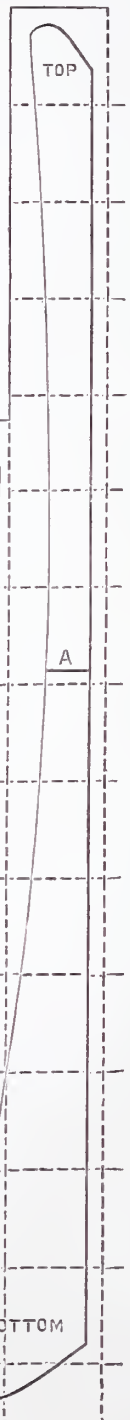



Fig. 10.—Pattern for Arching across Waist at A (half size).

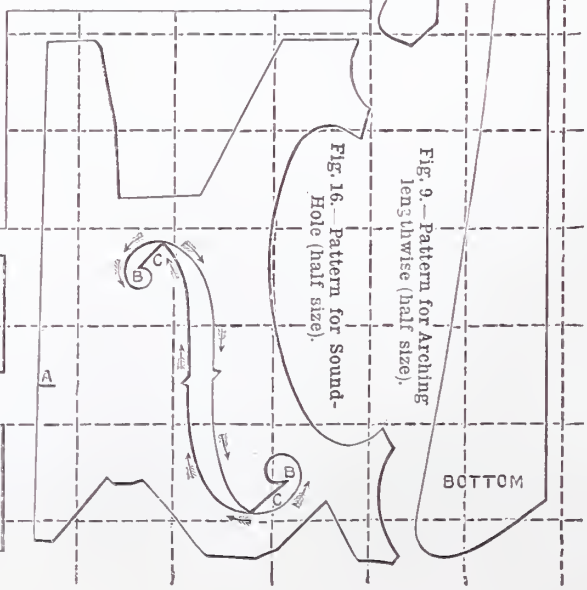



Fig. 16.—Pattern for Sound-Hole (half size).

Fig. 9.—Pattern for Arching lengthwise (half size).

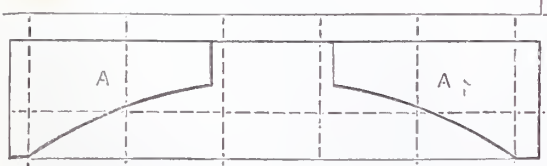



Fig. 13.—Blocks for Hollowing (half size).

will be ready to be glued in. This may take you a few minutes or it may take a long while, but it must be done properly. Now remove all the chalk with a dust-brush, glue the bar, and cramp it in position with the bass-bar cramps (H, Fig. 5). A little fine sawdust should be thrown along the angles formed by the bar and the belly, then with a narrow chisel remove both sawdust and the glue which it will have taken up. When the bar is quite set, plane it down to the right size $\frac{3}{8}$ in. deep at the point where a line between the two inner V's of the sound-holes would cross it, and gradually diminish with a slight curve to $\frac{1}{16}$ in. at each end.

*Rounding Top, etc.*—With rough sandpaper, followed by fine, the top should next be made round.

The edges of the belly should now be made round in the manner described for the back. The sound-holes, when finished, will be rather larger than the pattern, as they have been traced inside a zinc pattern, and it is intended that all the lines should be cut away.

*Gluing Ribs to Back.*—Before fixing the ribs to the back, the blocks should be sized by giving them a good coat of glue, then burning the glue with a hot iron, afterwards rasping off the burnt glue. This effectually stops the blocks from absorbing any more glue. A coat of very thin glue on the rib edges is also beneficial. The ribs may now be glued, placed on the back to the position marked from the outsides, and the end blocks be cramped down with iron cramps, having a piece of wood between cramp and back, to prevent the latter being marked, and also to extend the pressure over the blocks; use the violin cramps all round, and when all are secure, sponge all the glue from inside.

*Gluing on Belly.*—In a few hours you may clean the inside with fine sandpaper, affix your label, and glue the belly on; if any glue should run down the inside, sponge it out directly, as you will not have another chance, but be quick, or the glue will be cold. When the belly is set, remove the cramps, and cut the recess for the bottom nut or rest, over which the tail-band or main-brace passes. With the dividers opened to $\frac{3}{8}$ in., make

a dot close inside the purfling at each side of the centre-joint, and with a knife and small straight-edge cut out the oblong piece of the belly thus described, and fit a piece of ebony $\frac{5}{16}$ in. square into the recess. When set, curve and file the ebony to the same sweep as the belly round it, and at $\frac{1}{4}$ in. from each end curve it down to the belly. The "box" is now made, and begins to look like a fiddle. In my next and last paper on this subject, I shall endeavour to show how the fiddle is finished and strung up.

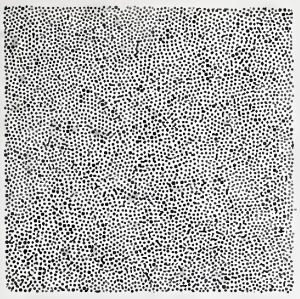


Fig. 2.

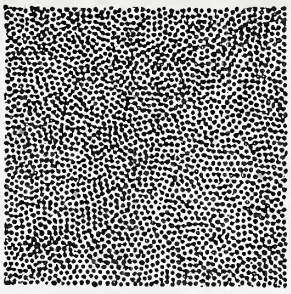


Fig. 3.

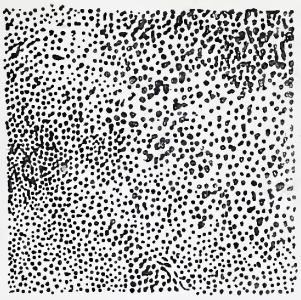


Fig. 6.

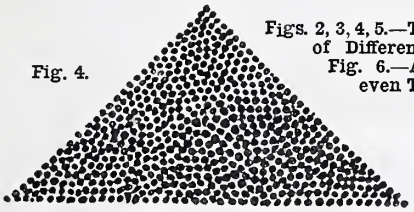


Fig. 4.

Figs. 2, 3, 4, 5.—Tints of Dots of Different Sizes. Fig. 6.—An Uneven Tint.

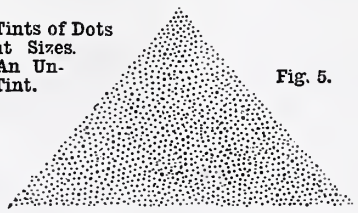


Fig. 5.

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

### Technical Work: Stipples.

First Efforts—Stone for Stippling—Position of Stone—Rest for Hand-Board—Hand-Rest Dots—Taking out Dots—Drawing Tint—Tints in Stars—Flat Tints in Lines—Plates of Tints.

Presuming the student already to have a knowledge of drawing, shading, and colour, he should commence by practising the technical part of lithography, after which we will take him through the different stages, beginning with a simple circular consisting of just a little writing, and proceeding until a finished chromo-lithograph in half a dozen printings is obtained.

Although precisely the same treatment of work is required technically in drawing on stone, whether the subject to be drawn is in colour (chromo-lithography), or merely in black and white (lithography); still, it would be better that the student should keep to black and white in its simplest form, at any rate, until he has mastered the first principles of the art.

There are two ways of working lithographic drawings, namely, stipple and chalk work respectively.

In order to practise stipple work the novice should have a clean polished stone about 12 in. by 20 in., that being a good size for practising, and also a block of wood about 6 in. high, 4 in. wide, and 2 feet long, on which to rest the stone, and so tilt it for convenience in working. (Fig. 1.)

For some work, such as ruling lines, drawing curves, etc., the stone would be better flat, and if a thick pad, made of brown paper, is placed underneath, about the centre of the stone, the artist will find he can turn a comparatively large one in any direction he pleases; but for a drawing he will find the above much more convenient, especially in reaching to the top of big stones, in which case a narrow piece of wood, nailed to the edge of the bench, would prevent the stone from slipping. For very large work, such as posters, etc., there are proper fixtures made, but in these cases the work is necessarily done at the printer's, it being impossible to move such huge stones about with convenience.

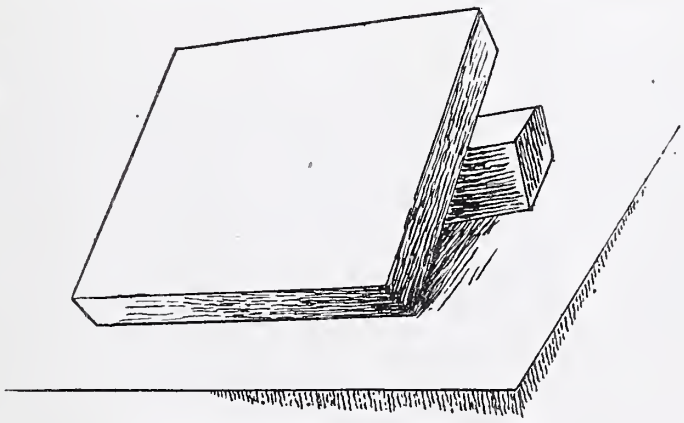


Fig. 1.—Position of Stone on Block and Table.

Gum a strip of mill-board about $\frac{1}{4}$ in. wide down the left and right edges of the stone, on which to rest the hand-board, and prevent it touching the drawing to the detriment of the work, and also gum a piece of white paper along the bottom edge, large enough to cover it, and if this be turned back at the top gradually as required, the stone will be kept covered and free from dust, etc., during the progress of the work.

The hand-rest should consist of a piece of wood about $\frac{1}{4}$ in. thick, 4 or 5 in. wide, and about 2 ft. long, having bevelled edges. A pad is sometimes used in place of it, and can be made of a couple of sheets of brown paper covered with a clean piece of white paper, and on which the pens and chalk can be tried.

Now rule three or four spaces, about 1 or $1\frac{1}{2}$ in. square, with a lead pencil, at the top left-hand corner of the stone, and in the first make an even tint of dots, of any size as long as they are uniform. The student must remember not to work over the blacklead line, or it may prevent fine dots penetrating to the stone, and a white line be the result when printed, especially if a soft lead pencil be used.

Figs. 2, 3, 4, and 5 give examples of different size dots, which it would be as well that the student should copy and get perfect before proceeding any further. He will, perhaps, find that until he obtains full control over the pen, sometimes, against his will, a dot will be made larger than he intended. In such a case leave it until the whole tint is finished, and then cut it in halves by means of the steel pointer, or else place the pointer in the centre of the dot, and by giving it a sudden twist round a slight hole will be made in the stone.

In taking out lines or dots, the stone must be scratched, it not being sufficient only to remove the ink; for, although not perceptible, it may still roll up in printing. The ink having once touched the stone, adheres so strongly to it that it cannot be removed without scraping away some of the stone at the same time, and although the part thus scraped will appear white in comparison to the surrounding stone, it does not affect the work when printed.

To draw tints like Figs. 2, 3, 4, and 5, make a dot, and use it as the centre of a star, then make about five dots round it, and so continually make it larger by placing each successive dot exactly between two other dots, and exactly the same distance apart. Thus, if the dots are of uniform size, the tint will be perfectly even; if too much space appears in any portion of the tint between the dots, it

Fig. 7.

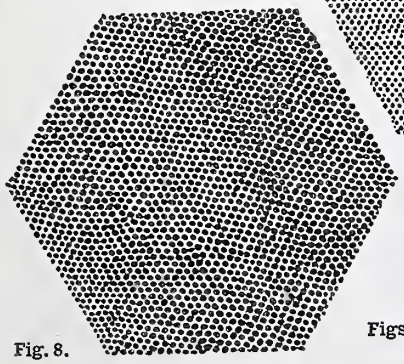


Fig. 8.

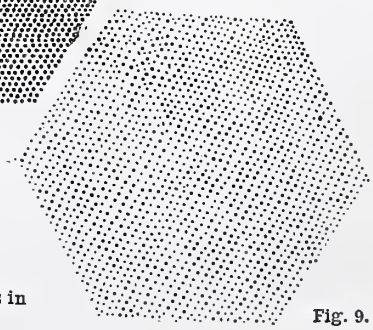


Fig. 9.

Figs. 7, 8, 9.—Tints in Dotted Line.

may be rectified by filling it with finer dots placed between the others, which would not materially affect the tint when finished, if carefully executed.

At starting, the novice will find that the dots, instead of appearing round, will look like triangles; this is because the pen has been dragged unconsciously along the stone, and perhaps only worked on one nib. The pen should be worked on both nibs and held nearly upright, so as to work on the point; it must be placed firmly on the stone, and lifted from it in exactly the same place. The longer the pen is allowed to remain on the stone the larger the dots will become. Fig. 6 is a specimen of uneven tinting and bad dots.

Unless the pen is cleaned frequently the ink will dry in it and get clogged, the substance of it being so much thicker than the ordinary writing fluid.

It is necessary to make a perfectly black dot on the stone, or the acid will eat through the ink quicker in those parts where it is weak.

Figs. 2 to 6 are examples of working different tints in stars, and Figs. 7, 8, and 9 show specimens of tinting where the dots are worked in lines. The student will soon observe by experience how closely one line should be placed to another, and the various sizes the dots should be made for different kinds of work.

In making a flat tint in dotted lines, the same as in stars, the dots must be placed between, and not underneath, each other to obtain an even tint, which at present is the student's ambition, and he should well understand that it is better not to depend on rectifying any mistakes in his work by means of scratching with the needle, or filling in with dots, as he would be likely to get into a careless way of working, and be very disappointed when his work was printed. If the tint is not progressing satisfactorily, the student must not get out of patience with his work, as that would only make matters worse, but try another pen or clean the one in hand, see that the ink has not got too thick, rule another square, and try again; and if he takes to heart that the cleaner the stone is kept, the blacker the ink is, and the rounder, firmer, and more uniform the dots are, the more even his tint will be, the clearer it will print, and the more satisfactory his work will eventually turn out.

Of course, there are times when it is not necessary to be so particular over a tint, but if the artist can do the best and finest work he can easily do the other; but on the other hand, if only able to do the common class of work, he will find himself at a great loss when wishing to undertake a better style.

Steel plates are made consisting of dots, lines, curved lines, curved dotted lines, etc., etc., which can be transferred to stone by gumming over the parts not required for the tint, and then placing a transfer from the plate upon it, the gum preserving the stone where no tinting is required. This saves the artist a great deal of trouble in large, flat tinting, but is principally used for colour work.

Having now become familiar with the use of the pen and gained full control over the same, the student should next attempt a shaded tint by means of dots of various sizes.

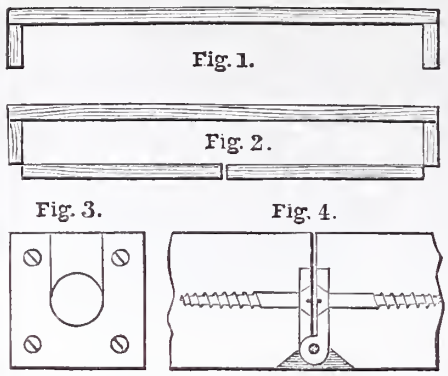



Fig. 1.—Mode of fixing Side Slips to Back. Fig. 2.—Mode of attaching Sides to Side Slips. Fig. 3.—Plate on Inner Upper Corners of Sides to carry Rod. Fig. 4.—Method of hingeing Side to Side Slip.

## A PORTABLE FOLDING WARDROBE.

BY B. A. BAXTER.

A Receptacle for Clothes — Light Framed Back—Framed Ends Hinged to the Back —Top to Fall over the Folded Ends when Closed, to Rest upon Ends when in Use—Preparation for a Curtain to form Front.

There may be many readers of Work who are longing to use their newly-found skill, and to make some article of utility. The difficulty is, often, in deciding what is within their capability. They would like to make the very excellent and ingenious combination bedroom suite by Mr. James Scott, in Vol. I., pp. 401-2, but that is, without doubt, a difficult task for an amateur. I recently made a portable receptacle for ladies' dresses, etc., for a customer, who suggested the plan, which, having somewhat improved, I submit to the notice of my fellow-readers. This portable wardrobe is shown complete and open in Fig. 5. The top is a piece of 1 in. deal, about 3 ft. 6 in. long and about 20 in. wide, but any suitable dimensions may be adopted, providing only the length is somewhat in excess of twice the breadth, for reasons which I will explain presently.

The back is a frame halved or mortised and tenoned together, about 2 in. narrower than the length of top. The stuff of which it is made may be 3 in. by 1 in. The height is variable, and depends on the length of the garments it is desired to put into the wardrobe; 5 ft. 3 in. or so would do, but in this also be guided by any lady who has a right to advise in the matter.

Having, then, a frame for the back of the dimensions deemed suitable, pieces of 1 in. wood should be fixed on to the face of the frame at the edges, as in Fig. 1, which is shown in plan.

This is to give room for the hooks. The ends are similarly constructed, and should be each alike, one-half of the width of the back frame in width, and the same height. These ends are hinged on to the pieces fixed on the back, so that the whole will close, as shown in Fig. 2; and when some brass hooks are affixed to rails screwed on to both back and ends, there will be room, with care, for the hooks, without any coming into collision. It would greatly assist in avoiding this if the hooks at the back were fixed at a different height to those on the ends.

Having made the three frames, and hinged them together, the top—a piece of 1 in. deal—should be hinged to a piece fixed on to the two pieces which serve to hinge the sides. If the maker chooses, preparation could be made for a more workmanlike and strong fixture by mortise or dovetail; of course, this would involve cutting the hingeing styles a trifle longer. It is necessary to observe that the width of the top hingeing piece is such that the piece which forms the top can fall down freely in front of the closed ends. A ledge fixed on under side of top at ends would form a suitable stop, and a rod cut to the length of the space between ends when open would keep the whole thing open to the proper distance.

This rod can be supported by two pieces of 1 in. hard wood, having a centre-bit hole of the proper size. One of the pieces must have the hole cut into, as in Fig. 3. On the rod a curtain can be hung; the back and end frames may be covered with a suitable cretonne, or covered with canvas and wall-paper to match the room in which it is to stand.

I ought to say that either "butts" or "back flaps" will do for the ends; for the top, however, the hinges should be let in so that the hinge does not project at all, for that would be in the way of the ends. Probably the best way is to use butts, as in Fig. 4. The part blacked must be planed off to the proper depth before fixing the hinges.

I can only hope that I have explained this simple construction with sufficient clearness, and that all who attempt may be successful. It will, I believe, keep the clothes from much dust, and will relieve the pressure upon the hooks of bedroom doors, where clothes hanging are in the way, and are both inconvenient and unsightly. Moreover, the weight thus thrown on the upper part of the door tends to exert a strain on the topmost hinge, which is undesirable. It may be added that as the wardrobe is both folding and portable, it could be taken to the seaside by visitors for any lengthened period to supply the want that is often felt in lodging-houses of a receptacle for clothing in addition to the ordinary equipment of the bedroom.

Fig. 5.—Portable Folding Wardrobe, shown complete and open.

## ITALIAN DESIGNS FOR FRET-WORKERS.

BY I. N. TARSIA.

ARTISTIC TREATMENT AND STYLE—MARQUETRY—XYLONITE — SUBJECTS OF DESIGN — MILAN CATHEDRAL DESIGN—MINIATURES.

ENGLISH, American, and German designs are known to all fretworkers in this country, and without any desire to disparage them, or to deny the excellence of many of them, the knowledge that a large series of Italian origin may be had will be welcome to those who wish for some variety. There are, no doubt, several collections of designs published in Italy, but, so far as I know, there is only one of them which is obtainable in this country, and the designs of which it consists are not so well known as they deserve to be. As I conceive it to be the duty of readers of WORK to proclaim for the benefit of their fellow-readers anything that may be of interest, I have pleasure in writing these notes.

That the artistic merits of these Italian designs, which, so far as I am aware, are only obtainable from Mr. Busschotts, Park Lane, Liverpool, are far superior to the average English and American productions, will be easily understood. They are, indeed, the work of artists, and bear, perhaps, a closer resemblance to the French than any others with which I am acquainted in delicacy of treatment. They, however, form a class by themselves, and it is only natural to find that many of them are in the style of the beautiful Italian Renaissance. Those readers who are acquainted with this will easily understand that a successful rendering of this in fret requires some very fine work, such as will tax the skill of the most accomplished sawyer. There are, however, many designs which, while equally beautiful, are of a simpler character, but speaking of them as a whole, anyone who can cut the designs nicely will find no other fret patterns beyond his capacity. For overlays or inlays most of the designs are well adapted; while those who possess some skill in colouring, or adapting colours, will have no difficulty in working them up as elaborate marquetries.

Ivorine, or xylonite, has been recently referred to in WORK, and I may say that it is a very good material in which to work up even the finest of these Italian designs as inlays, and much easier than veneers or thin woods.

In the collection are found the usual articles which are mostly made up in fretwork, such as boxes of various kinds, brackets, etc., etc.; and there is one specially noteworthy design, or rather series of sheets, for the formation of a model of Milan Cathedral. This wonderful article in fretwork, which, by the way, I understand, has lately been completed by one of Mr. Busschotts's customers, contains no fewer than 3,621 pieces, measures 6 ft. in length by 3 ft. in width, and stands 4 ft. 6 in high. It is quite the largest and most important design ever attempted in fretwork. Perhaps someone will get up the "Milan Cathedral" for a future WORK Exhibition. The designs themselves are printed in solid blue, and the various parts of the articles represented are shown in the clearest way.

I do not think Mr. Busschotts has catalogues showing the miniature designs, at least I have never seen any, as my usual plan has been to call in and make a selection from the sheets themselves whenever I have been in his neighbourhood. I understood lately, when speaking to him on this subject, that he intends to have sheets of miniature designs; so possibly by the time these remarks meet the reader's eye they may be ready. With this, however, I have nothing to do, and, having drawn the attention of those who wish for designs quite distinct from those usually seen, I must leave them to take care of themselves. As I have many of the Italian designs, I shall be happy to answer inquiries respecting them in "Shop."

## MEANS, MODES, AND METHODS.

### A SIMPLE AMBULANCE.

SOME of the readers of WORK may have invalid relations or friends that have to be carried from room to room. My wife has been obliged to lie prostrate for the last ten months, and having to be carried, set me to work to devise a simple ambulance, which has answered so well that I think it may be useful to others. I went to the upholsterer's, and bought two 6 ft. lengths of common cornice-pole (2 in.), for which I paid 2s., but any similar pieces of wood will do if nicely rounded. I then went to the linendraper's, and got 4 yards of strong unbleached calico, 30 in. wide; and with this made two bag-like cases, 32 in. deep by about 2 ft. wide. These are passed under the patient, one under the legs first, and the other under the body. This can be better done than if the sheet was all in one piece. The two poles being then passed through the sides of the bag, forms a simple and safe hand-barrow. Of course many will ask, where is the difference between this and a stretcher? I claim, first, the simple form, and attach great importance to it being in *two pieces*, as the use of it will soon prove. Then, why is it necessary to have a bag-like arrangement, and why not two cases for the poles? First, I say it is stronger for the same kind of cloth; and then, being without seams, it is smoother to lie on. The width should be according to the size of the patient; but I found it a mistake to have it too wide, as the patient sank down in a most uncomfortable manner; 20 in. to 26 in. will be enough for any person. Then the cost—only 3s. or 4s.—is something.

I have spoken of this simple ambulance as being suitable for home use, but I am inclined to think that it is equally well fitted for general use, and that in cases of illness or accident in the street it would prove far more desirable for the sufferer than the ordinary stretcher.

## PHOTOGRAPHIC TENTS.

BY AN OLD HAND.

INTRODUCTION—MEANS OF CONVEYANCE—VARIOUS TENTS AND CHANGING BOXES—COVERING—FITTING—LIGHTING—VENTILATING—PACKING.

FORMERLY a photographic tent was as much a necessity as a camera, but with the advent of dry plates, most of the chemical manipulations required to make the negatives have been conducted at home, where a suitable room could be prepared for development and the prolonged washing requisite under the new order of things. The few minutes' washing formerly required has changed now to so many hours, and the development much simplified. Plates can now be kept months after exposure, and developed at leisure. The fact of immediate development being unnecessary, without entailing any deterioration of the results, has induced a general practice of bringing home the exposed plates; thus avoiding the incumbrances of tent and chemicals being taken on tour as a necessary part and parcel of the photographic kit.

The outdoor photographer of the present day has no idea of the number of bulky and weighty articles his less fortunate predecessor of years ago had to put together and convey with him if only two or three negatives were required. I use the word "convey" advisedly, as carrying was quite out of the question, unless one or two other persons were pressed into the service; even then it was somewhat a toil of a pleasure. If going single-handed, a truck, or wheels in some form or another, were generally used. Professional photographers on the warpath often had a single horse carriage fitted as a laboratory, which was, perhaps, the most convenient tent of any, and the working conditions rendered similar to those at home no small advantage, when taking a good negative was always an extremely critical and careful operation under any circumstances, and a good, clean, brilliant and soft negative was something to be proud of. Tents are, however, even now sometimes required. It may be necessary to finish a negative off on the spot, so to say, to test an exposure, or for some other reason; and although an absolutely dark closet and a small table are all that are required in the way of an operating chamber, these are not always available nor convenient. A tent will then be found to tide over the difficulty, as it can be set up anywhere indoors or out of doors, and make the photographer independent of any concession, either graciously or grudgingly given. Some people have a great objection to their furniture and fittings being splashed and stained, and do not go into ecstasies when a brown patch gradually develops on the drawing-room ceiling. A tent set up out of doors, or in an outhouse by preference, avoids a considerable amount of friction with the household powers that be, and conduces to general good feeling all round.

In this and a paper to follow I propose to select a few of the most useful forms of tents and changing boxes, with illustrative diagrams that will enable anyone with a small amount of constructive ability to make one for themselves. The variety of forms of tents are legion. Two or three points in all forms should never be overlooked. These are plenty of room to work in, good ventilation, and convenience of arrangement. Tents may be roughly classed into three species—first, those that are portable laboratories, in which work can be as easily done as in a properly appointed dark room at home; secondly, tents that can be used for development, but more generally for changing the plates or fitting the slides; thirdly, those for changing the plates only, that may either admit the operator to work inside or to remain outside with his hands passed through sleeves, and either watch the operation through a small ruby glass window with a face piece, or trust entirely to feel.

No. 1 represents the most elaborate, or I should rather say convenient, of the tent tribe, being, indeed, a perfect laboratory of its kind, and in which almost any sized plates in general use can be conveniently manipulated. It consists of a tray made watertight, 36 in. long by 18 in. wide, and 4 in. deep, made of ⅜ in. pine, and clamped at the corners—in fact, made strong and serviceable as a packing-case, for which it has to do duty.

Inside this tray, at each corner, is fixed a square iron socket to hold the uprights that form the framework of the tent. A hole is pierced through one corner for a rubber tube to carry away waste water. Centrally another hole is made, strengthened with a brass plate for a bolt to attach it to its support, which may either be a very strong tripod or, much better, the box in which the chemicals, etc., are packed. A narrow detachable shelf is fitted to the side away from the operator for bottles, measures, etc. The frame consists of ¾ in. square rods. Two pairs are hinged together, as in diagram; the two back uprights and two cross-pieces are separate. The front uprights are 3 in. shorter than the back ones, so that, when fitted in place, the roof will slope upwards towards the back, giving more head room than if they were on a level; the longest pieces, which are the two back uprights, are just the length to lie in the tray for packing. The cross-pieces which bind the sides together are provided with pins, with beads fitting into slots on the inside sides of the uprights. The whole is then covered with a suitably-shaped bag made of three thicknesses of twill, and bound, the inner ones being respectively red and yellow, and the outside drab or black. By cutting away the outside layer for a space of 12 in. by 8 in. in the front of the cover, just above the tray, a window is formed; or, if preferred, an opening can be made through all the material, and a light wooden frame screwed to it, in which ruby glass can be slipped for those who prefer this mode of illumination. An extra curtain of yellow or red may be placed inside and hooked up out of the way when the light will permit. Several hooks and pockets are made inside to contain dusting-brush and other little useful items that are to be kept dry and clean. A strap inside the cover, made of 3 in. webbing, attached to the front and two sides, fastens round the tray with a buckle, keeping it taut and light-proof. On the left side a bag is attached to the cover, hanging outside the tray and opening inside, to contain a vertical hypo. fixing-bath, thus economising the room and putting a troublesome solution as much out of the way as possible. The back part of the cover is made on the cross-over principle, and the operator, on taking his place inside, hooks a strap attached to this cover round his waist (as he sits on a camp-stool), which effectually excludes all white light, and leaves a roomy, comfortable space to work in. The length of the cover is such that, when set up, it will fall an inch or two on the ground—an extra precaution against the admission of dangerous light. On coming out of the tent the folds of the cover can be thrown back, and thus thoroughly rid the tent of any disagreeable fumes from ammonia or anything else. For ventilation, a sleeve or a box ventilator can be let in. The sleeve ventilator is a tube of twill about 4 in. in diameter and 1 ft. long, that when in use is filled loosely with hay, grass, etc., or anything of the kind that may be available to allow passage of air without light, and lie on the roof of the tent. The box ventilator (Fig. 2) consists of a ring of metal—tin will do—3 in. or 4 in. in diameter and about 1 in. wide, securely fastened into an opening in the roof of the tent, into which is brought another metal cylinder with diaphragms alternately fastened to each side to act as a light trap and not interfere with the passage of the air; a bit of muslin may be fastened over the top to keep out dust. This ventilator is suitable for any tent that may require one. It will be seen from the diagram of the tent that the rods of the side frame project over, or rather beyond, the head of the operator for the sake of gaining room and air space.

A shallow waterproof wooden tray 18 in. long, 15 in. wide, and 2 in. deep, with an indiarubber tube securely fastened in one corner, and which can be passed through the tent tray, acts as a sink and also to pack in developing dishes, etc., in travelling. To pack, remove the cover, take the frame to pieces, laying them in the tray, fold up the cover, lay it at the top, and pull over all a canvas waterproof cover, and strap together. This, although a heavy tent, is, nevertheless, a most useful one, never gets out of order in any way that cannot be easily repaired, and is thoroughly efficient for any photographic purpose.

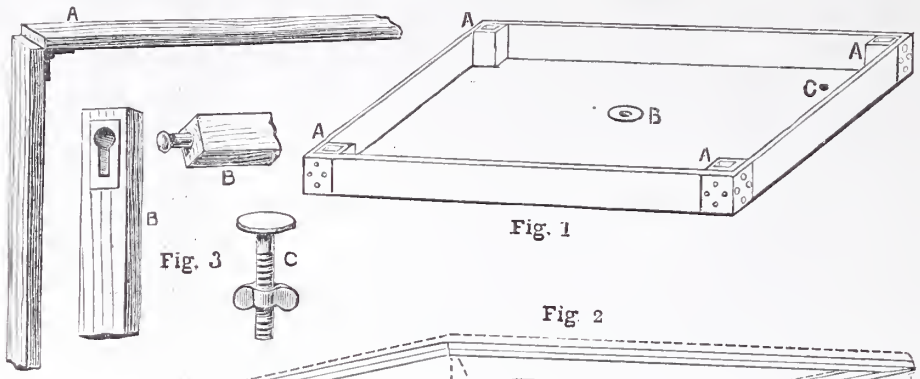
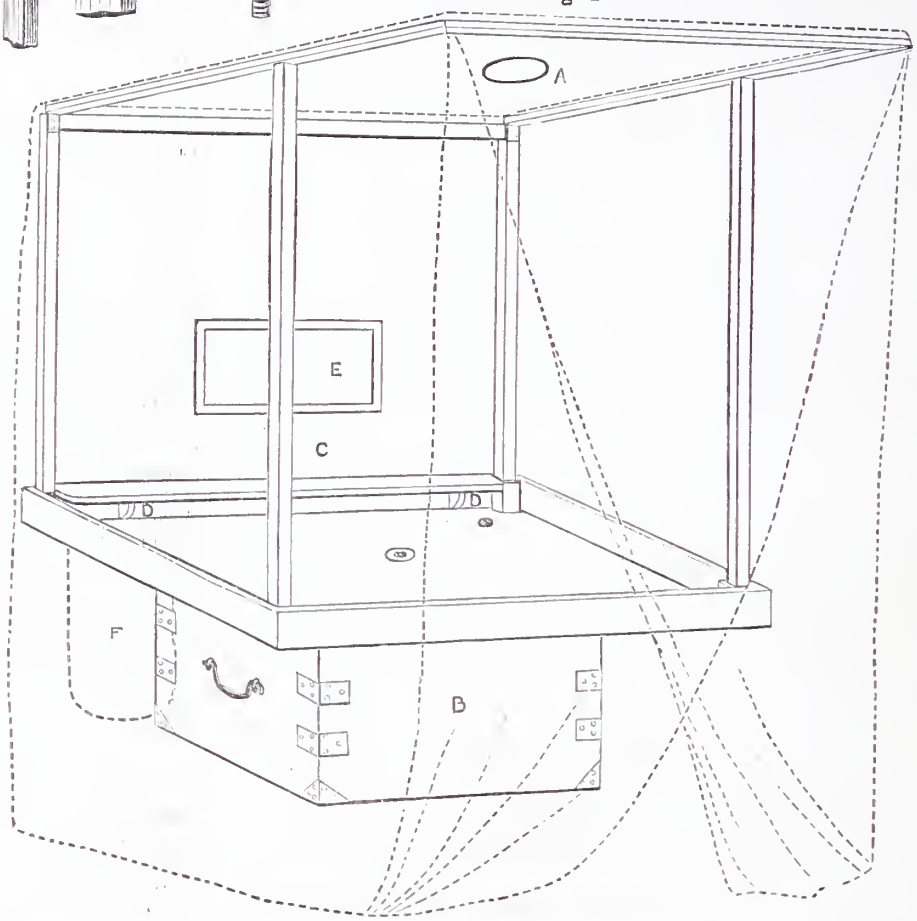



Fig. 3 Fig. 1

Fig. 2



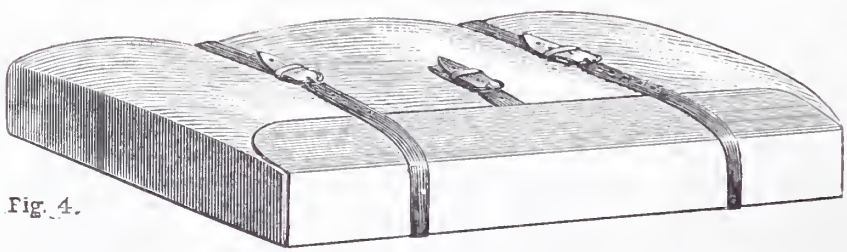



Fig. 4.

TENT No. 1. Fig. 1.—Tray of Tent—A, Square Sockets for Uprights of Framework; B, Brass Plate with Hole for Nut and Screw to fasten to Support; C, Hole for Waste Pipe. Fig. 2.—Tent set up: Dotted Lines show Covering—A, Ventilator; B, Box for Support; C, Shelf; D, Shelf Support; E, Window; F, Bag for Hypo. Bath. Fig. 3.—Details of Tent—A, Hinged Upright and Top Bar; B, B, Ends of Upright and Cross-Piece with Slot and Pin; C, Nut and Screw to attach Tray to Support. Fig. 4.—Tent Packed.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

Straightening, Soldering, Galvanising, Tinning Brass and Copper Wire, Lacquering, etc.—The Swift.

There have been several diagrams given in past numbers of Work, by several correspondents, illustrating the numerous methods adopted by different men to straighten wire as it is uncoiled, or when in irregular lengths; but I do not see any reason why I ought to refer my readers to any or all of them, although the results of using either method would lead to the desired result—in fact, my series of papers dealing with wire-work would be incomplete were I not to say something about this part.

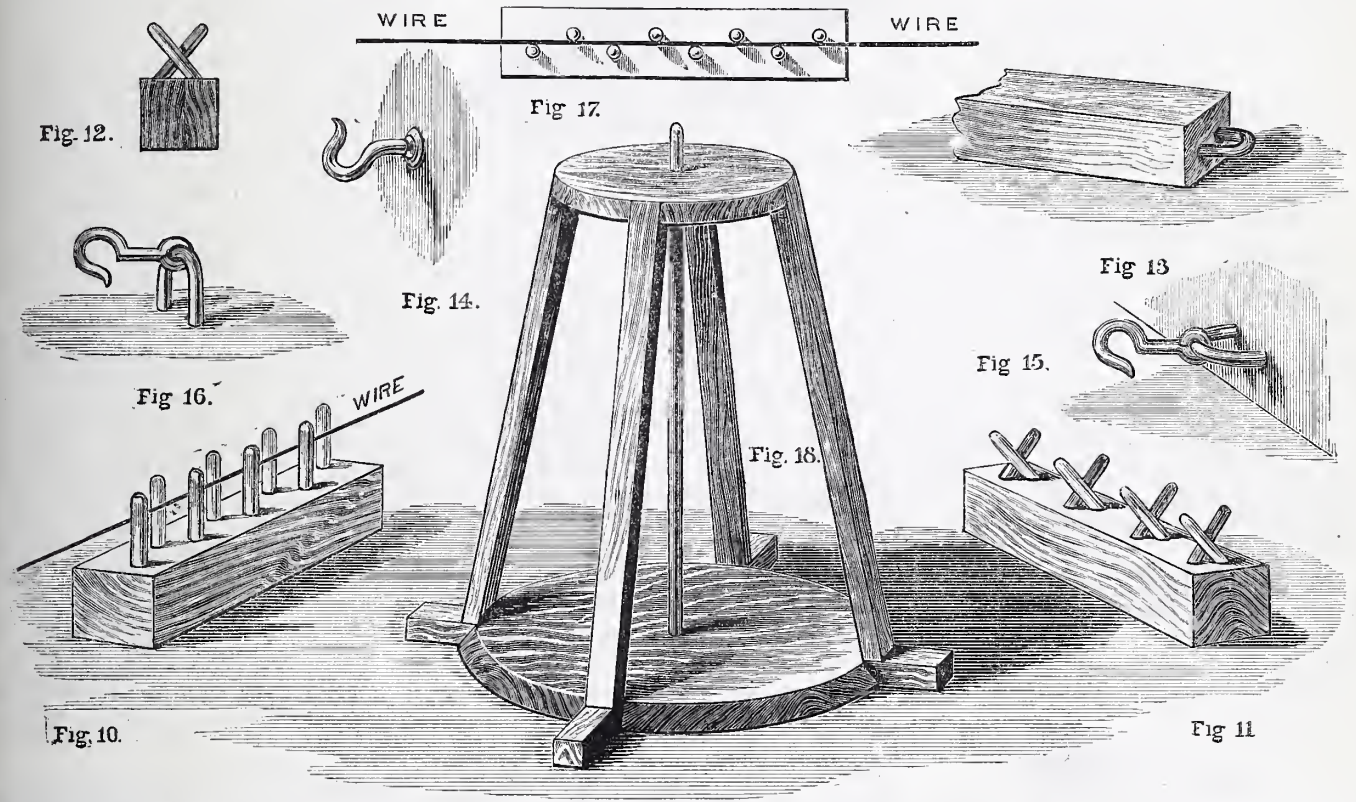
I understand that what is considered a good means of straightening wire is that which I have drawn in Fig. 10. There is a wooden block of three or four inches depth, and of a similar width, and in length what might be considered preferable, into which are inserted at the top a number of iron or steel pegs or nails; the second, fourth, sixth, etc., peg being very slightly to one side of an imaginary straight line, upon the other side of which is similarly situated the first, third, fifth, etc., pegs.

The wire is drawn between these pegs, entering them at one end of the block, and being pulled out at the other end of it. It is advisable to have different blocks and pegs for every few consecutive gauges of wire; but for any of those which do not vary much in thickness to each other, the same block, etc., would serve, as the pegs could then be slightly hammered inwards or outwards, as the case might be, to accommodate properly the wire to be straightened.

If the pegs are so fixed that each row inclines towards the other at a very acute angle, as in Fig. 11, both pegs in each pair touching and crossing each other, as is made plain by the elevation sketch (Fig. 12), very irregular lengths of wire may be comparatively well straightened by being drawn through the holes or arches formed by the different pairs of pegs.

If it is not considered convenient to have the block as a fixture upon the bench, it could be used as a loose affair, and be secured in temporary position when required, by being fitted with a staple at one end, as I have shown in Fig. 13, and having a hook, or staple and hook, in the wall or bench, as in either of the diagrams, Figs. 14, 15, and 16.

As before said, the ways of effecting the straightening of wire are numerous; but these descriptions will be found suitable and convenient.




**Figs. 10, 11.—Two Forms of Straightening Machines. Fig. 12.—End Elevation of Machine shown in Fig. 11. Fig. 13.—A necessary Staple in End of Straightening Block. Figs. 14, 15, 16.—Various Means of securing Straightening Block to Bench or Wall. Fig. 17.—Plan of Fig. 10 as seen from above. Fig. 18.—The "Swift," on which Coils of Wire are placed previous to being unwound.**

Although the word "lacquering" is used frequently in connection with several operations in different trades, in wire-working it is understood to mean the covering of *brass* wire for purposes of preservation with a certain semi-liquid. No doubt many readers are aware that lacquer is very similar in appearance to fluid gum, and is dealt with, like that commodity, by being contained within bottles. There is a paper on "Lacquering Brass Work" in Work, Vol. II., No. 55, page 35. I will ask my readers to be good enough to read the particulars therein given—they, in every respect, being quite suitable for application to wire-work.

Galvanising is a very important process, through which an enormous number of wire-work articles pass. I cannot explain the operations having to be gone through for this purpose, for the simple reason that I am entirely ignorant of anything whatever concerning them directly; and, indeed, I see no more reason why I should enter into a description, even were it in my power to do so, than should a writer who gives a design of a piece of furniture, or who speaks of wood-work, enter into details of the art of polishing.

Wire-workers—*i.e.*, the workmen—do not galvanise their goods: they are sent to be so finished at a neighbouring galvaniser's; for such a trade is carried on as quite distinct from wire-work. The same remarks will apply equally to the process of tinning.

Need I say much about painting? What workman is there who could not paint any piece of wire-work to his satisfaction with either enamel or the ordinary stuff? Of course, the article to be painted would have to be entirely free from dirt, etc.; but very few men, I think, need to be told that.

Brass and copper wire, it scarcely needs telling, are more expensive than ordinary wire; and both are, as a consequence, used almost exclusively for ornamental work, such as baskets, screens, etc. Occasionally, however, such articles as fenders and other household requisites are constructed with it.

Soldering is an operation that frequently has to be called to the aid of wire-work, but comparatively few different articles need its assistance. For details of the process, I must refer my readers to Mr. Alexander's paper on "Soldering" in Vol. I., page 257.

The "swift" is an accessory to wire-working, upon which is placed a coil of wire preparatory to being straightened or crimped. A clear idea of its appearance can be gleaned from Fig. 18. In the bench is firmly inserted, in a perfectly perpendicular position, a stout iron or steel rod, upon which will revolve the swift proper. This latter consists, as can be seen by the engraving, of two circular boards, one much smaller than the other, with canted or bevelled edges, connected to each other by three or more uprights.

Each board has a hole bored through its centre, sufficiently large to permit of free action on the part of the swift whilst upon the vertical rod. The larger board rests upon the bench, while the smaller one is placed at a convenient height from it, both being strongly connected to each other by three, four, or more, wooden or metal rails. It is not desirable, however, to have it of any inconvenient weight.

The inside diameter of one coil of wire may happen to be less than that of other coils, and it is to accommodate all dimensions that the swift is made on a graduated scale; for it will be seen that should one coil be too small to fit round the bottom of the swift, it will rest in just as suitable a position upon the sloping rails. If the swift is properly made, it should be all that is required to assist in unwinding any particular coil.

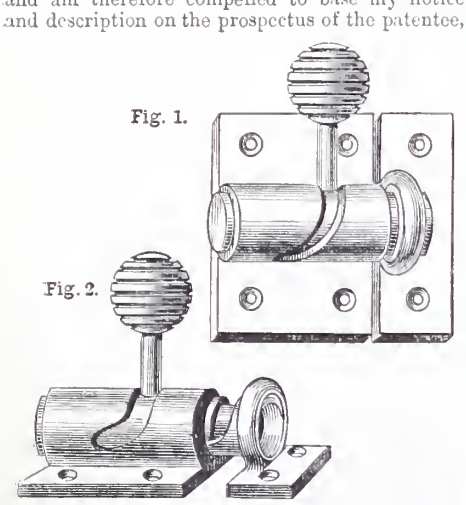
It is advisable that two swifts be used—one much smaller than the other, in order that it can be used for very small coils.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

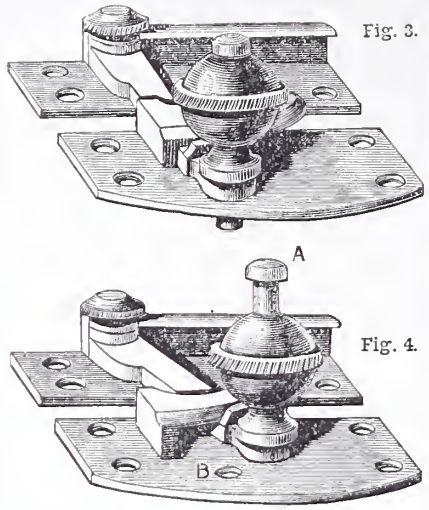
### 19.—Cormell's Patent Grip Fastener.

A fastener for doors and windows that is perfectly secure against all operations from without—operations, that is to say, which may be carried out without injury to glass and frame of window and rails and panel of door—is manifestly a thing to be sought after; and any fastener that cannot be operated on from without, except by violent means, is decidedly a "good thing." Apparently, Cormell's Patent Grip Fastener is a fastener that promises security to those who adopt it—I say apparently, because I have not had an opportunity of seeing and handling a specimen fastener, and am therefore compelled to base my notice and description on the prospectus of the patentee,




Cormell's Patent Grip Fastener.

Mr. J. Cormell, Lansdown, Cheltenham. The appearance and general construction of the Patent Grip Fastener may be gathered from Figs. 1 and 2, in the former of which it is represented shut, and in the latter, open. There are two plates to be fastened to the door and frame of the door, or to the sashes of the window to which it is applied. The larger plate carries the bolt, and the smaller plate the socket, staple, or ring in which the bolt engages. The description tells us that "the holt is moved by the action of the arm, which moves it in the barrel," and that the *female* screw on the end of tho bolt grips the *male* screw in the staple, thereby tightening the sashes together, if loose, and avoiding rattling




Brookfield & Whitehead's Burglar Proof Sash Fastener.

and securely fastening them. Now here comes in the disadvantage of not actually seeing the article to be noticed. I should have thought myself that the screw on the end of the bolt would have been the *male* screw, and that in tho staple the *female* screw; but, in determining this, the drawings in tho prospectus, which are here reproduced on a smaller scale in facsimile in Figs. 1 and 2, lend but little assistance. Still, there is enough to show that the fastener is a secure one, and is worth looking after, as it is simple, has no spring in it, is thief proof, prevents loose frames from rattling, and is cheap, as it is supplied at the rate of 7s. 6d. per dozen in the ordinary make. For high windows tho bolt is made without the knob on the arm, as shown in Figs. 1 and 2, and is actuated by a wheel fixed at the end most remote from the socket. Over the wheel a cord is passed, the groove of the wheel in which the cord lies being fashioned in such a manner as to prevent the cord slipping. The cord may be fastened up on one side of the window in the same manner as the cord of a Venetian blind.

### 20.—Brookfield & Whitehead's Improved Sash Fastener.

The construction of tho fastener for doors and windows just described differs materially from that of the ordinary fastener; but this is not the case with regard to Messrs. Brookfield and Whitehead's Improved Sash Fastener, which is represented, when shut, in Fig. 3, and when open, in Fig. 4. At first sight, indeed, one may be disposed to ask in what particular point or points this may differ from the ordinary sash fastener, so much alike are they, and it requires close inspection to find out that these differences are to be found in the increased size of the plate which carries the piece, under which tho catch passes, and in the knob of the catch which is pierced from top to bottom to take a pin, A, in Fig. 4, which works up and down in it. When the catch is released, the bottom of the pin moves over the surface of the plate, and the pin is kept in the position shown in Fig. 4; but when the catch is brought completely under the piece that projects from the plate that is fastened to the lower sash, the pin drops into the hole, B, and assumes the position shown in Fig. 3, thus closing the window and securing it against all attempts that may be made to open it from without. When it is desired to release the catch, the pin must be lifted. This fastener, which is extremely simple, and has no spring to get out of order, is manufactured and supplied wholesale by Messrs. Brookfield & Whitehead, 25, Change Alley, Sheffield, who are the makers of other desirable specialities. Its cost is no more than that of the ordinary fastener, and it may be had in brass, or japanned or nickel-plated, of all large ironmongers and builders' furnishers in town and country.

I have purposely noticed this and the Patent Grip Fastener together, as each is a type of a totally different mode of fastening a sash-window. Each, without doubt, will have its admirers, being considerably in advance in every respect of the ordinary fastener, which is so easily thrust back from outside by the aid of a thin steel knife.

### 21.—The "Ring" Cushion Tyre.

The "Ring" Cushion Tyre is one among the various forms of tyres of this kind that are now competing for favour and adoption by wheelmen. The nature of the tyre, and the arrangement of the rings from which it takes its name, may be gathered from Fig. 5. The inner and outer metal tyres of the kind in general use by the trade are separately drilled to receive studs which secure the ruhber rings in position between the two tyres. The rings are moulded to fit *over* the outer tyre and inside the inner crescent, and their strength is regulated to suit various weights. The spokes of the wheel, in case of necessity, may be replaced without disturbing any portion of the tyres. The objects of this invention are stated to be—1st, to maintain at the point of contact with the road a true circle in the outer tyre; 2nd, to avoid the cutting of the cushion; 3rd, to promote economy of cost, about one-half the weight of rubber being used, inclusive of the outer tyre; 4th, to provide a cushion tyre for narrow forks, which may be easily fitted to existing machines. It is claimed by the patentee that the use of the tyre ensures all the benefits to be derived from the pneumatic tyre, inasmuch as "the shape and position of the rubber rings ensure the most sensitive and perfect action in running. Every ring is in continual play; in the lower portion of the wheel they are in extension; at the sides of the wheel a vertical movement takes place. The double, and hitherto impossible, duty of resisting hard road wear, and, at the same time, of yielding that ease and elasticity essential to the comfort of the rider, is by this arrangement separately provided for. The sole duty of the rubber rings is to carry the weight of the rider in easy suspension, whilst the outer tyre, narrow in width and fairly hard in texture, is propelled with less exertion than the wide soft tyres which flatten upon the ground and add materially to the draught of the wheel. The greatest ease in running, with perfect insulation from vibration, is thereby obtained, the rubber rings acting freely upon the road inequalities, and within one inch of its surface. In turning corners they adapt themselves to the deflection

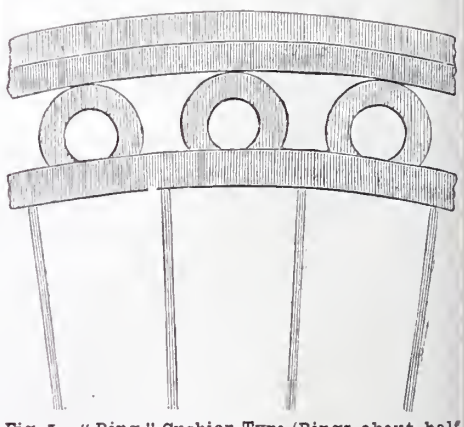


Fig. 5.—"Ring" Cushion Tyre (Rings about half size).

of the rider's weight, and obviate the tendency to side slipping. Travelling against the wind, the resistance would not be greater than with an ordinary solid tyre." The "Ring" Cushion Tyre is applicable for vehicles of all kinds. Complete wheels, tyres, or any of the necessary parts may be obtained at 19, Barbican, London, E.C., the London Depôt of Messrs. Thos. Smith and Son, Saltley.

THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Work Exhibition.** — W. C. (*Shrewsbury*) writes:—"I beg to offer you my heartiest thanks for the medal, prize, and certificates awarded to me in Work Exhibition, and which I have safely received. I should have acknowledged their receipt sooner had I not been very fully employed in moving from Birmingham to Shrewsbury, and taking up another situation. I am glad to believe that my success in Work Exhibition may have been a determining factor in obtaining for me the situation above mentioned, in which I benefit to the extent of £60 per annum. The award of the jurors came at the very time I was making my application; and I, of course, made mention of the fact of my success. Though I have no direct authority for stating that I owe my better situation to my Work award, I feel confident it had its share (and probably a large one) in obtaining my appointment in the face of over 300 competitors. I am delighted with the medal, which is a little work of art, and also with the prize and certificates, which I shall always be proud to show to my friends."

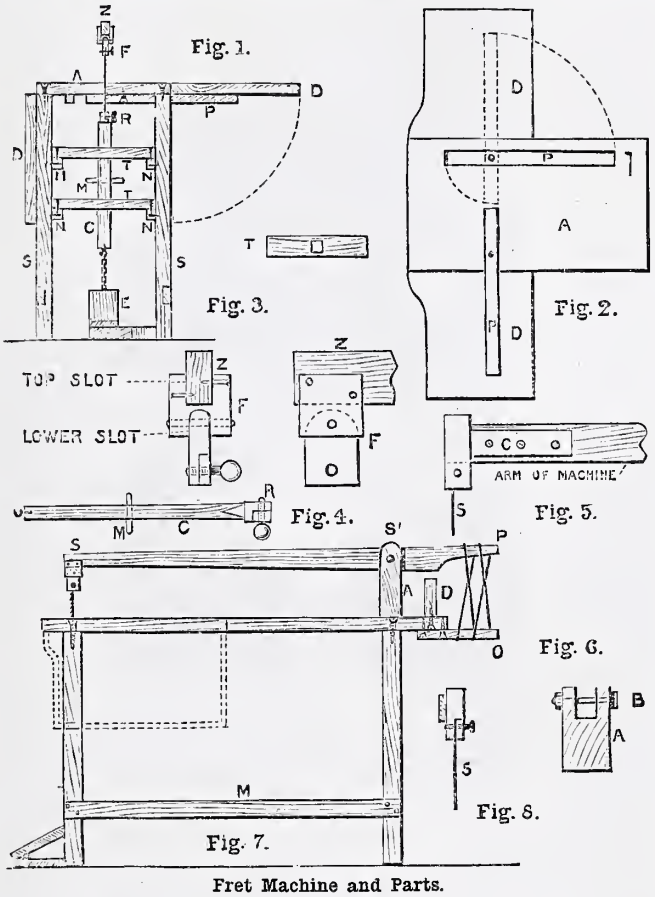
**Protection for Patents.**—A. J. W. writes:—"I have duly received medal and awards safely, and must say that I am very well pleased with them, and thank Messrs. Cassell & Company for their kindness and enterprise in the prizes and awards given, and labours in connection with the late Exhibition—which could not have been an altogether simple matter from first to last. At any future time, should you think of inaugurating another exhibition, I shall be only too pleased to do all that lies in my power to give assistance, however small it may be, in exhibiting to the best of my ability. Last month a provisional protection was granted me for a patent banjo, in the taking out of which I was much assisted by your article which appeared in Work; and hope in another month's time to procure a complete patent for same without the expense of an agent. I may add that the drawings I sent in to minimise labour were incomplete."

**Work Exhibition Certificate Frame.**—W. J. (*Laurencekirk*) writes:—"Now that the exhibitors at the Work Exhibition are in possession of their certificates, I have no doubt that many, like myself, wish to frame them; and for those who use the carving tools an appropriate design given in Work would be hailed with delight by not a few."—[Will some reader kindly consider this?—Ed.]

### II.—Questions Answered by Editor and Staff.

**Cutting Elephant Teeth.**—J. S. S. B. (*Dublin*).—I presume from your letter that it is your idea to make elephant's grinders into boxes. If that is so, then all your difficulty will vanish if you once know how to get through, or get rid of the external layer of enamel. It will really be best to get a lapidary to cut the teeth across with his slitter, but the following is a way that you can do yourself:—Get some iron binding-wire about the thickness of a pin, and twist two pieces up together like a cord, say about 2 ft. long; mix up some flour emery with water and charge this twisted wire with it. Now, for the next step, you must devise means yourself to attain this end—viz., that the tooth has got to have the wire passed backwards and forwards like a saw until you have worked through the enamel. Fixing it in one of your bow saw frames will do, or you might fix one end of the wire and hold the other with your hand while you pass the tooth rapidly up and down. As the wire is merely for the purpose of holding the emery, it can be replaced by a straight piece of hooping-iron, and you can get through the enamel with that; but, as I said, a lapidary's slicer which is charged with diamond dust is best. So much for cutting pieces off; now, if the outside (enamel) is to be got off so that you can carve the exterior, the handiest method for you is, I should think, to take it to the grindstone and grind it off. If these hints are of no use, you have only yourself to thank, for no details are given in your letter.—H. S. G.

**Fret Machine.**—G. G. (*Abergavenny*), requires further particulars concerning my fret machine (see page 846, Vol. II.). I feel it a pleasure to answer the above from one who, I think, sees the advantages of this machine—firstly, its simplicity; secondly, its having a true vertical stroke; thirdly, its lowness of price for construction. I will now endeavour to give him and others all the particulars so far as my ability will allow. Fig. 1.—Front view of table, from the ground to top of table, 2 ft. 5 in.; S, legs of table, four in number, 2 ft. 4½ in. long, 2 in. wide, 1½ in. thick, secured to A (top of table) with screws; D are the leaves of the table—you can dispense with these, if you like—1 ft. long by 10 in. wide, ⅞ in. thick, secured to table by two hinges, 1½ in.; P are the stretchers for keeping leaves of table in position, 1 ft. long by 2 in. wide, ½ in. thick; A, top of table, 7⅛ in. wide, 2 ft. 4 in. long, ½ in. thick; if you do not have leaves to your table, you can then make the table what width you like, to suit your own purpose; E, treadle, secured by means of a small hinge, 1 ft. long, 4 in. wide, or, if you make the table wider, that will be wider, but not longer, in proportion; N are small pieces of wood, ¾ in. square, 2 in. long, to support cross-pieces marked T. Fig. 2 represents table reversed or bottom upwards, to show how stretchers are placed and secured. The two pieces of wood, P, are movable, as shown per dotted line, and are secured to the table by stout screws. Fig. 3 (there are three parts included in this).—We will take T first, it being a strip of wood 4 in. long by 2 in. wide, with a 1 in. square hole cut neatly through the centre; you require two of them, as in Fig. 1; they are to form a guide for the bottom cramp, marked C; Z is the most complicated part of the machine, it being a knuckle-joint. Without this you do not obtain a true vertical stroke. If you cannot make this, although very simple, I have another way, which I will explain in Fig. 5. To make this knuckle-joint, get a piece of iron ¾ in. wide, 1½ in. long, 1 in. thick. Cut the top flat, so as to suit the end of the arm. The lower part of the joint which holds the saw is part of any old frame filed to suit the lower slot, secured so as to work easy by means of a small rivet. Fig. 4 is the bottom cramp driven into a piece of 1 in. square wood 14 in. long (R); M is a small piece of wood driven through C to form a stop, so that, should the saw break, C cannot slip through T. Fig. 5.—If you cannot make the knuckle-joint, proceed as follows: Cut your old frame which you have been using, according to Fig. 5, at C; secured to arm with screws it makes a very good substitute, but not so good as the drawing F, Fig. 3. Fig. 6.—Stump of wood 6 in. long, 2 in. square, with a slot cut to allow arm of machine to work in; B is a ¾ in. ball to secure arms to stump A. Fig. 7.—Distance from S′ to S, 1 ft. 8 in.; from S′ to P, 8 in.—the whole to be ½ in. thick; O, piece of wood 1 in. by ½ in., to correspond with the length of the arm, secured, as you see in Fig. 7, with strips of indiarubber to form a spring; D is a guard to prevent the arm from rising too high when saw breaks: size, 1½ in. square; M, stay for legs, 1¾ in. by ½ in. Fig. 8 is front view of Fig. 5.—J. H. W.




Fret Machine and Parts.

**School Blackboards.**—J. J. (*Leeds*).—Refer to the Index of Work, Vol. II.

**Cutting Mounts.**—Omar.—It is a great pity to cut your old engravings, as by so doing you destroy any value there is in them. Some rare specimens of Hogarth's engravings fetch very high prices. The best method I should suggest is, procure sheets of card large enough to cover present margin, and have a suitable equal margin; measure size of engraved part, or that which you wish to appear, and mark the size in pencil square upon centre of your card with a sharp mount-cutter's knife; cut the centre out; procure a second cheap cardboard and lay your engraving flat thereon, just attaching the corners, and fix your mount over engraving to board you have the engraving on. You will then have it perfectly flat for framing, and can at any future time remove without injury should you wish to realise. There is also a special graining known in the trade as "Hogarth pattern," and designed by him for his engravings, and very suitable. I should consider in the way of mounts it is cheapest to get them cut by a mount cutter, for they will mount them without fear of injury in front and back mounts for 1s. 3d. complete, 2 ft. 6 in. by 1 ft. 10 in., with edge of bevel in gold or plainly cut, and you can have a variety of tints to select from. The City Frame Company, 29, Basinghall Street, E.C., are not far from your address, and are wholesale mount-cutters, and who would advise you as to whether your engravings would clean, as old engravings with their original margins are better than mounts, and can be cleaned if not too far gone.—G. R.

**French Clock.**—R. M. (*Liverpool*).—Before altering the snail make sure the fault is there, for if it has struck all right till now, the fault may be elsewhere. Take off hands and face and examine the wheels that carry the hands, and you will see a dot mark on each; arrange the three dots in a line with the pivots of the minute, and shake minute or cannon arbor, and then try if it strikes right, as this, if only one tooth is wrong, with a graduated snail is often sufficient to throw the whole striking wrong. If not right, see if either arm of the rack is loose, and rivet up if it is; then put on the minute hand and turn round, and see that rack hook falls fair and clear in each tooth as the wheels go round; if not, mark where they do not fall deep enough and slightly file the snail. Do not overdo it: better take a little twice than too much at once. I forgot to say, examine rack teeth and see if any are bent. Should the rack fall too far or not enough at *all the hours*, bend the rack arm that rests on the snail down or up a little, and test it at the one o'clock hour. To make a new snail, fit up a piece of brass on the hour wheel, put a sharp-pointed pin in the rack arm, put the rack hook in the first tooth, let the sharp pin rest on the new snail piece, hold the rack and hook steady, and turn the snail round. Now let another tooth of the rack down, and repeat the movement till twelve teeth of the rack have fallen and you have twelve circles on the snail piece. Next put your minute hand on and hold it up tight at twelve; let the rack fall on the twelve teeth; press the pin on the snail, at the same time drawing it fully up: this will give a radial line. Now turn the minute hand round an hour, and let rack down and draw it up; do this twelve times, then your snail will have twelve circles representing twelve hours, and twelve lines (radial), giving you the length the steps must be. Now all you have to do is to file down to the first circle the distance between two lines, between the next two, or, rather, one of the first you used and another; file down to the second circle, and so on till you have the twelve steps. You will find this the best way to mark it out, I think, as should your rack teeth be ever so uneven, having marked the snail by it, it is sure to drop right.—A. B. C.

**Algebraical Question.**—Mathematics.—You should submit your question to a scholastic paper. It would have no interest for the majority of our readers, and "Shop" space is valuable.

**Cocoa-Nut Fibre.**—J. I. (*Bath*).—Try the following places for the above:—Messrs. Treloar and Son, Ludgate Hill, London; Messrs. P. Maddin and Sons, 98, Borough High Street, S.E.; or write to Mr. A. Robottom, Commercial Sales Rooms, Mincing Lane, London, E.C.

**D Dulcimer.**—G. H. (*Camberwell*).—The measurements are taken "over all"—that is, including blocks and facings—and, as before stated, the distance from back to front is 1 ft. 4 in. It has forty brass and forty steel strings, divided into alternate groups of four each, commencing with brass

at the bottom. Making the soundboard thinner would hardly be likely to improve the tone. The only way to ensure a good tone is to use nothing but the best material, and to be very particular about the workmanship to see that everything is cleanly and neatly finished, and that no more varnish is used than is necessary to get a good face. For this reason a polished sounding-board is best. The piccolo D is half the size of the other in every way as far as the shell of the instrument is concerned. It has, however, the same number of notes, and consequently the same number of strings. Particulars of this are given, in reply to A PLAYER, in No. 90, page 615, Vol. II.—R. F.

**Sign-Writing Charges.**—CONSTANT READER.—I never attempt to give these: every man must find this out for himself, and all I can do is to refer you to Laxton's "Builders' Price Book," published annually by E. & S. Spon, Strand, London. There are, of course, all prices, a good workman naturally commanding a better figure than a poor hand, who is often willing to do work at a starvation price.—H. L. B.

**American Leather Cloth.**—C. L. L. (*Queen's Walk*).—The manufacture of this article was introduced from America about the year 1854, and met with a large sale up to 1861, when it fell off greatly. We are not aware that the composition was ever made public, nor do we know much about it. A Mr. Dodge, however, is said to have taken some patents for its manufacture, and we believe he originally introduced it here. We do not think it could be used as proposed by our correspondent, but requires to have special plant and means provided for its manufacture and use. There is, or was some years since, a large factory for its manufacture at East or West Ham, or somewhere in that neighbourhood; but whether it is still in operation we do not know. If our correspondent would state clearly exactly what he wants to do, perhaps we might be able to help him.—C. E.

**Royal Navy Carpenter.**—DARKEY.—In many cases, if not in all, carpenters in the Royal Navy are obtained by the Government from the dockyards. Applicant will, of course, have to be physically fit to be a seaman. You do not state age or give any idea of educational or mechanical attainment. Apply by letter to the nearest dockyard. The pay is £50; officer, £100 to £150; chief carpenter, £164; extras, £5. The above (if you can get it) is better than artificer in Royal Engineers—the pay is 1s. 11d. per day extra to regimental pay.—B. A. B.

**Hair Sieve Bottoms.**—C. B. (*London, E.C.*).—You should make your address known to HOOPBENDER by advertising it in our cheap "Sale and Exchange" column.

**Engraving on Metals.**—PERGY.—This subject has been treated in WORK, with full illustrations, and will be found in Nos. 35, 38, 43, 45, and 48. Messrs. Field & Tuer, Leadenhall Press, London, E.C., publish a shilling book of letterings. Fairbairn's "Crests and Monograms," price 42s. (Lewin, 20, Ludgate Hill, London, E.C.), will probably suit you; and Messrs. J. Sellers & Son will supply you with a complete outfit of engravers' tools. Consult "Shop" in back numbers for "wrinkles."—N. M.

**Engravers' Wages.**—F. M. T. (*Swansea*).—You ask for information as to the wages of engravers. It is a large subject, and requires treatment from various standpoints. Broadly speaking, the wages of an engraver range from 12s. up to 120s. per week. You will quite understand that there are engravers and engravers. A general engraver is not often found as a journeyman; the simple fact of his being able to take up and execute general work enables him to take a small workshop and work for his own individual profit; and his earnings may be from 30s. to 50s. per week. Working under such a master, the engraver would receive from 4d. to 8d. per hour, according to ability, as, of course, the master wants a profit on his employee's work, as well as to pay his portion of shop-room, firing, and lighting. Heraldic and inscription engravers will earn about from 9d. to 1s. per hour, depending on ability and continuous work. I know nothing of the present prices of door-plate work, but should know what to charge if I had one to cut, much depending on the size and style of letterings.—N. M.

**Cutting Stencil Plates.**—W. E. T. (*Hibbard*).—The plates may be cut in a fly-press, but the expense of the cutting-out tools will be very great, unless a great quantity were required. They can be filed out beautifully clear, requiring nothing but a little flattening. The best way of cutting out only a few stencil plates is with the graver, as follows: First, procure a piece of hardish wood, and have it planed smooth; next procure some sheet zinc of the proper thinness, and cut out to the required size. These will not be quite flat, therefore get two sheets of steel of any convenient size *larger* than your sheets of zinc, and about ¼ in. thick. Place these sheets of steel in the fire until hot—not red-hot—and place half a dozen or so of zinc plates between them, and then and there screw them up tightly in the vice until cold, when they will be found to be flat. Next cut out of cardboard the letters you are desirous of cutting in stencil, and mark them in outline on the zinc with a sharp point or etching needle; bore a small hole at each corner, and tack down with a common iron tack. Next sharpen a "lozenge" graver (see Indices Vols. I. and II.) rather, but not too acute an angle, and cut away till you cut through the zinc. If you are not used to handle a graver, you will require considerable practice; but with courage and perseverance all may succeed, and stencil cutting is not so difficult as some other kinds of work.—N. M.

**Cutting Machine.**—A. R. B. (*Dublin*).—There is no reason why such a machine should not work well, provided (1) That the board is well supported *up to the extreme end;* (2) that the cutter has some traversing as well as descending movement; (3) that the cutter is sharp and thin; (4) that only small pieces are removed at a stroke; (5) that the workman has ample power. Given wood cut to the proper lengths and at the proper angle, very little shooting is needed, and end grain is not very often used as a glue joint.—B. A. B.

**Corrosive Sublimate (or Chloride of Mercury).**—BUSYBODY.—This may be obtained at any chemist's, and costs about 4d. per oz. Block or pure tin can be had at almost any ironmonger's, and certainly of any dealer in plumbers' requisites. See reply to AMATEUR (page 13, No. 105, Vol. III.).—OPIFEX.

**Combined Clothes and Tool Chest.**—A. R. (*Somerton*).—Considerable annoyance would probably result by storing your clothes and tools together in one box; but by adopting my present suggestions you would not experience trouble in gaining access to either a tool or a garment. Two boxes are what I advise you to use—hinged together

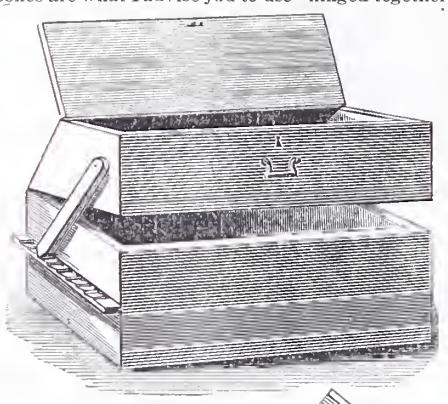


Fig. 1.

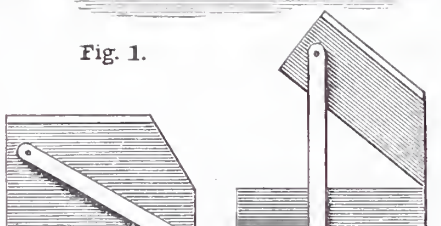


Fig 2. Fig. 3.

Combined Clothes and Tool Chest. Fig. 1.—Chest shown open. Figs. 2 and 3.—End Elevation, showing Box closed and open respectively.

on one side as in Fig 1. The back of the top one should be at other than a right angle to its bottom, to permit of its being opened sufficiently when required. At each, or only one, side of the upper chest, outside, pivot one end of a rail, allowing the other end to rest upon a notched gallery on the side of the lower chest. When the top one is lifted, the rail or rails, as the case may be, would retain it in that particular position.—J. S.

**Clarionet Pitch.**—TOPPER.—Your clarionet is a half-tone *too flat* for your piano. Clarionet players, as a rule, have a difficulty in getting down to the pitch of pianos, which are nearly always more or less flat. We think TOPPER must have a clarionet made in the French pitch or "diapason normal," which would be about a semitone below English pitch. If this be the case, it is impossible to bring the instrument up. Clarionets can be sharpened slightly to the extent of less than a quarter of a tone without affecting their *justesse* by removing the German silver tip from the barrel or socket of the instrument—*i.e.*, the small section which receives the mouthpiece and top of the first joint—and turning it down about the width of the tip—say ⅛ in. If it be a large bore clarionet, it would bear a little more; but it is not safe to go much beyond this, as if shortened too much it will throw the instrument out of tune, making the notes in the bottom register too flat and in the upper register too sharp. Instead of running the risk of spoiling his present socket, TOPPER would do well to buy from some musical instrument maker a "sharp" socket—that is, if his instrument is in the *English* pitch; for, as already stated, if it is in French pitch it cannot be brought up.—G.

**Darkening Bronze.**—J. E. (*Loughborough Junction*).—There are so many kinds of bronzes, each varying in colour and treatment so much, that, unless you give further particulars, it is difficult to advise you. Perhaps your panel is lacquered; and, if so, that would account for your not being able to darken it by exposure to the air.—R. A.

**Soldering Lamp.**—H. P. (*Shepherd's Bush*).—Consult the Indices to the two volumes of WORK already published, and search them through before asking queries, as the back numbers can always be had of Cassell & Co., London, E.C.—R. A.

**Black for Lamp Stand.**—BARRON.—Yes; you are quite right in supposing that Brunswick black is unsuitable for this purpose. You will find Berlin black very good for the job, because it dries with a nice, smooth, dead black; and if you brush it over when thoroughly dry with a rather soft brush, it takes a nice dull polish, if such a term can be applied to a dead black. Be sure to ask for Berlin black. It is sold at most ironmongers', 6d. and 1s. per bottle.—R. A.

**Moderator Lamp.**—A. L. (*London, S.E.*).—These lamps can be procured new at Gardner's, Charing Cross, or at Burton's (late Rippon & Burton), Oxford Street, and, in fact, at most high-class ironmongers'. But you would probably get one very cheaply by advertising for it in the "Exchange" column of WORK. Prices of new ones range from 12s. 6d. to 12 guineas. The quantity of oil per hour that a lamp of this kind would consume depends on the height it burns at and the size of the wick, but about 7½ hours to the pint is a fair average.—R. A.

**Building and Accommodation.**—A. C. (*Loveclough*).—I must take it for granted you wish the people to sit down. If this is so, you can easily get at the sitting accommodation of a floor space 40 ft. by 30 feet by taking the seat of an ordinary chair as being 1 ft. 6 in. by 1 ft. 6 in. Now allow 1 ft. 6 in. in front of the chair for the knees of the person sitting down, and this will just (and only just) allow of people passing in front without compelling the sitter to rise every time anyone passes in front of him or her, as the case may be. This gives us the exact space one person will occupy when sitting down—viz., 1 ft. 6 in. by 3 ft. 0 in., or 4 ft. 6 in. sup., occupied by one person. There are 1,200 ft. sup. in your room, so that as many 4 ft. 6 in. there are in 1,200 ft. will be the number of people the room will hold. You must make your own deductions for gangways, tables, or platform, seeing that you give me no particulars. You would find by setting the size of the room out to scale on a sheet of paper, and the size of one chair and the allotted space in front of chair out to the same scale on a piece of thin card, by cutting out the card and placing it on the paper, that you could move it about and at once see what you wanted.—E. D.

**Fountains.**—F. M. (*Manchester*).—I am not quite clear as to what you mean by "small illuminated fountains," or whether they are wanted for in- or out-door use. Write again.—C. M. W.

**Paraffin Lamps.**—ALADDIN.—Fig. 17, page 696, Vol. II., No. 95, is just the lamp you want, even to the silk fringe. The opal saucers used on the Argand gas lamps to soften the light will slide over the chimney of this lamp down to the level of the top of the wick. Some are large enough to go right down to the burner. If you want a fancy paper shade, you will have to make a wire support, of the kind used to support the common green card shades. That you could make yourself if you can solder. If you want it suspended at one fixed height, you have only to hook the three chains together at the top. I cannot tell you where you can get a lamp similar in design to the one you wish for, as, if I have correctly understood your requirement that the chains shall be easily detachable, you want the lamp to stand on the table on occasion; and I have never seen a lamp for sale similar to Fig. 17 on page 696, the chief recommendation of which is the possibility of using it as a hanging or standing lamp. If you are content to forego this advantage, and wish to buy one ready made, you can see a very good variety at Messrs. Benetfink's, 107 and 108, Cheapside, London, or you can write for their list.—THOMASO.

**Obtaining a Patent.**—DELTA.—The Patent Office rules state that—"On the acceptance of the complete specification, the comptroller shall advertise the acceptance; and the application and specification, or specifications, with the drawings (if any), shall be open to public inspection. Any person may, at any time within two months from the date of the advertisement of the acceptance of a complete specification, give notice at the Patent Office of opposition to the grant of the patent, on the ground of the applicant having obtained the invention from him, or from a person of whom he is the legal representative, or on the ground that the invention has been patented in this country on an application of prior date, or on the ground of an examiner having reported to the comptroller that the specification appears to him to comprise the same invention as is comprised in a specification bearing the same or a similar title, and accompanying a previous application; but on *no other ground.* If there is no opposition, or, in case of opposition, if the determination is in favour of the grant of a patent, the comptroller shall cause a patent to be sealed with the seal of the Patent Office." There are two modes of applying for the grant of a patent—one in which a provisional specification is lodged with the application, which, when accepted, is kept quite secret and never printed unless and until the patent is completed, and the complete specification filed. On the acceptance of this provisional specification, the applicant is at once protected, and has to complete his invention and

file his complete specification within nine months from the date of his application, on the acceptance of which, and after the expiry of the time granted for opposition, the patent will be sealed and issued. The other plan is by filing the complete specification and drawings *with* the application for the grant of a patent; but in this case the nine months' protection is lost, and nothing further in the way of improvement or addition which may be found desirable can be made to the patent, but another patent, embodying the additional improvements or knowledge, would have to be applied for, with the disadvantage that the acceptance of the documents by the office at once renders them accessible to the public, as has before been shown by the quotation from the rules. Both plans have their advantages; but great experience is required to know when and how to adopt each or either. The rules state that "A patent shall be sealed as soon as may be, and not after the expiration of fiftcen months from the date of application, except in the cases hereinafter mentioned," whieh do not enter into the nature of our correspondent's inquiries.—C. E.

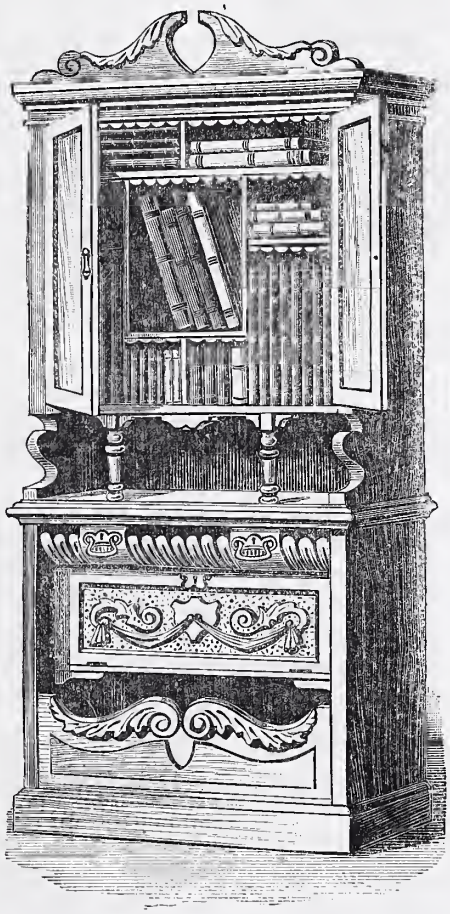
**Schools of Electrical Engineering.**—W. R. (*Carlisle*).—I have the opinion of a gentleman who is acquainted with the three schools mentioned. He places them in the following order of merit:—(1) City and Guilds of London Technical College, Leonard Strcet, Finsbury, London, E.C., with Professor Silvanus P. Thompson at the head of the Electrical Engineering Department; (2) School of Electrical Engineering, 12, Princes Street, Hanover Square, London, W., with Chas. Capito as senior instructor; (3) the Electrical Standardising, Testing, and Training Institution, Faraday House, Charing Cross Road, London, W.C., a new institution of great promise. Terms and a list of fees can be obtained by writing to the secretaries of these institutions. You will, perhaps, prefer a college nearer home. In that case, try University College, Liverpool, or Owens College, Manchester. As this profession is now in its youth, there are good prospects for a young man with an abundance of good health and plenty of "real grit" in his constitution.—G. E. B.

**Advice to Young Workman.**—DENNY.—My advice to you, and all like you, who have nearly learnt a trade, is to stick to the trade you have learnt until you can clearly see your way into another. You wisb to be an electrical engineer. I sketched out for you the course I could recommend in my reply to you on p. 702, Vol. II. of WORK. I do not know of a firm that would take you as "improver," and pay you sufficient wages to maintain you. Electrical engineers want premiums with pupils. The galvanometer you propose would be almost useless to an electrical engineer, but might suit a telegraph or telephone linesman. Make the instrument as Mr. Allsop directs, but do not follow your own notions of improvement until you have made an instrument strictly on the lines of the directions given you by Mr. Allsop. He is a practical electrical engineer, one who has *worked* his way up in the profession. An electrical engineer must not only know all the theoretical rules of electrical engineering, but must also have put them into practice by years of hard work. Should you see a chance of getting into an engineering firm where they make electric apparatus, such as dynamos, etc., seize the opportunity, and put in your best work.—G. E. B.

**Squeezing Wax for Carvers.** — J. W. B. (*Huddersfield*).—There seems no reason why the squeezing wax made acecording to the recipe to which you refer should not remain in a usable condition "for years," but I have not tried its durability, so cannot say. From the ingredients, I should say that it can be softened at any time by heat. A wax that constantly remains soft and has no tendency to harden would be as defective as one whieh could only be used once because it gets hard. I should think you might build up plaster of Paris on wood, and then carve it; but I do not know that this method is much practised, if at all. Surely it would be better to cast in the plaster if you want more than one copy of the same pattern; or if only one is wanted, carve it in some suitable material.—D. A.

**Etching Letters on Glass.**—EMBOSSTYRO.—(1) In answer to your first question—"What acid is used in glass embossing?"—if you wish for clear letters, you must use hydrofluoric acid; but if you want a ground appearance the gas must be employed—made by mixing fluoride of calcium and sulphuric acid together, and afterwards heating; directions for which you will find in WORK, No. 82, p. 487, or I will repeat for your benefit if you have not got it. And by all means stop out with Brunswick black, if you like that best. (2) No colours are used. You cannot get coloured letters by this method; but white letters upon a coloured glass are very easily obtained by using flushed glass of any desired tint, and after stopping out, pouring the acid upon the flashed side; it soon eats through this, and leaves exposed the white glass underneath. I hardly think you know what glass embossing is, and, of course, I cannot tell how the glass you refer to is done, as I have never seen it. In embossing, or etching, as it is properly called, all the parts unprotected—*i.e.*, not stopped out—are eaten away by the acid, and if it was left on long enough it would go quite through the glass (therefore it can never be kept in glass bottles, but in something it will not touch: gutta-percha, for instance); and although, as you say in your letter, by it you can "put a name or inscription of any kind on a shop or other window or glass door," yet, as I have before explained, the letters or designs will be white. But if it is simply gilt letters you wish to put on glass, why go to the trouble of etehing first? However, by this and other pieces upon the same subject, which you will, no doubt, have seen before this can appear, you will, I hope, have learnt what etching is, and if it is what you want, I have no doubt you will succeed, as it is not at all difficult; but if you know nothing of this acid, let me caution you to be very careful in using. It produces bad sores if dropped upon the flesh, and the gas is very injurious to breathe.—W. E. D., JR.

**Bookcase.**—WELL-WISHER.—I have designed the bookcase here shown, hoping that it may contain a suggestion or two of service to you. If the shaping and fitting of the shelves are not beyond your skill, I should advise you to scatter them in some such manner as that shown. The spaces would then be very convenient for the reception of your large volumes. You can either construct the top carcase to terminate in the brackets, or at the bottom of the latter join a moulded board, and



Bookcase.

screw the top carcase to the lower one. In the under carcase I have intended that the cupboard shall lay back a few inches, and have a flap door. In making the drawer, have a flat front joined perpendiecularly to the sides, and glue and screw a curved-front plain or carved piece along it. I have introduced a shaped piece attached on the front of the job at the bottom, to hide any loose articles whieh might occasionally be thrown into the recess, whose appearance, perhaps, would not tend to enhance the good looks of a piece of furniturc.—J. S.

**Polishing.**—X. L. U. M. (*Hebden Bridge*).—Either wax or oil polishing would suit your old cabinet. It could afterwards be French polished, but I should strongly recommend you not to have this done. French polish on such a piece of work would be quite out of place.—D. D.

**Bending Fretwork.**—E. C. (*Bristol*).—Does it not stand to reason that a piece of wood 12 in. long by 1¾ in. to 2¼ in. wide cannot be "rounded to a 2 in. diameter circle," either by bending or otherwise? I am inclined to think you have misinterpreted the instructions or drawings to whieh you are working. I can only suggest that the mysterious circles should be either turned or sawn according to their size. I suppose these pieces form the "concave and convex sides" to which you refer.—D. D.

**Wood-Carving Designs.**—A. L. W. (*Aberystwith*).—You can obtain a list of printed designs and photographs by writing to the Manager, School of Wood Carving, Exhibition Road, South Kensington. Write also for a list of photographs of carvings to Bedford Lemere & Co., 147, Strand, London, W.C. Write also to Mr. G. A. Rogers, Maddox Street, London, W.—M. E. R.

**Pedestal Dressing-Table.**—YOUNG HAND.—The drawer runners of a pedestal dressing-table should be tongued (*i.e.*, the boards should be rebated on the top and bottom surfaces at the side ends, leaving projections from back to front), and fit into grooves on the inner surfaces of the sideboards. Plinths should be separately made, and screwed, from underneath, to boards which should be joined to the bottom of the sideboards. Either a whole board, framing, or beams, may be used within the four dovetailed boards of each plinth; the top surface of the former, in whichever case may be preferred, being a distance down from the top edges of the plinth boards equal to nearly a thickness of a drawer-runner. If you had referred to the articles I named in the reply to which you allude (page 325, No. 72, Vol. II.), you would have gained some insight concerning plinths. Look also to "A Writing Cupboard."—J. S.

**Mounting Lenses.**—LENSES.—There is no hard and fast rule for mounting, as this is determined by the lenses themselves. The best distance of the stops from the lens must be determined by actual experiment. Portrait and rectilinear lenses must almost invariably have the stops plaeed half-way between the two combinations as the most effective position; with landscape lenses a short distance in front. The nearer the stop is to the front of a landscape or single lens, the greater is the field covered, and also the greater the curvature of the lines. The farther away (of course in reason) the straighter the lines, but the smaller the field. In placing the stops, a compromise must be made to obtain as straight lines and cover as large an arca as the lens is capable of. As to the sizes of the stops, no universal plan is adopted. The size of the openings is arbitrary. The Photographic Society of Great Britain introduced a uniform system based on 4 as the largest opening, each stop in succession smaller, requiring an exposure of double the time of the next largest. Very many lenses have their stops made in accordance with their focal length. The expressions F8, F16, F32 mean respectively that F8 is the diameter of the stop and one-eighth part of the focal length of the lens, measured from the back lens to the ground glass of the focussing screen; F16 means a sixteenth part of the focal length, and as the light diminishes according to the square of the distance, F16 would require four times as long exposure as F8, and so on with the other sizes.—D.

**Bone Handles for Table-Knives.**—F. G. H. (*Islington*).—The table cutlery trade is almost entirely confined to Sheffield, and unless F. G. H. can get what he wants through some friendly working cutler (*i.e.*, mender), we doubt whether he can do so except at that place. A Sheffield directory will give him the address of a dealer in such things. African ivory is used for all the best knives; the bone for the inferior ones is mainly imported from South Ameriea.—S. W.

**Battery.**—W. H. Y. (*Battersea*).—An article on the Austin Leclanché battery appeared in No. 84.

**Incubator.**—WHITE LEGHORN.—I gather that you have made a hot-air machine on Hillier's principle which answers well, but as you have not tried it you do not know whether it will succeed or not. If you will send me a rough sketeh, with full particulars, I will give you my opinion of it. In my promised article you will have described a thoroughly reliable machine, which you can get ready in good time for next season's hatching.—LEGHORN.

**Greenhouses.**—C. S. (*London, N.W.*).—If you will examine the published Indexes to WORK, Vols. I. and II., you will find much already existing on greenhouses. WORK is issued both monthly and weekly. You are entitled to the presentation plate issued, gratis, with No. 105 of WORK.

**Lithographic Stone Press.**—G. A. (*Edinburgh*).—You should advertise your Quarter-sheet Litho. Press in WORK.

**Fretwork Machine.**—F. F. (*Leeds*).—If you wish to make a Fret machine, consult Indexes to Vols. I. and II. of WORK. There is a mass of matter in WORK relating to fret machines.

**Price for Shed.**—HEATHFIELDS.—You omit to say what the scantling of the oak posts are, also who is to make the shed and erect it; for if the carpenter frames and fits the various pieces together at his place, it must be taken to pieces before you can bring it away. You likewise make no mention of tie beams, or if the wood is to be wrought or not. I give below a fair price for the different sizes of stuff you mention, taking my own idea of the size of oak posts required. These prices are for stuff in the rough, not planed. This, I think, will be sufficient guide for your purpose.

| | | | |
|---|---|---|---|
| 6 in. by 6 in. oak posts, per foot run, | | 1s. to 1s. 3d. | About. |
| 4 in. by 4½ in. yellow deal | ,, | 2½d. | |
| 3 in. by 4½ in. | ,, | 2d. | |
| 2 in. by 4 in. | ,, | 2d. | |

—E. D.

**Contents of Saucepans.**—HOLLOW-WARE.—To find the contents of the part outside the dotted lines, multiply the area of the space contained between the dotted line and the outside of the vessel by the circumference of a circle passing through the centre of gravity of that space. The area of the space referred to will be very nearly equal to the length of the dotted line (or height of

the vessel) multiplied by two-thirds of the breadth of space at centre. To find the centre of gravity of the area, draw it on fine card or stiff paper, cut it out, and hang it up freely on a pin by one end. On the same pin hang a plumb-line, and mark its position on the paper. Then in like manner hang the paper up on the pin by its other end, and where the plumb-line crosses the line drawn previously on the paper will be the centre of gravity. The distance of this point from the centre of the saucepan will be the radius of the required circle. If the vessel is in existence, you can get its contents by finding the weight of water it holds, taking the difference of its weight when full and when empty in pounds, and dividing by 62·37 to give the contents in cubic feet, or by 10 to give the contents in gallons. —F. C.

**Electrotype Copies of Printer's Type.**—COMPO.—The tools required will be: A moulding case—*i.e.*, a shallow brass pan to hold the cake of wax forming the mould—a clean copper or iron ladle to melt the wax in, a steam-jacketed pan for melting the wax and heating the moulding case, a set of "building irons," a shave knife, a press capable of taking forme, mould, and mould case, and a set of soft-haired brushes for the blackleading process. In addition to these, you will require a vat for the electrotyping solution, a battery of large cells, or a dynamo-electric machine to furnish current for the process, a backing tray, soldering tools, planing machine, and many other appliances found necessary in an electrotyper's workshop to finish the electro, and mount it ready for the printers. The materials required will be: Some best yellow beeswax for the moulds, sulphate of copper for the electrotyping solution, pure sheet copper for the anodes, best plumbago or blacklead for the mould, solder to "tint" the electro, stereotype metal to back it with, and wood blocks to mount the electros type high when finished. The type to be copied in this way must be specially set up for the purpose. The type should have a good bevel, as should also the rules and leads. All rules and leads should be thick. The quads, reglets, and spaces must be high, pages and blank spaces must be guarded, and the formes locked up tighter than for ordinary printing. The necessary quantity of beeswax should be melted by steam, and poured into the previously warmed moulding case from a clean ladle. The filled case must be kept level until the cake of wax is cool. The forme must be cleaned thoroughly, dried, and carefully blackleaded. Then the face of the type must be placed true with the face of the cake of wax in the moulding case, and the two pressed together in the press, so as to drive the wax of the mould into every crevice of the type. When this is done, and the forme removed, the mould must be well coated with dry, finely powdered plumbago, brushed well into every crevice with soft, long-haired brushes. The blackleaded surface is then connected to copper strips embedded in the mould, and placed in the electrotyping bath until it receives the necessary thickness of copper shell. This is removed from the mould, and placed face downwards in a backing tray floated on a bath of hot stereo metal, where it is first tinned with solder, then backed with a layer of stereo metal. The edges are then trimmed, and the electro mounted in the usual way on type-high blocks of wood. This is a brief outline of the method. For full and illustrated details of the process, get Mr. Watt's book on "Electro-Deposition," in which eighteen pages are devoted to the subject, and much other useful information given.—G. E. B.

**Camera Bellows.**—M. A. (*Maidenhead*).—The bellows can be purchased at most camera makers. Some firms make a speciality of supplying camera fittings of all kinds. No special tools are required in the process, which is exceedingly simple. H. Park, 5, Station Buildings, Acton Street, Kingsland Road, London, N., might supply your requirements.—D.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Printers' Oil.**—F. J. R. (*Bursledm*) will be obliged for a good recipe for making printers' ink as used for ceramic work of copper plates.

**Steel Lacquer.**—J. B. (*Tyldesley*) writes:—"Will any reader tell me of a good steel lacquer, or give me the address of anyone who makes or sells it?"

**Glossy Ticket Ink.**—A. H. (*Oldham*) writes:—"Can any correspondent say where I can get glossy black ink for ticket writing ready for use?"

**Artists' Easel.**—S. A. W. (*Wallasey*) writes:—"Will any reader oblige me with full instructions of the working of, and how to make, a neat portable artists' easel?"

**Cotton Belting.**—S. A. & Co. (*Stockport*) write:—"Will any correspondent point out a good remedy to prevent injury to cotton belting where the friction is very great?"

**Colouring Gun.**—GUN writes:—"I have a gun, the barrel of which has been black, but has worn off. Can anyone tell me how I can black same? Also if I can 'blue' the bright parts without getting them hot, and how?"

**Canoe.**—J. G. (*Sunderland*) writes:—"Would any able reader give me the design of a canoe of simple make, with a few hints as to its construction?"

**Turned Balusters.**—F. E. H. (*Lancaster*) writes:—"I shall be glad to be informed of any turner who can supply me with these."

**Rope Pulleys.**—T. P. S. (*Tudhoe Grange*) writes:—"Will any reader give me a rule to work the proportions of rope pulleys that are used for winding engines at collieries? I want one to work with a working load of seven tons, including ropes, eages, and tubs. I cannot find one to suit."

**Pyrotechny.**—F. W. T. (*Heathfield*) writes:—"Will any reader kindly inform me where I can obtain the following works on Pyroteehny—a work by Practieus, a French work by Chertier, a volume by Brown, and one by Thomas Kentish?"

**Index Rerum.**—J. B. (*No Address*) would be glad to be informed how to set about making this article.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Leclanché Battery.**—M. (*Bishop Auckland*) writes, in reply to C. F. W. N. (*Forest Gate*) (see page 78, Vol. III.):—"You can procure Leclanché batteries from Mr. Bowron, electrician, 93, Praed Street, London, from 1s. and upwards."

**Books on Coach Building.**—COACH BUILDER writes, in answer to YOUNG WHEELER (see page 829, Vol. II.):—"There are the following works on coach building: Budd, "Carriage Suspension" (2s. 6d.); Philipson, "Coach Body Making" (4s. 6d.); Boag, "Coach Painting" (12s. 6d.); Mattison, "Coach Body Making explained Geometrically and Mechanically"—to be had of Thos. Mattison, carriage draughtsman, Southampton—(price 10s. 6d.); Foggett, "Carriage Springs" (2s. 6d.); Philipson, "Carriage Suspension" (4s. 6d.); Foggett, "Carriage Wheels" (2s. 6d.), "Carriage Timber" (2s. 6d.); Philipson, "Draught" (2s. 6d.), which can be had of John Kemp & Co., 46, Cannon Street, London."

**Leclanché Battery.**—THE ELECTRICAL COMPANY (*Crewkerne*) write, in reply to C. F. W. N. (*Forest Gate*) (see page 78, Vol. III.):—"Our prices for Leclanché batteries are: No. 1, 1s. 6d.; No. 2, 2s.; No. 3, 3s."

**Lace Frame.**—W. B. (*Camberwell*) writes, in answer to MART (see page 14, Vol. III.): "He must get a board 20 in. by 6 in., and ½ in. thick, across the ends of which then fasten a piece of wood 2 in. by 1 in. substance, 6 in. long, the 1 in. side to be fastened to the board. Along the tops of each end piece bore a row of holes—about twelve—to take small screws, to which the work is fastened."

**Incubator Regulator.**—H. H. S. writes, in reply to W. P. B. (*Colnbrook*) (see page 78, Vol. III.):—"The difficulty of making a regulator is not great, but when such regulators as Hearson's patent capsule can be obtained for 10s. 2d. or so, it seems hardly worth risking a break-down by making one. W. P. B. may make one of a U tube having one end closed, and putting a little ether at the closed end, and filling up with mercury, on which rests a float which is connected with the damper."

**Turned Wood Cases.**—F. C. (*Liverpool*) writes, in reply to W. H. (*Stirling*) (see page 14, Vol. III.): "P. Macmuldrow & Co., 168, London Road, Liverpool, make turned cases such as you require."

**Joiners' Bits.**—C. A. N. (*Wolverhampton*) writes, in answer to A. A. W. (*Leicester*) (see page 734, Vol. II.):—"I beg to say that he can inspect or purchase any of the bits used by joiners at any good tool shop, and also have them thoroughly explained. But I would like to call attention to an expanding centre-bit which was brought under my notice through your paper, and which is certainly the most clever and ingenious little tool I have bought for some time. They are made in three sizes, viz., ⅝ in., ⅞ in., and 1 in., and cut any hole up to double their size; so that with the three bits you can cut any sized hole, from ⅛ in. up to 2 in., to a hair's-breadth. They are sold at 1s. 6d., 2s., and 3s. One very important thing about them is a small regulating screw at the side, which prevents the sliding cutter from expanding during the act of boring. I wrote direct to the inventor for mine after reading the article in your paper, WORK—a Mr. Anderson, 3, Poulton Road, Seacombe, Cheshire—and I consider them a valuable addition to my stock of joiners' bits."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—AMATEUR PRINTER; B. Co. (*Colchester*); G. W. Y. (*Wolverhampton*); W. L. (*No Address*); F. H. (*Rochdale*); E. L. (*Bath*); G. T. (*Hollingwood*); J. F. (*Elgin*); J. F. (*Sandbach*); C. T. E. (*Somerset*); R. J. (*Leominster*); L. U. M. (*Hebden Bridge*); AN AMATEUR; J. C. (*Chelsea*); A. C. (*Leicester*); J. H. (*Wolverhampton*); G. P. (*Bebington*); A. H. (*Manchester*); BERTIE; G. H. (*Newcastle*); W. H. (*Penzance*); G. H. S. (*West Kensington*); G. W. W. (*Thornton Heath*); T. S. (*Morpeth*); W. J. B. (*Deptford*); E. H. (*Sunderland*); R. W. V. (*Camberwell*); M. H. M. (*Hull*); H. H. L. (*Bebington*); J. R. (*Kilmallock*); BRASS (*Glasgow*); H. R.; P. O. C. (*Cork*); A. G. (*Sheffield*); J. J. (*Kidderminster*); G. H. S. (*London, W.*); A. H. (*Manchester*); GALVANIO; APEX; J. A. M. (*London, N.W.*); PARALLAX; J. M. (*Kilmarnock*); R. J. (*Sheffield*); T. E. (*Wandsworth*); F. D. (*Margate*); A. K. (*Bristol*); M. W. (*Bath*); F. G. I. (*Dundee*); G. F. (*Paisley*); F. Y. (*Sunderland*); H. C. (*Oldham*); W. E. G. (*Preston*); V. D. (*Hereford*); G. M. (*Hull*); L. A. (*New York*); S. W. (*Watford*); E. P. (*Hampstead*); T. K. (*Windsor*); G. L. (*Reading*); J. H. (*Brighton*); C. P. (*London*); A. S. (*Yarmouth*); A. L. C. (*Richmond*); E. J. P. (*Belfast*); R. B. (*Chiswick*); T. G. (*Liverpool*); B. E. (*Newcastle*); F. L. (*Edinburgh*); A. L. (*Manchester*); S. K. (*Birmingham*); T. W. S. (*Glasgow*); R. B. (*Birmingham*); A. E. B. I. P. (*Cheshire*); W. W. (*Fulham, S.W.*); R. T. (*Paisley*); W. M. L. (*London*); A. B. (*Nottingham*); J. B. (*Devonport*); J. M. (*Fulham, S.W.*); F. S. (*Bristol*); W. B. P.; A REGULAR SUBSCRIBER; VEBAX; MUSICUS.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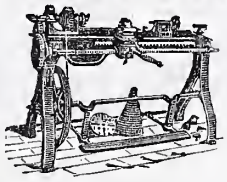

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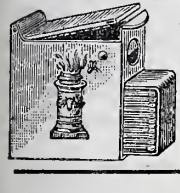

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 115.] SATURDAY, MAY 30, 1891. [PRICE ONE PENNY.

### A PORCH FOR A COTTAGE OR SMALL VILLA.

BY ARTHUR YORKE.

MATERIALS — DIMENSIONS — CONSTRUCTION OF FRAMEWORK—FILLING IN THE FRONT—THE ENDS—THE ROOF AND ITS ARRANGEMENTS.

*Materials and Dimensions.* — The porch for which a design is now given is provided with seats, and is intended for houses standing in their own gardens, and to some extent secluded from observation. It is built with straight stuff, the heavier parts being supposed to be of some one of the straight-growing fir woods, and by preference of larch, which is best and most enduring. Its dimensions are such as are suited to a small house. It projects 3 ft. from the wall, is 6 ft. wide, and 6 ft. high to the lintel. The perspective view (Fig. 1) and Figs. 4 and 6 are not drawn to scale; Figs. 2, 3, and 5 are drawn $\frac{1}{2}$ in. to the foot.

*The Framework.* — In the ground plan (Fig. 2), it will be seen that the front is supported on four collar-posts, *a*, *a*, *a*, *a*. These are cut from so many rough larch poles—say $3\frac{1}{2}$ in. or 4 in. at base, and not much less at top, for plantation-grown larch tapers very gradually. They rise 6 ft. above the ground-line. The best way of setting them is on blocks of stone, where the post will be prevented from moving by an iron dowel let into the stone and the bottom of the post. Since, however, this rustic work is perhaps most frequently followed by the non-professional workman, who will prefer an easier method, it should be said that it will suffice to let them into the ground, like ordinary gate-posts, for a couple of feet, and to well ram them in with stones and earth. If this last plan is adopted, it will be well roughly to shave off the bark from the part to be buried, and to gas-tar it. Though more liable to rot than when mounted on a stone, a well-seasoned larch-post, thus treated, will last for many years.

The back-posts, *b*, *b*, are of poles sawn in half, and nailed to plugs driven into the masonry. The nails alone will hold them in place, as also the dwarf-posts *c*, *c*, which are 14 in. high, and support the corners of the seats.

On the top of the four front collar-posts rests the lintel, which is nailed down to them, and over the two corner-posts it is cut half through to receive the wall plates (*d*, Fig. 3), which here rest upon it. These wall plates, it will be seen from the figure just named, are 3 ft. 3 in. long, and so project 3 in. beyond the collar-posts. This allows the front rafters to be set slightly farther forward than the posts, which will thus be better sheltered by the roof. At top the rafters

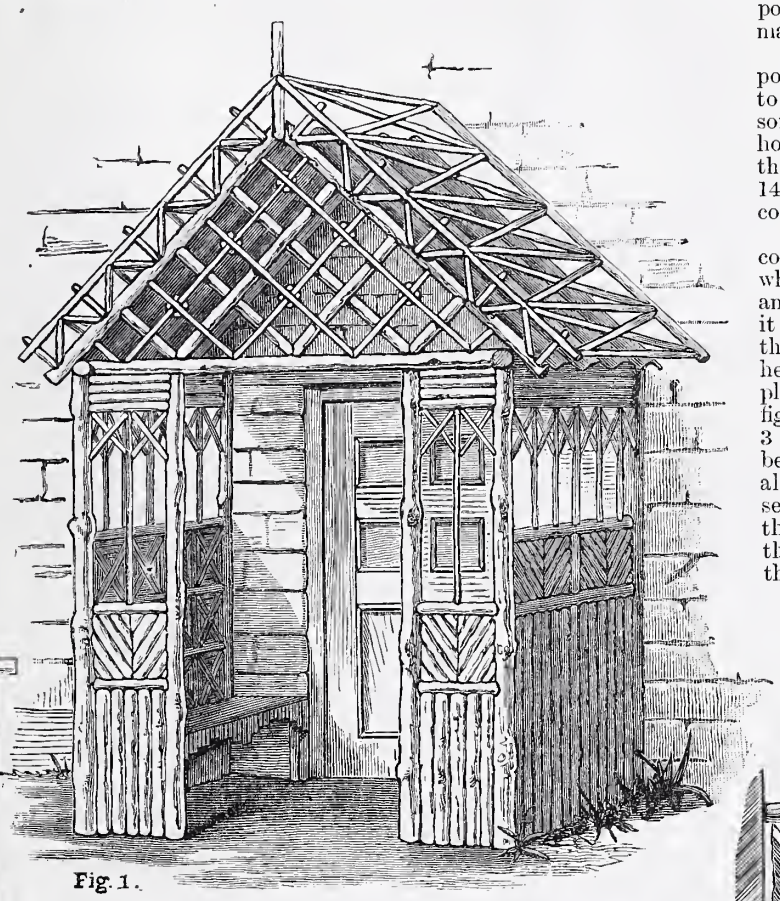


Fig. 1.

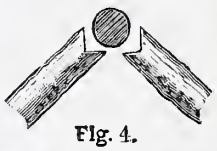


Fig. 4.

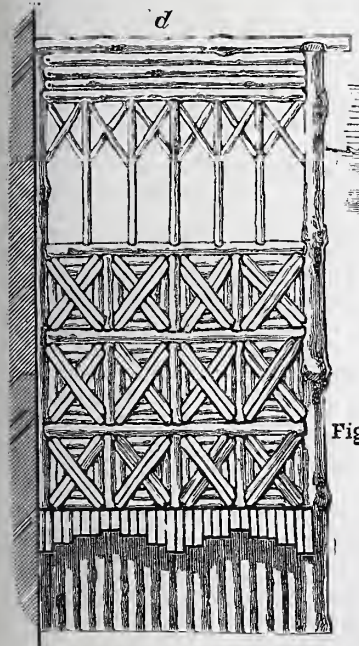
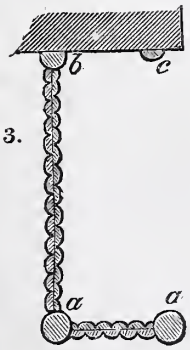



Fig. 3.



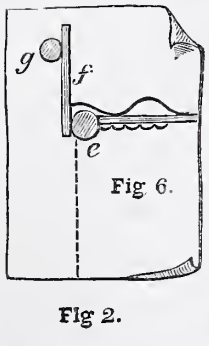




Fig. 6.

Fig 2.

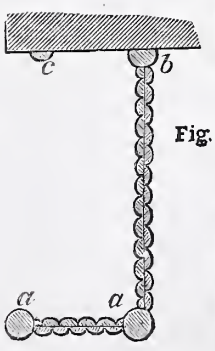



Fig. 5.

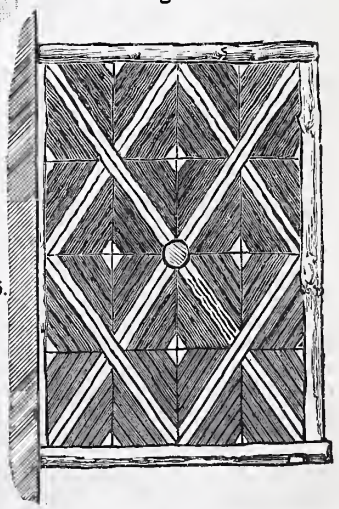


Fig. 1.—Perspective View of Rustic Porch for Cottage or Small Villa. Fig. 2.—Ground Plan. Fig. 3.—View of Side as finished within. Fig. 4.—Rafter Ends showing Mode of Connection with Ridge-Pole. Fig. 5.—Ceiling. Fig. 6.—Support of Trellis for Climbers.

are cut to clip the rustic ridge-piece, as in Fig. 4. The back rafters are, of course, of half stuff, and are nailed to the wall.

*The Front.*—Having thus put together the main framework of our porch, we will consider how the front is filled in. Between the two collar-posts, at each side, it will be seen that the space is closely filled up halfway—that is, to a height of 3 ft. In the first place, we take a piece of quartered stuff and nail it from post to post, one of its sawn sides being outwards and in a line with the middles of the two posts, and the other sawn side upwards and 14 in. from the ground. To the former side will be nailed the pieces of half stuff seen in Fig. 1, which form the outer side of the wall, and on the latter will rest the end of the board which forms the seat. The upright pieces of half stuff mentioned above are 2 ft. long, and on their tops another cross-piece of quartered stuff (shown in Fig. 1) is fixed, and nailed down into them. Other upright pieces of half stuff, so arranged as to "break joint," are nailed against these from within, both above and below the seat; and the diagonal pieces seen outside (Fig. 1) are again nailed against these latter. Above comes some open work, which explains itself, and at top is a little more solid work—viz., four or five horizontal pieces of round stuff, of which the ends are cut to clip the posts somewhat as those in Fig. 4.

Above the lintel, it will be seen that the gable is filled with open trellis. The little quatrefoils seen in this are made by nailing short bits of rod, with their ends to the front, at the intersections of the smaller members of the trellis.

*The Ends.*—The construction of the ends, as regards their lower and upper parts, is much the same as that of the sides of the front. There is a cross-piece for the seat, and the space beneath is filled by a double row of upright halved stuff; but here we have the closed work rising higher than at the front—namely, 4 ft.—in order that the heads of those sitting within may not be exposed to draughts. Fig. 3 shows the inner side of one end. Here the seat-board, which will be some 14 in. wide, is supposed to be seen fixed, and its edge is ornamented with short strips of split rod. To fix these last securely, a slip of lath should be nailed along below the front edge of the seat-board; the strips can then be bradded to this, as well as to the edge itself. Above the seat, and below the open work, is a large space to be filled with rustic mosaic, to the given design. The cross and upright pieces which form the panels in this are of constructive value, as keeping in place the pieces of half stuff which form the outer wall. In the panels light and dark rods may be used in contrast, the St. Andrew's crosses being of peeled willow, and the filling-in of hazel, birch, or the like, with the bark on.

If, as in this rough work is pretty sure to be the case, chinks should show where they ought not, they can be made air-tight by neatly stuffing with moss.

*The Roof.*—Passing to the roof, it must be observed that its under side—the ceiling, so to speak—is of rustic mosaic; the design for it is given in Fig. 5. In outdoor carpentry there is no prettier work than fitting together rustic mosaic, but it is not so if it has to be done overhead. It is better, therefore, to arrange boards to cover one side of the roof, to screw them temporarily together with ledgers on the off side, and to brad the mosaic upon them before they are fixed up. To the backs of these boards the roof proper, which is of zinc or galvanised iron, will be screwed down.

A metal roof has been introduced, because of the greater facility with which such a roof can be applied by the amateur builder, and not that metal roofs are in other respects things to be desired. They are the reverse of ornamental, and are far too effective as conductors of heat. I have, therefore, taken precautions both to disguise the present one and to keep it cool. Fig. 1 shows a trellis thrown over it, so that it may be hidden and shaded by climbing plants. If brought close to metal, and the aspect is a warm one, climbing plants will not thrive; this trellis is, therefore, kept 4 in. or 5 in. above the roof. Fig. 6 is an oblique section showing how the trellis is fixed over the true roof: *e* is the true rafter; *f* is one of the short pieces of rod which support the false rafter *g*; and it will be seen that these pieces are nailed to the *front* of the true rafter and to the *back* of the false one. The front of the trellis, therefore, projects beyond the roof, and is, in consequence, more effective. At its back the trellis is supported on rafters of half stuff nailed to the wall.

## CONSTRUCTIVE STRENGTH IN METAL WORK.

BY J. WHITFIELD HARLAND.

STRENGTH OBTAINED BY FORM ONLY—CAST-IRON COLUMNS — BEAMS — GIRDERS — "FISH-BELLIED" GIRDERS—T SECTION—DOUBLE-FLANGE HOLES IN WEB OF CAST GIRDERS—TESTING GIRDERS—FRAMING FOR MACHINE TOOLS—SECTION THEREOF — BOSSES OR LUGS FOR LONGITUDINAL TIE RODS—"A" FORM OF SUPPORT—LATHE BEDS—SHARP INNER ANGLES PRODUCTIVE OF FRACTURE—OBVIATING THIS.

IN a former paper I said that the further consideration of this subject divided itself into two distinct classifications: the first involving strength obtained by form only, the other obtaining strength from aggregating separate parts in a constructive manner; and it is the former class that I now propose to describe.

In the construction of buildings, bridges, etc., the replacement of wooden beams, formerly used almost universally, by the use of cast or wrought-iron ones has caused the fullest inquiry and experiment on the part of engineers, and whilst the result has been the compilation of tables of strength of both and formulæ for calculating the required dimensions to carry the necessary weight, and for ascertaining the direction and force of the strains it will be subjected to, it has also led to various theories as to the strongest possible form or shape of material for the purpose in view, and to the economy of weight, and therefore value. Hence it is now recognised that a hollow cast-iron column is able to bear a heavier perpendicular pressure than the same quantity of metal if cast solid; and as columns are intended entirely to support weight, and are not subject to side thrusts, the result has been that cast-iron columns are the rule. It would be expeusive to make wrought-iron columns tubular, and the expense would be unnecessary, as, with the exceptiou of a fire taking place, cast columns are just as good, and at one-third the cost.

In beams—or, as they are called when made in iron, girders—the strain is no longer vertical, *i.e.*, compressive, but deflective or tensile, the whole superincumbent weight being supported at the ends where the girder rests on either walls or columns, as the case may be. Its breaking weight in the centre can be accurately ascertained from formulæ and tables, and the point of fracture will naturally be exactly in the centre, if the weight be at all evenly distributed. On this account the form of the girder known as the "fish-belly" is designed, in which the top flange is straight, whilst the under edge of the web takes the form of an inverted arch, so that at the centre of the girder the depth is considerably more than at the ends. Virtually the metal is taken away from the part where it is not needed, and placed where the breakage would be certain to take place, so as to strengthen such part by economical distribution of the same weight of metal in a more scientific form (see Fig. 1). Here the dotted line shows the original straight girder, and the curved line the "fish-belly" or inverted arch.

It is not only in the length and depth of a girder that difference of form produces extra strength, but also in the breadth, or, as it is generally termed, the "section." Thus the T section, as shown in Fig. 2, can readily be either rolled in wrought iron or cast in metal, and the flange thus formed keeps the web from buckling and overcomes side thrust, besides giving a broader flat surface at the top upon which to lay joists, etc. Sometimes a second though smaller flange is made at the bottom also (see Fig. 3), upon the upper edge of which the ends of joists abut, so that their upper edges and that of the top flange are flush, or nearly so.

Sometimes, especially in bridges, the girder is formed of either one arch-shaped segment or of several segments flanged at the joints and bolted together to form one arch, butting against the springers of the piers, and sometimes cast girders are straight and level at the top flange, whilst the web is, instead of being of inverted arch-shape, latticed and pierced, the bottom flange being really an arch pure and simple, and such girders are in wide spans made in several separate segments and bolted together through flanges at their ends. Girders of wrought iron, on this principle, come under the second classification above-mentioned, as do roofs. There is one point in respect to cast-iron girders that should not be lost sight of, viz., that when necessary to strut them apart, it is very bad construction to drill holes in the web itself. The effect of a hole in the web of a girder weakens it in this way: that the forces are by it divided (as the draft in a flue is divided by a slate put edgeways across) into two directions. The weight upon the top then uses the part of the web above the hole as a fulcrum to tear the part below the hole asunder; whilst the depression or side thrust (acting downwards in this case) has only that depth of the web above the hole to resist it instead of the whole depth of the web. Thus the web is attacked in two directions by opposite forces—one tensile, tearing at the lower part, and the other at right angles as a side thrust; and it will be seen that even a small hole, by its dire consequences in thus dividing opposing forces, weakens the web by very nearly one-half, if the hole be central. The nearer the hole to either flange the less dangerous it becomes, because either the upper part of the web is greater, and therefore better able to support the thrust, and at the same time less able to act as a fulcrum, whilst the lower intact part of the web is reduced so as to be subject only to the partial tensile strain (the rest of such being neutralised by the rest of the down-thrust); or, the hole being nearer to the top

flange, the upper part is less, and therefore the lower part is the greater and the better able to resist tensile strains. At the same time, whilst the fulcrum, it must be admitted, is better, yet the amount of increased cohesion below is so much greater to overcome than before, that the down-thrust loses, in antagonism with the balance or rest of the tensile strain, much of the power it would have were the hole in the centre, so that it is nearly neutralised. Still, a hole anywhere weakens the web; and what is more curious, and almost seems paradoxical, is the fact that two holes in the proper places do not weaken it so much as one in the centre of it. The reason is this: that all space between the two holes is neutral territory where the forces spend their energies in counteracting one another; it is only that below the lower hole that is subject to the undivided force of tensile strain, and that above the higher hole that has to resist the undiverted down-thrust. I am not going now into the method of ascertaining the exact value in pounds of such strains, but they can be ascertained; all I attempt is to point out their existence, and to deduce the inference that, to bolt any strut to a cast-iron girder, holes should be bored in the flanges in preference to the web. It is also evident that if a hole bored on purpose right through may so weaken a girder, that a blow-hole might exist, invisible from the sides, which would weaken it almost as much. Therefore, every girder ought to be tested up to at least two-thirds of its intended breaking strain, which is usually three times that of the maximum load it is intended to carry.

Leaving girders, let us glance at the construction of what is termed the framing of machines and tools, as to the form which gives the greatest amount of strength, and also confers the quality of rigidity—a most essential point. It ought scarcely to be necessary to point out that in order that any machine may work well it must be placed on a perfectly level foundation or floor; if this be not done, all sorts of twists and strains are created, and the journals and shafts work at very great loss through extra friction. In such machines as have horizontal beds, such as lathes, printing presses, planing machines, shaping machines, saw benches, etc., the bed should be dead level both transversely and longitudinally, and the feet it stands upon should, moreover, be placed on an equally level foundation, so that the weight be evenly distributed equally amongst all the supports. The broader the base the lower the centre of gravity will fall, and the more stability will be obtained; at the same time forces will be carried harmlessly away to the earth. The ends, therefore, of a lathe-bed are usually made in the form of a capital letter A (see Fig. 4), which not only is broad at the base, but also, by being bridged across by a rail which is both tie and strut at the same time, affords a solid bearing for a pedestal to be fixed in which the crank shaft revolves. For extra strengthening of this support it is most often made of the section of a double-flanged T girder—*i.e.*, consists of a web and flanges (see Fig. 5)—this form being strong in proportion to the weight of metal used. Upon this flange at the top is fixed the bed itself, and it is often strengthened by longitudinal wrought-iron bars. Too often these are put through the web itself, but in good construction either the web is thicknessed out by having a boss cast upon it or a lug is cast on the outer flange for this purpose (see A and B, Fig. 4), bored, and the rod turned true to fit, and screwed for a nut to force it up to a shoulder forged on the rod (see Fig. 6).

By using the "A" form of support, in which both legs are of the same length, it follows that the contracting in their cooling will be equal, and the after expansion and contraction from changes of temperature will be equal in both and act at the same angle, as also at each end, so that the level of the bed will never be disturbed either lengthways or crosswise—a most important point, as has been shown above, the true working of the tool depending upon it. In a lathe, in order to prevent the bed deflecting out of the straight line—or, rather, plane—of its upper surface, its two parts are cast fish-bellied underneath, as the slightest springiness would be fatal to the work intended to be done. In very long beds, intermediate supports are even requisite, so as to reduce the span between the supports at the two ends.

By a glance at Fig. 2, section of a T girder, at c, c, it will be seen that these angles are rounded off, not left square and sharp. The reason for this is that much extra strength with very little extra metal is gained. Were they allowed to go sharp and square at the shoulder, they would help the forces in certain directions to break the flange away from the web; but this slight rounding obviates this, and the tendency that all sharp inner angles have to go farther, like a crack or the beginning of a crack, is overcome.

In the construction of surfaced bed-plates for all tools, whether shaping machines, planing machines, printing presses or machines, surface plates, drilling machines, saw benches, and the like, where absolute rigidity is a *sine quâ non*—a required necessity—one has to consider the best means of

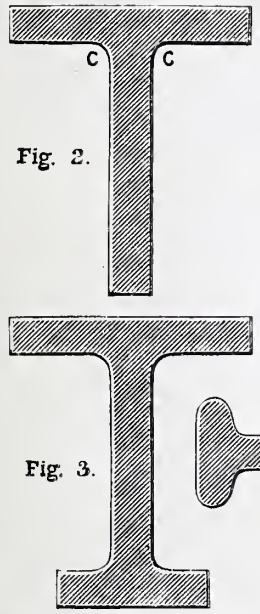


Fig. 2.


Fig. 3.

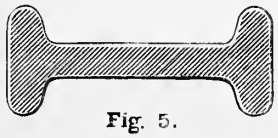
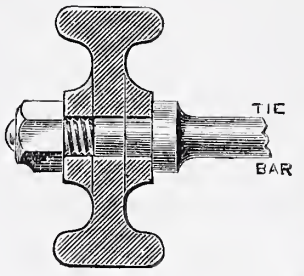


Fig. 5.



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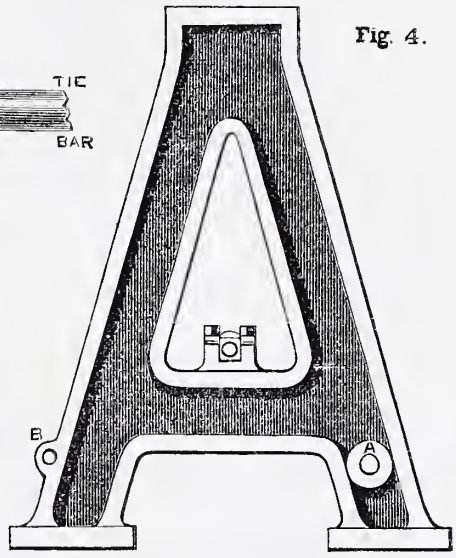


Fig. 4.

Fig. 1.

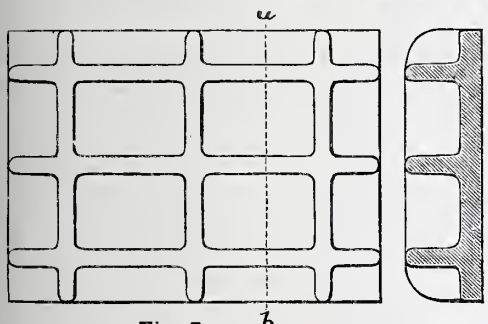


Fig. 7.


Fig. 8.

Fig. 1.—"Fish-Belly" Girder. Dotted Line shows where Metal is taken away and where added. Fig. 2.—Section of T Girder. Fig. 3.—Section of Double-Flange Girder. Fig. 4.—Elevation of Support in "A" Form. Fig. 5.—Section through the Support. Fig. 6.—Section at A, Fig. 4, showing Boss and Tie-Rod. Fig. 7.—Plan, looking up, under Parallel-Ribbed Plate. Fig. 8.—Section through *a b* in Fig. 7. Fig. 9.—Plan, looking up, under Diagonally-Ribbed Plate. Fig. 10.—Section through *a b* in Fig. 9.

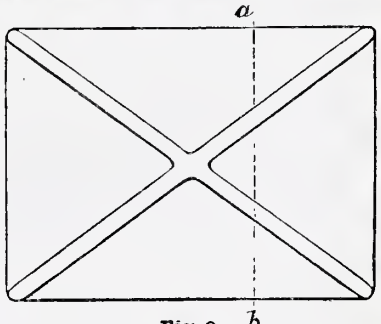


Fig. 9.

Fig. 10.

attaining this attribute by the form given to the metal, for they are almost without exception cast. Taking the square or, more often still, the oblong form of table or bed-plate—usually supported at the corners or all along the sides—experiment teaches us that diagonals drawn from each corner, crossing in the centre (and thereby giving the centre), show us the weakest point in any plate of even thickness throughout—viz., that centre which, under pressure, sustains the full brunt of all opposing forces. To avoid thickening the plate out until it shall be strong enough everywhere to enable the centre to resist the opposing forces, which would entail putting metal where it was, not only not required at all, but which would also throw in an attraction to the forces evolved, absolutely weakening the centre (by putting more weight of metal at the extremities of the plane), the principle of the fish-bellied girder is logically resorted to. In Figs. 7 and 9 (the underside, or plan, looking up) I show two forms of this application: the one, Fig. 7, showing webs or ribs running parallel to the four sides of the table intersecting at the diagonals; the other, Fig. 9, diagonal webs intersecting at the centre. A combination of these two forms with slight modifications is probably the best form of construction, especially where very great strength is required—but an illustration of it is scarcely needed. Note always that internal angles of intersection should be rounded into one another and never left sharp (see Fig. 2, c, c), as also where they die into the underside of the plate itself. Fig. 8 is a section through *a b*, Fig. 7. Fig. 10 is a section through *a b*, Fig. 9.

Having thus explained the reasons for the most usual and ordinary methods of gaining strength by form only, I must leave the rest of the subject for another paper.

## EAR-RINGS AND OTHER ORNAMENTS FOR THE EAR.

### PRINCIPALLY WITH REFERENCE TO THEIR MODES OF ATTACHMENT.

BY H. S. GOLDSMITH.

### Joint Hooks — Ear-Studs — Ear-Rings for Unpierced Ears.

Joint Hooks—Rules for Joint Hooks—Stops—Patent Spring Ear-Ring Joint—French Mode of fixing Ear-Top—Ear-Studs—Modes of Retaining Ear-Studs—Spring Pieces—American Spring Piece—German Hook—Details of German Hook—Fastenings and Modes of Attachment for Unpierced Ears.

*Joint Hooks.*—Joint hooks, such as Fig. 18, A, B, were formerly used here in England to a much greater extent; in fact, most of the jewellery made more than forty years ago will be found to have this class of fastening, and even at the present time the French use it a great deal. We find, whenever we examine their work, that the hooks are of a proper shape, and in addition, they have made the fastening into a nicely-formed lip piece, which acts as a guide to lead the wire into the hole, whose edge retains the hook in its place. It is sketched in Fig. 18, B.

Just a word about the proper shape spoken of above. This hook is governed by the same rules as the ear-wire, and *must* be brought well forward if the work is to hang properly.

It is because these are generally bought ready made, and are put on to the work in the shape they then are, that we so often see English-made collet ear-rings hanging down like Fig. 18, C, instead of like Fig. 18, A and B. These last two *could* not hang very much out, while the other one is sure not to hang properly for the whole of its natural life.

Some of this class of fastening (now mostly seen in museums and collections) have the hook and its catch-piece straight up and down, like Fig. 19, A and B, and yet there is nothing wrong with them when in the ear, for the tilting forward is prevented by some arrangement or stop. These stops are generally small, like Fig. 19, A and B; but now and then we meet with a wire mount, devised to keep the ear-top in its place. The arrangement is large enough to rest against the firm cartilage of the ear. The pair sketched here, which are really rather larger than the diagram shows, point out very unmistakably this way of keeping the ear-top in its place, and that is why both right and left are shown in both back and side views.

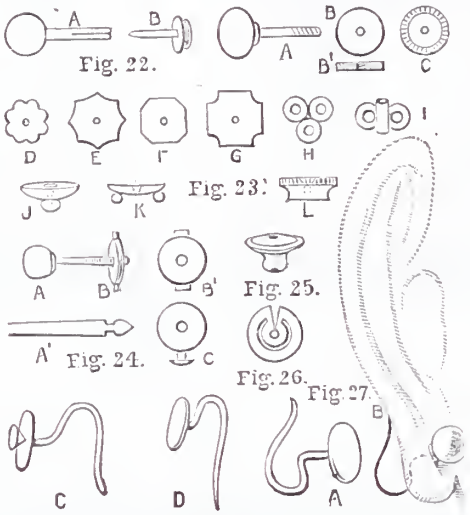



Fig. 22.—Ear-Stud Split Tube (A) and Plug Fastening (B).
Fig. 23.—A, Ear-Stud with end of Ear-Wire as a Screw; B, C, D, E, F, G, H, Different forms of Nuts for same: B' gives the average thickness; I, J, K, L, Other and deeper forms of Nuts.
Fig. 24.—A, B, Side View of Spring Ear-Stud when fastened: B', End View or Plan of Spring Back; C, Plan of another Spring Back.
Fig. 25.—New Patent Spring or Magic Fastening to fasten on to Plain Wire.
Fig. 26.—Form of simple Spring Back to fasten on Plain Wire, made from a piece of fla. Plate pierced as Diagram.
Fig. 27.—German Hooks—A, Correct Form; B, Correct Position in the Ear; C and D, Incorrect Forms of same.

If ends ever do justify the means taken to attain them, then these clumsy ways may be justified, for they certainly succeed in keeping the front of the ear-top *to* the front, and that is one of our chief ends that we must always keep in view and attain, somehow or other. But, after all, would it not be much easier to have the wire of a proper curve whenever we can, so as to bring it into conformity with the remainder of our work, which we take pains to make neat and nice? Not only would it be a saving of trouble, but it would be the best way, because of its suitability and of its simplicity; and in our trade, as in all others, good work shows no effect of labour or worry, but simply seems to have grown like it is, and then it possesses some of the qualities of beauty as defined by Ralph Waldo Emerson, who writes:—"We ascribe beauty to that which is simple, which has no superfluous parts, which exactly answers its end, which stands related to all things, which is the means of many extremes." And in the same essay on Beauty he quotes Michael Angelo: "It (beauty) is a purgation of superfluities."

There is no doubt that stop pieces are necessary under some conditions; but unless such conditions obtain, let us never use ugly arrangements like these except when other and neater methods are not available. Similar to the foregoing, but acting differently, are those sketched in Fig. 20 and Fig. 21.

Fig. 20 is the patent spring ear-ring joint, of which Messrs. Calipé, Dettmar, & Co., 19, Poland Street, Loudon, W., are the sole agents.

The diagrams Fig. 20, A and B, are copied from their handbill; Fig. 20, B, is the form in which they are sold ready for soldering on, Fig. 20, A, being the complete article, the limits of the spring action being shown by the dotted lines. The principle on which this is made seems a good one, for the hook is a fixture, being hard-soldered on, thereby lessening the chance of losing the ornament even if the spring failed to act. The movable or spring piece has no strain on it, and that is, of course, an advantage in favour of security.

Another way of fixing an ear-top is shown in Fig. 21. It fastens in this way:—First the straight piece that passes through the ear is soldered on in a slightly downward direction, and is flattened and notched as sketched. Then the jointed piece is pierced with an oval hole to allow the notched end to pass through until it clips down, and thus it is secured. For both of these we are indebted to the French.

*Ear-Studs.*—Ear-studs are those ornaments which rest on the lobe of the ear, for I have for my present purpose defined ear-rings as the ornaments that hang below it.

To achieve the proper position of this class it is a necessity that the piece of tube or wire that actually rests in the thickness of the lobe should be straight, and should have the ornament fixed on its end, just the same as a brass-headed picture nail has the head fixed on.

This straight piece is the real difference between ear-studs and ear-rings, and in the diagrams, be they screws, pegs, or the German ear-wire, we find the same straight piece; and in the latter it will help us to get the right shape if it can only be understood that in the thickness of the lobe of the ear the straight piece should go, for it is not a hook to be used as we use an ordinary ear-ring hook, as you will see when you get to the details of this a little further on.

Generally, these ear-studs are retained on the ear by one of three methods—first, by pegs, like Fig. 22; secondly, by screws and nuts, Fig. 23, A to L; thirdly, by a spring piece to clasp the wire, like Fig. 25, or to fasten on the end of it, like Fig. 24.

The mode of fastening by a peg, or plug, can be judged from Fig. 22, A and B. It is merely a thin, unsoldered, or split tube for the front piece, which passes through the ear from front to back, and when in position the back plate B (which has a peg soldered on it) is inserted, and, if properly made, holds well. The only two things to see to are—first, that the split chenier is made of rather thin (say size 2 Shakespeare gauge), tough gold, and that the peg fits rather tight.

Those fastened with screws are now the most often made, and after the fashion of Fig. 23, A to L. The other way of screwing the back into the chenier seems to have been dropped entirely. If it were made, the two pieces would be just like Fig. 22 in appearance, but then the chenier would be soldered and tapped to take the peg, which would also be given a screw thread so as to screw in.

Fig. 23 shows that the wire which passes through the ear is screwed at the end, and on this screwed part a nut is made to run. Here are a few shapes that I have taken note of, some drawn in plan, some as seen from the side. They are all in use and all act pretty well, but the best are those which have a good thickness for the screw, like Fig. 23, I, J, K, L, for here we not only get a steady-running nut, and one that will wear well, but we have the chance of bevelling the hole on its top edge, and so be able to lead the end of the screw more easily into its place. Ever such a little bevel is better than none, for we know that ladies have to fumble about behind their ears to get these nuts on.

Spring pieces (Fig. 24, A, B, and C), that clip the bulb-like end of the wire (Fig. 24, A), do not seem to have given universal satisfaction, for between the two evils of a clumsy wire that will give a good grip to the spring, and a neat wire that will pass through the ear nicely, but is too thin to give good hold, no means seem yet to be devised, unless Fig. 25 should be the one. Both (Fig. 24, A, B, and C) act by pressing the thumb-piece in when the wire is to be released, and they both fasten automatically when the beaded end of the wire is placed in the hole made to receive it.

Fig. 25, of which better things are expected, is an American invention, and Messrs. Calipé, Dettmar, & Co., of Poland Street, London, W., are the patentees here.

The wire needs no preparation or alteration ; it simply must be straight and smooth. Then the fastener is made so that it will slide easily up the wire, and will remain and hold just where it is placed, until the bottom bead is caught hold of; then it comes away easily enough. This is a great advantage if the wear and tear of use do not find out defects. There have been a few attempts to use the plain wire and something to grip it. Fig. 26 shows one, but if successful ones have been previously made they have not come under the notice of the writer.

The description of the interior of Fig. 24, B and C, will be given in a paper yet to be written on spring fastenings employed in jewellery.

The so-called German hook, Fig 27, is one of the best, if not the very best, arrangements we have for an ear-stud. It has no loose nut or spring to get lost, and is formed from a simple piece of wire, usually bent as sketched, Fig. 27, A, and worn as sketched in Fig. 27, B.

Now, to make this properly, there are about four things to remember, apart from the quality of the wire, which must not be too soft.

Fig. 18.

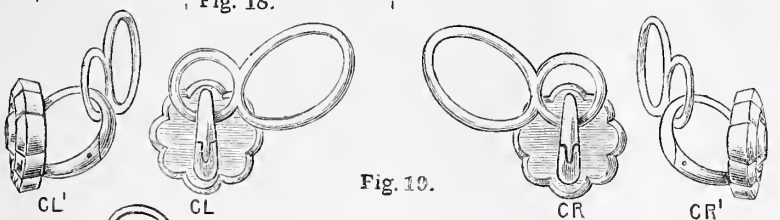


Fig. 19.

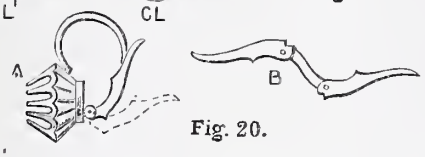


Fig. 20.

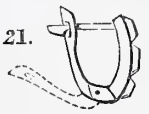


Fig. 21.

Fig. 18.—A and B, Good forms of Joint Hooks, the dotted straight line showing the proper relative positions of highest part of Ear-Wire and the Ear-Ring itself; C, Ordinary and bad shape, which hangs as shown.

Fig. 19.—A, B, Joint Hooks with Stops to prevent the Ear-Ring hanging like Fig. 18, C—A, Mostly used in Seed Pearl Work; B, in Antique Paste Work; C L, Back view of Ear-Ring for Left Ear; C L', View of same from the outside; C R, Back view of right Ear-Ring; C R', Side view of same.

Fig. 20.—A, French Spring Fastening: limit of action shown by dotted lines; B, Form as made and sold, ready for dividing and soldering on.

Fig. 21.—Another French form of jointed Ear-Wire.

*First.* The part that rests *in* the ear must be straight, and at right angles with the front of the stud.

*Second.* This part must be just a shade longer than the average thickness of an ear, not much longer, and certainly not shorter.

*Third.* As to the shape of the whole wire, it must be that of a curve, which will permit of easy insertion and withdrawal, subject to the

*Fourth* detail, which is that the very end has to be in line with the front of the bottom loop, so as to steady itself against the back of the ear.

The simplest form is shown correctly bent and inserted in Fig. 27, A and B. These two should be contrasted with C and D, both of which are wrong, and both are prevalent forms of this hook.

Fig. 27, C, is turned wrong way about, to start with, and if worn as an ordinary ear-wire, the front would hang face downwards ; if worn in the proper way, the end is much too far away and will not touch the ear, as it should do.

Fig. 27, D, is but a bad ear-ring hook, and possesses all the defects of that class—which has already been spoken of—and possesses none of the advantages of the German hook. This form of hook, or something that is intended for it, is much used, for we find it attached to the costly diamond or pearl, as well as to the faceted steel and common silver so much affected by the linen-draper jewellers.

**Methods of Attaching Ear-rings to Unpierced Ears.**—With an account of fastenings for ear-rings for ears not pierced, these papers on ear-rings and their fastenings will be brought to a close; for the present, at any rate. And although the writer hopes he has been able to give a little information on the subject, he is by no means confident that he has written a perfect and complete paper, his own opinion being that many good methods have not been spoken of ; but the few he has dealt with are those in every-day use, and, after all, they are likely to be the most useful to the junior members of the trade generally.

Hitherto we have attached the ornament by means of a wire of some shape or other, which passed through a hole in the lobe of the ear. Now we have to find some other way, for that road, we will suppose, is entirely blocked for us. And the wire, which was of necessity continuous when passing through the ear, now must be divided at the top where the ear goes, and the ends so obtained must be made to catch the ear, and hold the ear in between them. Nipping the ear is really what is done, but don't tell the ladies that ; say the ear-ring is secured, clasped, clipped, sprung on or held by gentle but yet firm measures. Say anything that may seem most suitable, so that you do not convey to their mind the idea of possible pain. For the fastenings should be quite painless, as the blunted or enlarged ends give a gentle pressure, and these are by the screw arrangement so easily and exactly regulated, until just sufficient hold is obtained for all reasonable purposes. The writer's definition of "reasonable purpose" is, that there is plenty of grip to hold the ear-ring *itself*. These sort of fastenings can all be pulled off, but they are safe enough to carry the weight of the ear-rings, and the pressure of an ounce or two besides, and that ought to be enough for us.

If greater security than this is required, then the

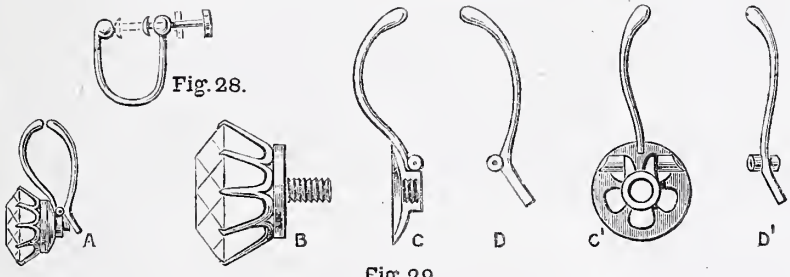


Fig. 28.

Fig 29.

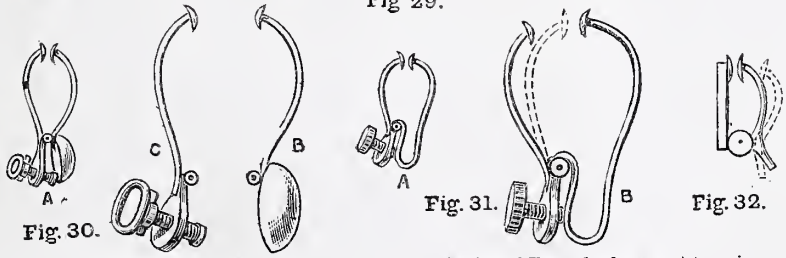


Fig. 30. Fig. 31. Fig. 32.

Fig. 28.—Simplest method of attaching an Ear-Ring to Unpierced Ears, the Ornament to swing or be soldered on to the Front.

Fig. 29.—A, Ordinary size and general appearance of Ear-Ring fastened from the Front; B, Enlarged Front of A, to act as handle to the Screw fixed to it; C, Shows Socket for Screw to work in in Section, and also where the Wire and part of the Joint is soldered; C', Back View of same, showing position of Socket-Joint and Wire; also showing how it can be pierced when the Stone is to be set à jour or transparent; D, Back Wire, with the other part of Joint to hinge to Fig. 28, C. This is the piece that actually nips the Ear, for the Screw acting on its lower end will regulate the position of the upper end.

Fig. 30.—A, General appearance and size of Ear-Ring fastened from the Back; B, Enlarged Front of same, with Joint and Ear-Wire soldered in Position; C, Back Wire and Mount which hinges on to B. This carries the Screw which governs the distance between the ends at the top; it also shows a small Collar or Stop soldered on to prevent loss of Screw.

Fig. 31.—A, Wire Mount for a taching a Drop, actual size; B, The same enlarged, shown open. By the aid of dotted lines it is also shown closed, the principle on which this acts being the same as Figs. 28 and 29.

Fig. 32.—Spring Fastening, acting as shown by the dotted lines: the front straight piece is left for the attachment of an Ornament.

pressure brought to bear will have to be much increased, or the ear must be pierced, and one or other of the previously described methods should be used.

Four out of the five diagrams have a screw for the acting power, and this is preferred for the reasons given above. If a spring is used in any other form, then there comes in the difficulty of always keeping it at a proper pressure, for if it is too great it will hurt the wearer, and if too little, then the whole affair drops off. These remarks apply generally to fastenings whose security depends on the proper action of a spring; not to the one sketched in particular, for that is a good form to use, if we elect to use springs at all.

The method common to all has been given above, viz., nipping the ear in between two ends; and, for the purpose of removal or attachment, one end is made movable either by a spring or a screw.

The simplest is given in Fig. 28; it explains its action clearly by the dotted lines; it is but a U-shape wire. To one end is attached a nut, in which a screw works, and the end of the screw which is blunted is made to approach or recede from the other end (also blunted) of the U-shape wire by simply rotating the screw, whose other end is enlarged, for the purpose of giving a better hold to the fingers. This is but a form of ear-ring wire, and to it an ornament has to be attached, or swing, before it is an ear-ring, properly so-called.

In the next two, Fig. 29, A, and Fig. 30, A, there is a greater resemblance to the ordinary wire, and they can be formed into ornamental ear-tops as ear-tops are usually made.

The desired result in these wires is obtained in a somewhat different way, and the next three diagrams, Figs. 29, 30, and 31, show that one part of the wire is *fixed* to the front of the ear-top, while the other (back) part of the wire is jointed to it in such a way that enough opening is obtained between the ends to let the ear pass, and so that a screw, acting on the lower part of the same jointed wire, will cause the upper end to approach the end of the fixed front wire. And it is in between these ends that the ear is nipped. After all, the diagrams, and the descriptions on them, will doubtless do more in the way of explanation than several paragraphs.

Fig. 29, A, Fig. 30 A, Fig. 31, A, are all about the size they should be made; but as it was impossible to in any way show the details in drawings of that size, the whole of the parts have been enlarged.

The reader will not require to be told that the coronet setting, with its open or skeleton back, of Fig. 29, and the plain dome of Fig. 30, are not at all necessary parts of these fastenings, for there is no reason at all against the employment of the coronet (without a screw, of course), as the front of Fig. 30; or on the other hand, if we should require a plain gold front to Fig. 29 in place of the coronet setting, we can use a plain gold front as a thumb-screw just as well. Or we could have a smaller centre on the dome, and make that act as the means to turn the screw. The principle upon which all these act is such a simple one that there should not be the slightest difficulty in adapting one or other of these to our work, be it ever so much unlike the few that are given here.

Fig. 31 is but an alternative form of wire to Fig. 28, and is here given principally for the purpose of showing the action which is common to the two previous ones.

This action is of the simplest description, and we should clearly understand that all we require is: first, to separate the ends for the lobe of ear to be inserted, which the untwisting of the screw allows; secondly, to cause these ends to approach each other, and be retained in the approved position, and this is managed as is clearly shown, it is hoped, by the diagram and by what is written above.

Simply moving the one end in the same line is all that is asked for; therefore, no lateral play is required, and there must be none, else the ear will not be properly clasped. In plain, workmanlike phrase, the joint should fit, and should not depend on the joint pin for its correct position, as too many joints are made to do, not only in such things as this, but in many other joints used in every-day work. But that is the refrain of a song that will always come into the writer's head, for he is in the workshop all day, and is always meeting with such small annoying details, which cause irritating delays, for generally the workman can do them all right at a second attempt, and should do them at a first, but he does not.

When we have room enough, a small collar or washer should be soldered on the top of the screw, for the purpose of preventing its withdrawal from the screw socket in which it works, for then it cannot be lost. It is shown in Fig. 30, C, and need be very small, for it has but to just *not* go through the female screw.

In Fig. 29, we use the front as a handle to turn the screw with, but in Figs. 30 and 31 we have handles expressly made. Now, of these, there are but two kinds, namely, fixed and jointed. Fig. 30 gives the simplest form of jointed, and Fig. 31 a simple specimen of the fixed form. Something must be drawn to show a complete article, so these two are selected, not that they should be always followed, for they can easily be made more ornamental; and if they are, see that the form selected combines neatness with unlikeliness of catching the lace or other material that ladies wear, and that, above all, the handle should be easily grasped when the screw has to be turned.

Fig. 32 is a spring fastening, made by the firm previously spoken of (Calipé, Dettmar, and Co.). The spring is contained in the hinge, and the limit of its action is shown in the diagram. This more nearly approaches an ear-stud in appearance, for the front straight bar is intended to have an ornament fixed on it, and is made of hollow wire for that purpose.

## FILLERS IN FRENCH POLISHING.

BY DAVID DENNING.

Object of Fillers—Choice of Filler—Filling with Polish — Pumice-Powder — Tallow Filler—Water in Filler—Oil and Polish — Turpentine and Whiting Filler — Colouring Fillers—Patent Fillers.

Anyone who has applied French polish, or even thicker varnish, to wood must have noticed that it sinks in or is absorbed, instead of remaining on the surface in a thin uniform coat. I say uniform, because here and there it will be observed that the polish or varnish has given more gloss than elsewhere. Where the gloss is brightest the varnish has sunk least. Those who know why size is used in painting or coarse varnishing will understand me when I say that fillers are used by French polishers for much the same reason—viz., to prevent immoderate absorption of the polish by the wood. That the grain may be filled up by going over the wood with polish till the pores are closed cannot be denied, and some beginners may want to know why anything else in the nature of a filler should be used. The reason is simply that the comparatively valuable French polish need not be used instead of a cheaper material, by the use of which, moreover, time is also saved. Some woods, being more open in the grain and porous than others, stand in special need of a filler, while with some fine close-grained woods fillers may be almost dispensed with. I do not, however, know that they—or rather, I should say, a suitable one—can do any harm to any kind of wood, so that, however fine the grain of this may be, there can be no disadvantage in going over it with a filler preparatory to polishing. At the worst, it may be a slight waste of time, and there are polishers who occasionally dispense with any filler except a preliminary rub over with polish when working on a fine wood such as olive, which those who have used it know is both close and hard. As in every other operation, in polishing opinions differ as to the best way of attaining the desired result—viz., the production of a thin glossy film of shellac, which shall not be liable to grow dull unreasonably soon. Some of the processes and methods of manipulation savour strongly of empiricism, so that, without advising the novice to use some particular filler with some particular kind of wood, and none at all with others, it will be more to his advantage to recommend him to use a filler whenever he thinks that by so doing he can save time and material. It may, however, be said that the woods ordinarily used in furniture—ash, oak, mahogany, walnut, etc.—certainly should have the grain filled. After what has been said, the reason for this is obvious, for they are all of comparatively open grain, ash and oak especially being coarse.

Now, when so many different kinds of fillers are used, and each has its advocates, I do not consider it would be fair to readers simply to mention the one I prefer, and claim for it all good qualities, while denying them to others which I may not so much approve of. It will be much better to name the principal fillers used in the trade, and make a few remarks about each, so that learners can experiment with them, and perhaps finally fix on that which may seem to suit them best. In any case, they will find them all reliable, for good work is turned out by polishers with any of them. Naturally, the man who has confined himself principally to one filler is more at home with it than with others; but, unless he is an extremely prejudiced individual, he would hesitate to say that the others are all bad. He uses the one which suits him best, that is all. Mind, it is not even said that he uses the one which he thinks is the best; for sometimes, owing to the great question of price, he may be impelled to use the easiest and quickest, irrespective of its quality. This, perhaps, is not as it should be, and the amateur, at any rate, will be free to follow his own fancy.

The first filler that will occur to one is varnish, or extra thick polish, rubbed into the wood till the pores are full. This is a clean and natural filler, but unfortunately it is a troublesome one, and the results are little, if any, better than those arrived at by a cheaper and more expeditious method. It is, however, easy to conceive that occasionally it may be an advantage to proceed with this, though, if he is doing it for trade

purposes and at trade prices, he will find that on ordinary furniture he is "out" by employing it. Briefly stated, the process is simply rubbing in polish or thin varnish, and when it is dry smoothing down with the finest glass-paper. The application of polish and paper must alternate till the former no longer sinks, and this will depend altogether on the nature of the wood and the material used. With fine, close-grained, hard wood, the process will be much more expeditious than with a coarse open one, such as ash.

A modification of this direct filling with polish is effected by the use of fine pumice-powder, which not only renders the process quicker, but better. I believe this method is more practised in France than in this country, where, though it is sometimes employed by the trade, it has not been anything like generally adopted. Apart from the time required with it, it is doubtful if any better means of filling the grain has been discovered, for it is both clean and free from greasiness. Those who wish to try it may proceed as follows, adopting such modifications as may seem advisable. As before, polish is the basis of the filler, the pumice-powder being useful not only in assisting to fill by getting into the pores of the wood, but in rubbing down inequalities of the polish. The powder is kept in a muslin bag, and lightly sprinkled on the wood, which is then gone over with an ordinary polish rubber fairly charged with polish. Only a small quantity of the pumice-powder should be used at a time, as if in excess, the work suffers. Instead of sprinkling the powder on the wood, some polishers prefer to put it on the sole of the rubber. The work will require papering down afterwards, whichever method be adopted, but perhaps not to the same extent as when the pumice-powder has not been used.

A filler that is very much used is composed of Russian tallow, mixed with either plaster of Paris or whiting; and I fear the chief thing that can be said in its favour is that it is a quick process, and therefore allows of polishing being done at a comparatively small cost for labour. Tallow is not, however, a nice material to work with, for reasons which will be readily understood. Apart from its unpleasantness, tallow is apt to increase the tendency of the polished wood to sweat, from the grease breaking through the film of lac. In saying this, I am aware that I am laying myself open to contradiction from many experienced French polishers who use no other filler than the one now referred to; but there can be no doubt that oil or grease, in connection with polish, can, at the best, only be regarded as a necessary evil. As there are fillers in which there is no grease, it is just as well to use them, even if, to avoid discussion, it is admitted that a "tallow filler" is not prejudicial to good work or to durability.

The tallow and plaster are made into a stiffish paste and well rubbed into the wood, from which any excess must be wiped off; and, to avoid repetition, the same remark applies also to the following fillers. Any that set hard must be wiped off while the filling is still soft.

But it may be asked whether, if grease is objectionable, water cannot be used instead, to render the plaster or whiting soft and pasty? It may be, and often is; but then, one objection is that the water is apt to raise the grain of the wood, which I suppose all readers know means making it rough. Of course, the surface can be rubbed down smooth with fine glass-paper, but then, tallow does not raise the wood at all. Still, whiting, or plaster of Paris and water, do not form by any means a bad filler, and, personally, I much prefer this mixture to any in which tallow or grease is found.

As tallow is unpleasant stuff, many polishers discard it in favour of oil (raw linseed), with some polish mixed with it. By the use of this with whiting, the objection to water is overcome, but it is not altogether a suitable filler for the novice. If he errs by having too much oil, the sweating already alluded to is apt to take place at no distant day; while if he uses too much polish in the mixture, the filling is apt to remain on the surface instead of being forced into the pores of the wood. It is, however, unfortunately not possible to give proportions of oil and polish which shall be suitable on all occasions, so that the polisher must use his own discretion. If he does not feel up to this exertion, he may as well leave this filler alone till he has acquired some experience, but in capable hands it is a really good one.

For a good general filler—in fact, the one which I consider the best—I do not know of one to beat whiting and turpentine. It is both clean and economical, does not raise the grain as when water is used, and it contains no grease. Those who have followed me will thus see that it is not open to the objections which are urged against other fillers, and, from personal experience, I can recommend it to all and sundry. I can certainly say, if they do not succeed with it, that the fault does not lie with the filler, and that they are not likely to succeed with any other. Another advantage it possesses over plaster of Paris and water is that it does not harden so quickly—some, indeed, urge that it does not harden sufficiently—but this objection cannot be treated as a serious one, or founded on practical experience. Let the mixture be in the form of a stiffish paste, but still thin enough to be worked into the wood, and no difficulty ought to occur.

It is advisable, if not absolutely necessary, that this, as well as other white fillers, should be tinted to correspond to some extent with the colour of the wood on which they are used. The following colours will be some guide to the novice, and it may be remarked that the polisher will seldom have occasion to use any other in his fillers: for mahogany, rose-pink; walnut, or any brown wood, such as stained oak, Vandyke brown; and for ebonised work, gas-black, are as good as any. Light woods, of course, may have the filler applied *au naturel*; but if it should be deemed advisable to tint it, there will be no difficulty in doing so, as an exact match is not necessary.

In addition to these, the ordinary fillers of the British workshop, there are several patent and American fillers which may be used by those who like them; but I do not think that any of them have ever come into general use, or are likely to supersede the commoner varieties. A common complaint among polishers against them is that they are more expensive than these, without having sufficient compensating advantages. I do not, however, wish to prejudice readers of WORK against any form of filler that may be introduced to their notice; but, at the same time, I cannot recommend any of those I have tried as being much, if at all, superior, for general purposes, to a good home-made filler, properly used. I do not affirm they are worse, and they may be as good, or even better; but I must say that I am inclined to be sceptical whenever I see the great advantages which are sometimes claimed for new preparations—a scepticism which may possibly be attributed to prejudice. Well, perhaps it may be, but at any rate it is a prejudice which I am quite willing to have removed whenever I can find a filler, clean, thorough, expeditious, and as cheap as any of those I have named. If any *professional* French polisher uses such a one, and can speak from his own experience of it for two or three years, perhaps he will kindly name it for the benefit of readers of WORK. A mere trial or experiment is not sufficient, hence my reference in the last sentence to professional polishers.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

DRAWING-BOARD—LINE DIAGRAM—RAKE OF STEERING—L-PIN—STEERING BARREL AND HANDLE-BAR ADJUSTMENT—BOTTOM BRACKET—TUBES AND MUD-GUARDS—STEEL CASTINGS—PATTERNS—CENTRE STEERING—DETAILS OF BOTTOM BRACKET—ADJUSTMENT SCREWS—DETAILS OF STEERING BARREL—DETAILS OF L-PIN SOCKET—MATERIALS, HUBS, AND FITTINGS.

BEFORE beginning the construction of our safety bicycle, we must provide ourselves with the materials, and our first step in practical progress is to make a full-size drawing of the machine, either on a large sheet of paper mounted on a board, or on the board itself, which is on the whole preferable.

The board must not be less than 4 ft. long and 3 ft. 6 in. broad. It should be planed clean and smooth, and have the near edge made quite straight. Proceed by laying down two 30 in. circles, 12 in. apart. Of course, only a part of each circle will be on the board, it being too short to hold the whole, but it is sufficient if the hubs are shown on the board. In the absence of beam compasses, use a thin wood lath. Make two holes in the lath, 15 in. apart—one hole for a bradawl or a nail, the other to let through the point of a pencil. Make two marks for the bradawl on the board, 15 in. from the near edge—which we will call the ground-line—and 42 in. apart, and from these points draw the two circles, which will each touch the edge of the board, or ground-line.

Now, with the line diagram before you which accompanies the second paper of this series, proceed to lay down the various lines as therein shown. In that diagram (Fig. 2, p. 100) we have A, A, the two wheels; call A, on the left, the steering, or front wheel. From C, in its centre, let fall the vertical line to D. Next draw a line parallel to the ground-line, and 12 in. above it, joining the two circles, as shown by a dotted line in the diagram. Divide the dotted line into four equal parts, and at 3 place the centre of the bottom bracket or pedal shaft, marked B on the diagram. From B raise a vertical line, which will touch the nose of the saddle on the one hand, and the rear end of the handles on the other. Now, in order to find the rake of the front steering tube, you draw the line E F from the centre of the rear circle or wheel to a point 4 in. above the periphery of the front wheel. Now, from C to O draw a line 3 in. long; then from D, on the ground-line, mark off towards H 4½ in.; from H draw line H G through O. This will be the centre line of rake. For the machine with curved fork, the curve of the fork ending at C C, 3 in. in advance of O, this line, if correctly drawn, will be found to form a right angle

with the line E F. Now, to find the true position of the L-pin socket, draw a line to the right of, parallel to and 3 in. from, the line rising from B. Mark off on this line the top of the socket, 30 in. from the ground-line. The complete socket, as shown in Fig. 1 (p. 33), may now be drawn, showing the attachments for the various tubes.

Now, turning to the fore-part of the machine, we have the barrel J (Fig. 1). This is drawn on the line G H; it is 6 in. long and 1¾ in. thick in the body. The drawn in, with its mud-guard and stays; also the spoon of the brake, with the hingeing pin which passes through the sides of the fork, 1 in. above the rubber of the wheel.

The bottom bracket has now to be indicated. In our design it is a fork having the chain wheel inside, and the two bearings close to the cranks, which makes by far the best bottom bracket. Further on, details of this fork will be given; meantime, it is only necessary, in preparing the full-size draw- cross-piece on their forward ends for bolting on to the back edges of the bottom bracket fork. The pair of tubes, F, enter sockets at the top, and on the tenons of the small rear stampings. The diameters of all these tubes are given in a former paper. The bent tube, D, which follows the curve of the wheel rim till within 3 in. of the top of the bracket fork, is about 1¼ in. clear of the rubber tyre; to the back of this tube is bolted the rear mud-guard. This guard has two pairs of stays, and is consequently sup-

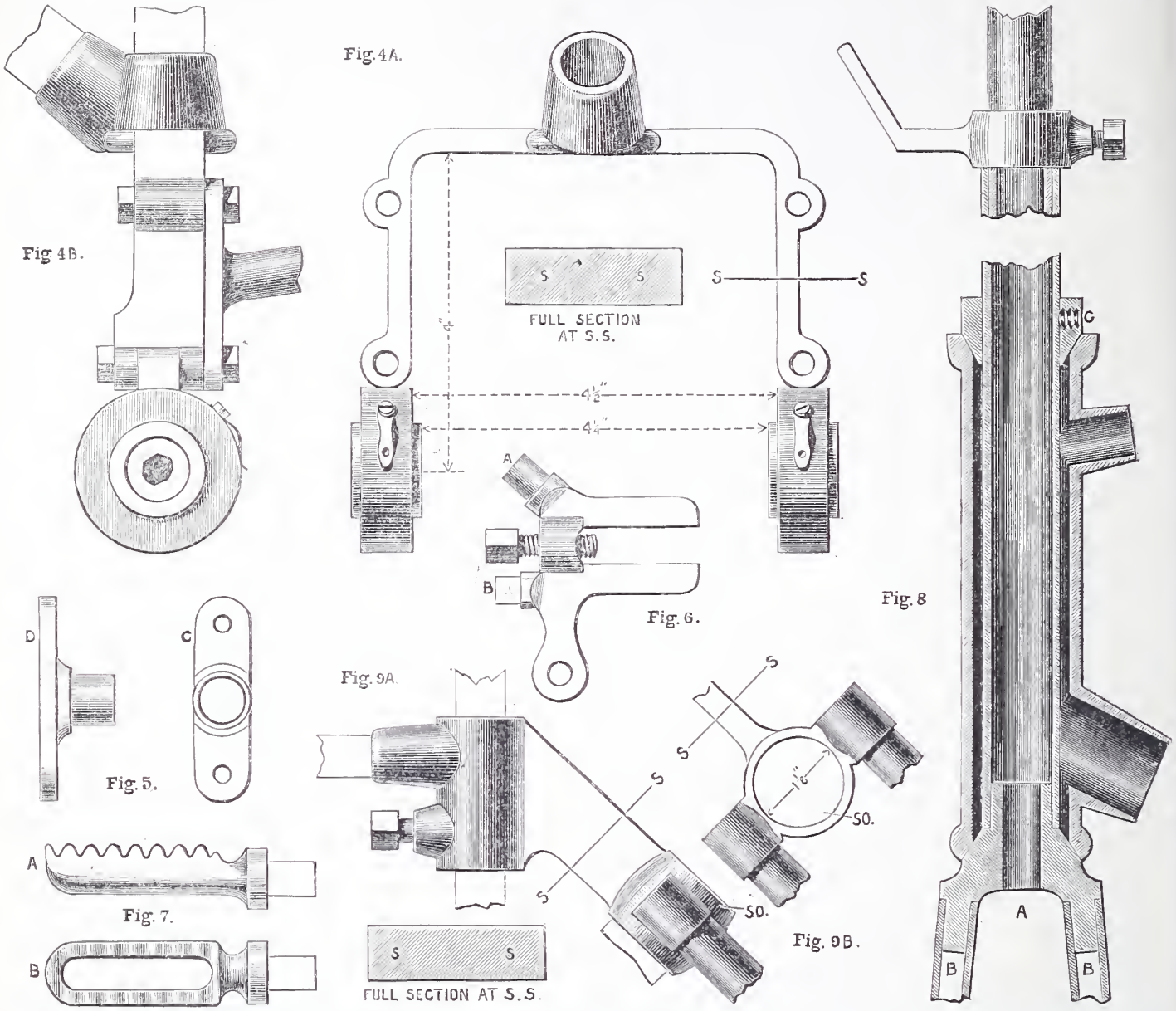



Fig. 4 A.—Bottom Bracket Fork. Fig. 4 B.—Ditto, Side View. Fig. 5.—T-Piece showing Face (C) and Edge (D). Fig. 6.—Rear Fork Stamping. Fig. 7.—Mounting-Step, in Side View (A) and Plan (B). Fig. 8.—Section of Steering Head or Barrel. Fig. 9 A.—Connection of Upper Tubes of Frame (Side View). Fig. 9 B.—Ditto, Plan. The above figures are all half full size.

position of the lower end of the barrel is 2 in. above the periphery of the wheel. The barrel should be drawn in section, showing the 1 in. tube passing up from the fork crown to the clamping ring. The full length of this inch tube, G, is 11 in. The handle-bar adjustment tube, K, which is 8 in. long and ⅞ in. diameter, may also be shown in section. On the barrel, J, should be drawn the two sockets for the tubes B and C, having their centres on the lines P, P, in Fig. 2. The socket for tube B is 1⅛ in. inside, and that for tube C ⅞ in. inside measure. The front fork should now be ing, to show the side of the bracket fork, as in Fig. 1, with a knuckle-joint ball-bearing fitted in. The socket for the lower end of tube B is 4 in. above the centre of the pedal shaft; from this point the bent tube, D, is drawn, from the top of the bracket to the L-pin stamping; M, radius from the centre of wheel at F. The small forked stampings that carry the rear wheel axle usually have tenons (not sockets) that enter the tubes. When this part is put down in the drawing, the lengths of the various tubes may be readily found, allowing 1 in. of tube to enter all sockets. The pair of tubes, E, have a ported at four points. I prefer the two stays, because I notice constantly that a badly-supported mud-guard sags in the middle.

There are but two stampings or castings in the frame here shown that cannot be bought in the market—namely, the bottom bracket fork and the L-pin stamping. These I get made (together with all my solid parts, in fact), cast from patterns, in malleable steel. The barrel, J, can be had in the market, fitted with balls. In the present case, however, we will show it as a cone-steering arrangement.

To those who do not care about making patterns for any part, stampings for all the parts may be bought. This would, however, involve a slight alteration in the design of the frame, particularly at the junction of the various tubes with the seat socket. But anyone laying down the full-size drawing, by observing strictly the positions shown in Fig. 2, and after drawing the stampings in their proper places, can set the various tubes with them.

Then, again, some might prefer the open centre-steering arrangement, which has the turning centres about 1½ in. behind the centre of steering tube. In this case two lugs are brazed on to the steering tube, about 4 in. apart, the lower one being immediately over the crown of the fork, and the upper one having a set or head-screw, with lock-nut for steering adjustment. All the parts for this arrangement may be readily purchased. The firms where to purchase, and the prices of the parts as near as they can be ascertained, will be given at the end of this paper.

Fig. 4A and Fig. 4B are half-size drawings of the bottom bracket fork, A being the front view and B the side, showing the attachment of the forward end of one of the lower tubes from rear of frame. In Fig. 4A, the width of the fork, as well as the height from the dotted line passing through the centre of the bearings, are indicated. A full-size section of the fork (S S) is given, the lower forked ends being broadened out to receive $\frac{5}{16}$ in. holes, to bolt in the knuckles of the bearings. The sockets for the main tubes are placed on the centre of the fork, that for the tube D being vertical with the arms of the fork, the other, for the main or backbone tube, going off at an angle, which can be readily determined from the full-size drawing. They run into each other, and are reamed out for 1⅛ in. tube, the vertical socket going quite through, the other running into it. The tubes should go at least an inch into the sockets. On the back of Fig. 4B will be seen the T-piece of the rear tube. It is a steel casting 2½ in. long, ⅝ in. broad, and ¼ in. thick, with a tenon on the back to enter the tube; it is bolted through the bracket at its upper end, and the lower end is held by the bolt that passes through the knuckle of the bearing.

This T-piece is shown half-size at Fig. 5, C, (face) and Fig. 5, D (edge). Two of them, of course, go to the one machine.

Fig. 6 is the rear fork stamping, which carries the rear axle; it has the two tenons for the tubes. The screw for adjusting the chain is also shown; the shank of the screw is square, and may be turned for adjustment by a small key. In the figure shown there is a descending projection for the mounting-step; the other, of the pair, would be on the right side of the machine and without the descending piece, the mounting-step being always on the left. The step itself may be either rubber on a steel pin, or a piece of hollow serrated steel, like Fig. 7.

Now we come to an important part of our machine, the steering head or barrel. Fig. 8 is a section of this barrel in half-size. As will be seen, the bearing parts are cones, not balls. To those who would prefer a ball-head, I should refer them to No. 92, Vol. II., of Work, where a ball-head is illustrated and described in answer to a correspondent. In our head (Fig. 8), the two ends of the barrel are coned to an angle of about 30 degrees; the top of the fork crown is coned to the same angle, while for the upper end of the barrel a coned ring is made. This fits easily on the steering tube, and is set in its place by a set-screw, passing through the side and pressing on the steering tube. The figure shows the sockets for the tubes, and the proper angle in making the pattern is found from the full-size drawing.

We now come to that part (Figs. 9A and 9B) which connects the upper tubes of the frame and contains the L-pin. This also is a steel casting from a pattern. The vertical part is that which is bored for the L-pin, ⅝ in. thick, of round steel. The part behind the L-pin socket fails away at the angle of the two tubes which descend to the rear axle. At S S a section of this part is shown full size. The part marked S O is the socket to receive the bent tube D, 1⅛ in. thick; on each side of S O is an eye or socket to receive the rear tubes above mentioned. The tubes are not brazed into these eyes, but merely fitted, and set-screws inserted through the side of the eye and into the tube. When these screws are removed, and the bolts at the bottom bracket, the hinder half of the frame comes away. The L-pin socket has on the front of it a socket to receive the ⅝ in. upper tube, C, corresponding in size to the upper socket on the barrel (Fig. 8). Beneath this socket is a ⅝ in. snug, which is bored and screwed for a set-screw to fix the L-pin. This casting is over all 4½ in. long. The small bracket which clamps the saddle-spring to the L-pin is bought ready made, and need not be described here.

Having described most of the parts, we have now to consider where they are to be procured, and at what price.

I may state, first of all, that steel castings cost from 6d. to 8d. per pound, and that there are from 5 lb. to 6 lb. in the machine. The whole tubes can be bought for 7s. 6d. Front forks, brazed, per pair, 1s. 3d.; weldless steel, per pair, 3s. 3d. Handle-bar tube, 2s. 6d. Full set break-work, 2s. 9d. in the rough. Pair mud-guards, 9d.; mud-guard stays, per pair 9d.; 30 in. by ¾ in. crescent steel rims, 3s.

Now as to the parts that may be bought finished.

We have first a pair of ball hubs, bored for spokes, tapped and plated, from 16s. to 24s. A pair of Bown's ball bearings, for bottom bracket, 11s. Chain wheel, sixteen teeth, 2s. 4 ft. Abingdon Humber chain, 6s. Cranks, rough, 1s. 2d.; finished, 4s. Pedals, ball, from 9s. 6d; plain, from 5s. (both plated). 3-coil spring, 2s. Long-distance saddle, 4s. 6d.; or saddle and spring combined, much superior, from 7s. 6d. to 15s. Handles (horn, rubber, or cork), from 2s. 6d. a pair.

Now as to the firms where these things can be procured, I have found the following to be good houses:—

Wm. Bown, 308, Summer Lane, Birmingham.

Thomas Smith & Son, Saltley Mills, Birmingham.

W. A. Lloyd & Co., Clyde Works, Birmingham.

Henry Matthews, Snow Hill, Birmingham.

Brown Brothers, 7, Great Eastern Street, London.

St. George's Cycle Company, London.

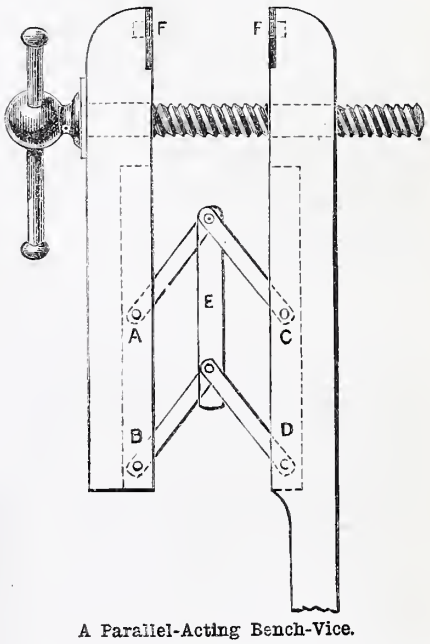
It would be needless to enumerate more, as anyone of the above will supply almost everything required, and will readily send their catalogues and price-lists to anyone writing for them. They will also supply rubber tyres at from 2s. 6d. to 7s. 6d. per lb. Considerable changes have been made in the form of tyres during the last year or two, but with this I have nothing to do at present. I am merely showing the reader where parts of bicycles may be purchased.

## A PARALLEL-ACTING BENCH-VICE.

BY J. CHARLES KING.

All contrivances to economise time and trouble in every-day shop work mark the impatience naturally felt at work that is irksome, producing nothing by its action, simply regulating other actions of tools. This must have been felt by wood-workers with the ordinary vice fixed at the back ends of benches.

The smiths have long used parallel vices, and know their merit. The cabinet-makers' and the coachmakers' vice in general use is something like the accompanying illustration, but it has a regulating blade at the bottom of the shifting jaw, which moves in and out of a mortise in the fixed jaw—parallel with the vice screw. It has a number of ⅜ in. holes in its length for an iron pin to be put in every time the work that is gripped varies with opening of the jaws. This little job of pinning and unpinning and repinning to widths of stuff to be gripped wastes a woodman's time




A Parallel-Acting Bench-Vice.

materially. If there is much vice work, two or three days in a year—half a week's work—are wasted, and nothing to show for it at the year's end.

If you are careless about pinning the vice parallel, the jaws do not grip properly, the work is held insecurely, and the screw worn out by unfair strain on the threads; and the process, after all, is one of guesswork as to what will be parallel. An automatic parallel adjustment is shown applied to the ordinary woodman's vice with wooden jaws, the action of compound levers from fixed points in the jaws effecting this to any width opening of the vice. There are nine light blades of iron. A, B, C, and D are four points for fixing double blades of iron 1⅛ in. by $\frac{3}{16}$ in. These, it will be seen, point upward, and are held to an upright blade, E (1⅛ in. and $\frac{3}{16}$ in.), all the parts being truly adjusted for lengths. When the vice jaws are closed, these blades shut up into recesses boxed out of the wood of the vice jaws shown by dotted outlines. The length of the blades may be: for upright piece 10 in., for diagonal pieces 8 in. The middle blade is, of course, held between the double diagonal blades by rivets

admitting of free movement of parts jointed together.

Why these compound levers should produce a parallel action, and set and rigid fixture of the jaws, however tightly they are screwed, may amuse some young workman to investigate.

A useful contrivance for gripping bolts and flanged iron or brass-work, is to have the iron plates of the jaws and part of the wood mortised out, as shown at F, F. It serves also to hold set-pieces of rubber or leather, used for galling-pieces.

## OUR GUIDE TO GOOD THINGS.

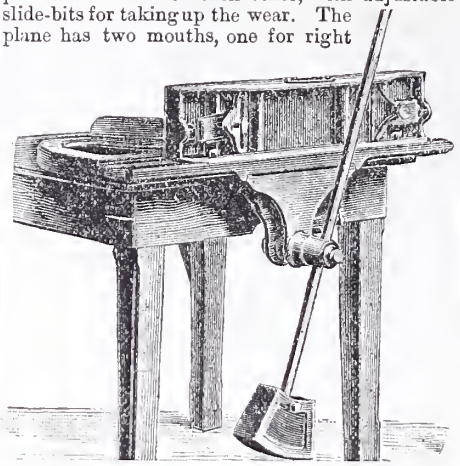
**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

22.—"The Machinery Market and Exporter."

Occasionally a Part of this publication reaches me, and this I am bound to acknowledge. It is published monthly at 6d., at 181, Queen Victoria Street, E.C. It has been in existence more than twelve years. It should be seen by all who are interested in machinery. In addition to information of a trade and practical character to be gathered from this journal, much is to be gleaned from its advertising pages, of which there are about seventy in the journal proper and its monthly supplement.

23.—Hutchens's New Patent Mitre Machine —the "Eclipse."

Some account of this excellent machine, whose inventor and patentee is Mr. William Hutchens, 70, Causewayhead, Penzance, was given in page 9 of this volume of Work, with working drawings in plan, end elevation, and front sectional elevation, and to these the reader is referred for details of the construction of the machine, of which a general view, showing how it may be fixed for use, is shown in the illustration given herewith. The machine is made in two sizes—namely, with shoot 6 in. by 3 in., and 10 in. by 5 in.; and each size has two different forms of construction — namely, with fixed and adjustable angle-plates, the machines of the smaller size being known as machines A and C, sold at £5 and £5 10s. respectively; those of the larger size, designated machines B and D, being supplied at £6 10s. and £7 respectively. Agencies and depôts for the sale of the machine, and where it is on view, have been established in London, and the great manufacturing towns of England and Scotland; and although it is not possible to give a complete list of them here, readers may obtain a prospectus giving this information from the patentee, and it may be useful to add that in London the machine may be seen at the establishments of A. C. Engert & Co., 75, City Road, and W. H. Oxenford, 51, Lowth Road, Camberwell. The patentee is constantly receiving most satisfactory testimonials, as a labour-saving machine that is easily worked, and does its work well, from picture-frame makers, carvers and gilders, and cabinet-makers, who all agree that "the machine works so easily, and cuts the moulding so sweetly, that it changes a usually disagreeable and laborious job into a pleasure, which is added to by the accuracy with which it is found the mouldings are cut." In the fixed patterns—that is to say, the A and B machines—the angle guide for the mouldings is fitted so as to be perfectly square, and firmly fastened at an angle of 45° to the plane face. In the C and D machines it has a very simple and secure adjustment by which the angle can be varied from 45° to 90°; in these machines the bed-plate is divided into degrees, and the guide has a finger-point to set it to whatever angle is required. The bed-plate and plane are of iron, each accurately planed and fitted to each other, with adjustable slide-bits for taking up the wear. The plane has two mouths, one for right



Hutchens s New Patent Mitre Shooting Machine —the "Eclipse."

and the other for left-hand mitres, so that the machine is always ready for either. The arrangement for adjusting, taking out, replacing and fixing the irons is at once simple, expeditious, and effective. The toothed quadrant actuating the plane is firmly keyed on a turned wrought spill, through which the lever of polished steel passes, leaving a wood handle at the upper end, and a balance weight at the lower end, which brings the machine in position and gives a saving to the cut.

24.—Machine-Cut Diamond Pattern Lumber.

Possibly some intelligent reader, who is only acquainted with the word "lumber" in the sense in which it is commonly used in this country, may think that I am going somewhat out of my way in talking about such stuff here, so I may facilitate matters by explaining that in the United States the term "lumber" is applied indiscriminately to all kinds of timber sawed or split for use, as beams, joists, boards, planks, staves, hoops, and the like, and, in the present case, to boards with a worked surface for decorative purposes. The engravings, Figs. 1 and 2, show the "Machine-cut Diamond Pattern Lumber"; the former in plan, and as viewed from above, and the latter in end view. Moreover, they show the exact size of the diamonds, and are therefore to be regarded as full-size patterns. "This stuff," says the card from which the illustrations are copied, "is made by a special machine invented by us"—the "us" being the Brown Bess Manufacturing Company, Clinton and Jackson Street, Chicago, U.S., according to my informant—"the *only* machine of its kind, and each piece will match *perfectly* with all other pieces, by 'jointing' the edges to the centre, lengthwise, of any row of diamonds. *Size* of each piece, 8 ft. long by 6 in. wide and ½ in. thick. *Price* 10 cents (about 5d.) per *running* foot of 6 in. in width, *net cash;* crated and delivered f. o. b. (free on board) Chicago, in orders of not less than 6 pieces. *Send for Sample.*" I have been particular in sticking to the text of the card, because my correspondent, Mr. Jas. Rollison, Armstrong, Kansas, U.S., evidently thinks it a big thing in wood-working, asking, as he does, on the card: "Can they (*i.e.*, British workmen) make it over there (*i.e.*, in the United Kingdom) and keep up with Yankees?" (This, please note, is Mr. Rollison's term, not mine.) His letter, which accompanied the card, runs thus:—"Mr. Editor, I send you this card to show you the latest Yankee notion in wood-working, as your paper is considerable in that line. I thought you might give it to some wood-working establishment and let them try to make such. If I were nearer to you I would send you a sample. I am not much of a scholar, but you must excuse me. I will send a sketch of a very useful wood article in course of time. Some of your wood-workers can make it easy. I do not want to see the English mechanic dropping behind; but in some things they are. I receive some stray numbers of Work out here. It has a good variety in it." Well, Mr. Rollison, we are agreed in wishing to see the English mechanic still to the front, and hence the existence of Work. I gladly introduce a reproduction of the card you send, partly in acknowledgment of your thoughtful kindness in doing so, and partly for the benefit of chip-carvers, who may like to work the pattern on facias, uprights, rails, edges of shelves, etc. There is not the slightest difficulty in contriving a machine to work the surface as shown in Fig. 1, for its principle lies in sending a shallow V-tool, whose edges are inclined to one another at a wide angle across the surface of the wood, first in one direction and then in another, thus making V-shaped grooves, which are inclined at the same angle to the edge of the wood under treatment. Apply this principle to a machine in which a number of V-tools of the same size and pattern move in parallel lines, and you get directly at the method in which the work is done. Similar patterns in a variety of designs might be made by altering the angle of inclination of the grooves to the edge of the wood, or by leaving an interval between each cutting tool.

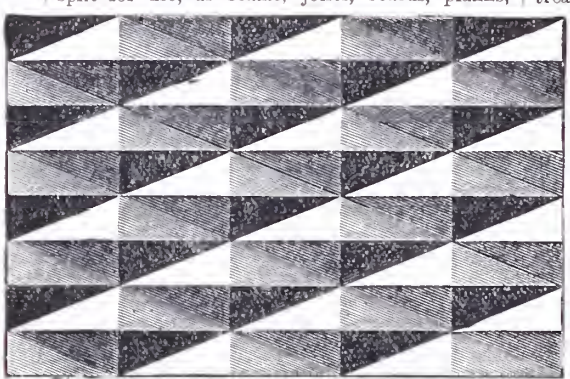


Fig. 1.

Fig. 2.

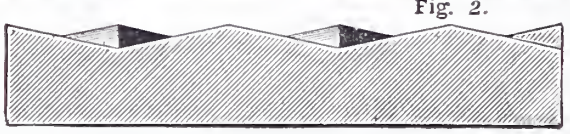


Fig. 1.—Machine-Cut Diamond Pattern Lumber, shown in Plan and as viewed from above. Fig. 2.—End View of ditto.

25. — Atkinson's Linesman's Galvanometer.

Electric bell, telephone, and telegraph linesmen, who are not overburdened with a surplus of cash, will be glad to know where to get a galvanometer or current detecter at a low price. A very useful linesman's galvanometer is made by Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham, and sold by him at the modest price of half a guinea. As it measures only 3½ by 3 by 2 in., it may be said to be a pocket galvanometer; but it is by no means a toy. The outer case is of teak, well jointed and polished. The dial is of brass, on a blackened background, and is enclosed in a thick bevelled glass frame. The coil is mounted on ebonite supports fixed to a brass plate, and all the mountings are of strong polished brass. The needle is of the dead beat type, soon coming to rest when the instrument is disconnected, thus rendering it valuable for detecting leakages in line wires, and testing the condition of battery cells.

I can recommend this neat and nicely-made instrument to such of the readers of Work who may require such an appliance, as it is not only effective, but cheap also, as may be judged from the comparatively low price that is asked for it.

The Editor.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—Questions Answered by Editor and Staff.

**Bricks.**—Penybryn.—Without any particulars or idea of your proposed method, it is difficult to give you a definite reply, but as a user of bricks for more than twenty years, I may say that unless your plan is cheaper and stronger than ordinary bricks, you will have a difficulty in getting it introduced. Many kinds of patent bricks have been brought out, but during last year I visited many buildings in various towns in this country and abroad, and did not see any of them in use. There is often a difficulty in getting the ends jointed properly, and if your plan involves any extra work at this point, the walling will cost more. The quality of the mortar has much to do with the strength. I have seen walls thrown down which fell in a solid mass, and in which the bricks were separated from the mortar joints with great difficulty; while in other cases the bricks have come quite clean from the joints when thrown down. Nevertheless, if you can make them, and they can be walled as cheaply and are stronger than ordinary bricks, there is no reason why you should not patent your idea. You must first ascertain whether your idea has been previously patented; and if not, get provisional protection for nine months, during which time you can bring them out, and see how they are taken up, before going to the expense of a patent. You will get much valuable information on taking out a patent in Vol. I. of Work; or if you like to send me particulars and a stamped envelope through our Editor, I will tell you if your idea is practical. I will promise you not to make use of or disclose your idea.—M.

**Repairing Old Chair.**—C. J. W. (*Brecknock Road*).—To soften the glue in order to take the chair partially to pieces, would not be the plan usually adopted by a cabinet-maker.. If it is imperative for you to soften the glue, it must be done with moisture and heat. It will be a very tedious job if it is practicable—and this I am inclined to doubt. Any way, it is hardly likely to be worth the trouble. Your best plan will be to cut through the tenon at the joint with a fine saw. If the tenon is a good one you will have no difficulty in reframing with dowels. Should the tenon prove to be rotten, chisel it out, and fill up the mortise with a sound bit of wood. If the parts are put together neatly, no one will be able to detect that anything has been done, and the frame will be as strong as ever it was. Possibly an expert might be able to manage without taking the frame apart, but without seeing the chair, I am unable to say positively. The plan recommended is thoroughly werkmanlike, and you can hardly adopt a better.—D. D.

**Repairing Veneer.**—C. J. W. (*Brecknock Road*).—Probably the best way to re-lay the broken veneer will be to insert a little hot glue under it. Then press the veneer down, and keep it down by pressure till the glue has set. Read the article, "Hints on Repairing Furniture," page 658, No. 93, Vol. II. of Work.—D. D.

**Use of the Word "Patent."**—R. H. (*Southport*).—Provisional Protection does not entitle you to use the word "Patent" on your articles. You have no legal right to use that word till the patent has actually been granted. If you make use of it before that time, any rival maker who may feel himself aggrieved has power to institute proceedings against you. Still, the thing is not unfrequently done, and the danger of interference in the shape of an action at law is generally very small. But we are bound to warn you that by using it you incur a certain risk.—C. C. C.

**Heat in Perkins' System.**—H. H. (*Cambridge*).—I am not able to give you any definite instances of the occurrences mentioned in my reply to a previous querist on the system of hot water, but a high authority on hot-water work—viz., Chas. Hood, F.R.A.S., F.R.H.S., etc., etc.—speaking of high-pressure systems, after describing them, says:—"The temperature of these pipes when thus arranged can be raised to a very great extent; for being completely closed and all communication with the atmosphere cut off, the heat is not limited as usual to the point of 212°. because the steam which is formed is prevented from escaping, as it does in the common form of hot-water apparatus. The most important consideration respecting it, however, is its safety; for most persons are aware that steam when confined beyond a certain point of tension becomes extremely dangerous, and in this apparatus the bounds of what has hitherto been used in other cases are very far exceeded. . . . The average temperature of these pipes is stated to be generally about 350° of Fahrenheit's thermometer; but a most material difference of temperature occurs in different parts of the apparatus, amounting sometimes to as much as 200° or 300°. This arises from the great resistance which the water meets with in consequence of the extremely small size of the pipe, and also from the great number of bends or angles that occur in order to accumulate a sufficient quantity of pipe. . . . The temperature of the coil, however, is what we must ascertain if we wish to know the pressure the apparatus has to sustain, and thence to judge its safety, for by the fundamental law of the equal pressure of fluids, whatever is the greatest amount of pressure on any part of the apparatus must also be the pressure on every other part. Now, the temperature of this apparatus is found to vary, not only with the intensity of the heat of the furnace, but also with the proportion which the surface of the coil bears to the surface which radiates the heat. In some apparatus, if that part of the pipe which is immediately above the furnace be filed bright, the iron will become straw colour, which proves the temperature to be about 450°. In other instances it will become purple, which shows a temperature of about 530°; while in some cases it will become a full blue colour, which proves then that the temperature is 560°." (Hood on "Warming and Ventilating," pp. 137-8.) Now, even supposing that the pipes only reached to the lowest of these three temperatures—viz., 450°—this would be quite hot enough to scorch textile fabrics *if laid upon it*, or to scorch paper if close to it. But it appears that this is not so much a source of danger as the extremely high pressure which such a heat indicates, for at a temperature of 560° the pressure is 1,150 lbs. per square inch, and with an increase of 50° the pressure is immediately raised to 1,800 lbs.; and a further increase of temperature, 40°, raises the pressure per square inch to 2,800 lbs.; so that any circumstance which causes the fire to burn more briskly than usual may at any moment increase the pressure to an enormous amount. The pipes are stated to be proved to a pressure of nearly 3,000 lbs. per square inch, but as pipes are always proved cold, this does not in any way prove what pressure they will stand when heated; but it is certain that it is nothing nearly so great, iron becoming much weaker as its temperature is raised. Hood further says (pages 146-7):—"This invention undoubtedly exhibits great ingenuity, and could it be rendered safe and its temperature be kept within a moderate limit, it would be an acquisition in many cases, in consequence of its facile mode of adaptation. Its safety would, perhaps, best be accomplished by placing a valve in the expansion pipe, which, from its large size, would be less likely to fail than one inserted in the smaller pipe. If this valve were so contrived as to press with a weight of 135 lbs. per square inch, the temperature of the pipes would not exceed 350° in any part." You will be able by the information now given to examine your pipes, and form an opinion as to sheer safety; probably, the precaution of a safety valve as suggested has been adopted.—R. A.

**French Polishing.**—A. H. (*Maidstone*).—You cannot do better than to read the articles and "Shop" answers on "French Polishing" which have appeared in Work. Consult the Indexes to Vols. I. and II. These will give you more than any book.

**Hardware.**—J. C. (*No Address*).—Obtain as many things as possible from one factor, who would give you very nearly as good terms as the manufacturers (the latter possibly might not care to execute a very small order), and you would save something in carriage if you reside far from London. You could obtain the screws, nails, bolts, and general ironmongery from Messrs. Harding & Sons, Long Lane, London, S.E.; lamps, etc., from Messrs. Falk, Stadelmann, & Co., 43, Farringdon Road, London; oils and colours from Messrs. Chuck, Lockett, & Co., 10, Norton Folgate, London, E.—T. W.

**Lettering on Opal.**—J. B. C. (*Coatbridge*).—This is work executed by means of acids, burning, and other mechanical processes. You will never get any colours to stand unless they have been specially prepared and burnt in at the ornamental glass works. The heat from gas is the cause of the mischief of which you complain. Give the work to a Birmingham firm.—H. L. B.

**Shocking Coil.**—Curious.—I cannot clearly understand the drift of your letter. If you have made some shocking coils in the past, and all these have worked well, I see no reason why the last two should fail in giving similar results. It appears to me, however, from your letter, that you expected to get shocks from the primary wire of your two last coils, and, because you did not get shocks as you expected, you suspect something wrong in the coils. Surely, you did not get shocks from the primary wires of your other coils! If you get more than you can stand out of the secondary coil, that should fully satisfy you. If you put more wire on the secondary coil, as you suggest, the shocks from this will be stronger with the same battery power. Cartridge paper is too thick to use as an insulator between the layers of the coils, and shellac is too stiff. Use instead some foreign post paper steeped in paraffin wax. I do not know anything about the other apparatus mentioned by you. Perhaps it was part of an electrical conjuring trick.—G. E. B.

**Electric Bell Manuals.**—N. B. (*Highgate*).—You will find "Practical Electric Bell Fitting," by Mr. F. C. Allsop, 165, Queen Victoria Street, a useful book. "Electric Bells, and all about them," by T. R. Bottone, may also be useful to you. As you will not be able to localise and repair all defects by reference to books, you will do well to submit your difficulties to us, and get helped out of them through the medium of Work.—G. E. B.

**Bath.**—Windermere.—I see no reason why you should not construct a bath as you suggest, providing you intend doing all the work yourself, for if you have to pay for bending and drilling the iron, rivetting together, etc., you might as well buy a tinned iron one right out. You will have a difficulty in getting a sheet wide enough of the gauge you will require, viz., 22 ft. or 24 ft., as few ironmongers keep sheets of that gauge more than 3 ft. wide. You also speak of giving it a coat of bath enamel; it would require at least three coats to make a good job of it, and four or five would be better still; let each coat get thoroughly hard before applying another. The way you suggest of bringing the water to the boiler is all right; you should also take a branch pipe out of the pipe leading to the boiler to supply the bath with cold water. It is a pity you could not have the bath lower than the boiler (which, from your sketch, I take to be an ordinary washing copper), for then you could have supplied both hot and cold to the bath without having to dip it out, as I presume you intend doing.—R. A.

**Book Edges.**—W. J. J. (*Southwick*).—The reason why your colours sank below the surface of your size may have arisen from various causes, and it would be difficult to tell unless I saw both your colour and your size. However, I suspect it is your colour that is at fault; you say that you used "ordinary colours in powder." Now these may, or may not, be all right. Only vegetable colours can be used for marbling, and they must be very specially ground; there must not be the slightest gritty appearance about them, or they will spread out like powder when thrown upon the size; and when transferred to the edge, they will be extremely faint, which you found. The colours, ready ground, which you ask for can be had from Messrs. Berry and Roberts, St. Bride Street, London, E.C.—G. C.

**Sheet Steel.**—C. E. S. (*Stoke Newington*).—Try Pfeil & Co., John Street, Clerkenwell. They sell excellent steel at moderate prices.—J.

**Horizontal Engine.**—A. W. A. (*Waltham Cross*).—Pocock's "Model Engine Making" is the only book I know of, treating specifically on this subject, but it is very amateurish. Hasluck's "Model Engineers' Handy-book" contains some useful information.—J.

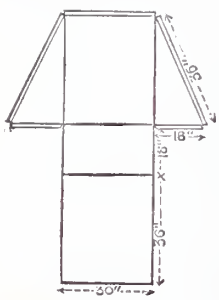
**Paquelin Lamp for Plumbers' Joints.**—Plumber.—The Paquelin lamp is a success for wiping joints. One of our men used it a few days ago for a joint in 2 in. lead pipe for a pump, and also for wiping the joints under a bath, waste, overflow, etc. I cannot understand why you cannot make the metal stick to the pipe. I expect the reason is that you are using too fine a solder, and get it too hot. Use ordinary plumbers' metal, two-thirds lead, one-third tin; get your pipe fairly warm with the lamp before applying the solder, and use the solder in sticks. The stick of solder acts as a spoon to keep the metal up till you have enough on the joint; then, when it is of the right consistency, go round with the cloth. When the joints are not wiped, use coarse tinman's solder.—R. A.

**Inlay and Carpentry.**—A. L. L. (*Farnham*).—Much has appeared in Vols. I. and II. of Work upon these subjects. A reference to the Index of each volume, which can be bought for one penny, will give the numbers and pages of Work.

**Beams and Scales.**—X. Y. (*Leeds*).—A beam constructed as represented in your sketch would be condemned. It would take more time to put right than it would be worth. You do not say if the machine is to rank first, second, or third class. If we take the turning load of a first-class machine as *one*, that of a second-class is *four*, and of a third is *six*. Again, you do not state if the ends of the beam are "swan-neck," "box ends," "Dutch ends," or if it has "agate" or "knife-edge" bearings. "Swan-necks" are discouraged, and will in course of a very few years be disqualified, after sufficient time has been allowed to wear out those at present in use. The friction on such, when worn or badly fitted, is quite sufficient to account for the extra weight you name as required to move it when the scales are hung on. Or, again, the "kuife edges" may be thick, dull, soft, or not straight, or at exact right angles across the beam. The same may be true of the bearings in which the "knife edges" work. Any of these faults would increase the friction, which would be intensified in proportion as the load was increased, and a larger amount of "force" would consequently be required to overcome that friction and cause the beam to oscillate—the "force" being represented by a heavier weight, as in your case: half a pound being required to turn the scales instead of half an ounce. To adjust weights, measures, and weighing machines successfully, a certain amount of "touch" is required that only practice can give. You may learn much about the theory of these matters if you study Ganot's "Natural Philosophy and Physics"; also Grieve's first, second, and third stages of "Elementary Mechanics" (Longmans—1889 editions). Also get a copy of "Model Regulations," 1890, for Inspectors of Weights and Measures (1s. 6d.), and also a copy of "Notices to Candidates" for examination as Inspectors of Weights and Measures (2d.), both

published by Eyre & Spottiswoode. You may then learn what the inspector will require of a machine before he considers himself justified in stamping it as fit for use in trade.—WORKER BEE.

**Lantern Stages—Making Gas Bags and Limes.**—A. E. D. (*South Lambeth*).—I should advise you to read the papers which appeared in WORK, Nos. 83, 87, 91, 96. Full particulars of how to make the slide stages will be found in No. 91; and the addresses of a few firms supplying cheap condensers and objectives have already been given in reply to Opticus, WORK, No. 91, page 633, and also in reply to J. P. (*Blackburn*), WORK, No. 97, p. 733. Should any difficulty occur, write another query, giving full particulars. You also state that you are desirous of making a gas bag, owing to the prohibitive price of this adjunct to a lantern. You will find this a very difficult job, and I have never yet heard of its being successfully accomplished by an amateur, and should certainly not advise you to attempt it. It may be possible for an amateur to repair a gas bag, but the making of a new one is quite a different matter. You do not state the form of jet you intend using. If you intend to employ a safety jet, procure from an indiarubber warehouse some strong twill mackintosh cloth, either check pattern or a brownish-black, which will cost from 3s. 6d. to 4s. 6d. per yard. For an ordinary 10 ft. wedge-shaped bag you will require to cut this to the form indicated in the accompanying diagram, the measurements of each side being 36 in. long, 30 in. wide, with a couple of wedge-shaped sides 18 in. wide at the thick end, with the back of the bag also 18 in. wide. About an inch should be left on all cut sides for turning in and cementing, the cement used being a solution of rubber in benzole; or, better still, a tin of proper cement for indiarubber could be obtained for about 1s. from the tradesman supplying the cloth. An accurately made gas tap will also require to be cemented into the middle of the apex or thin end of the wedge of the bag, in order to provide the means of ingress and egress for the gas. I am very much afraid, however, that you will not be able to make a satisfactory job of it, as professionals use several appliances for making a bag air-tight which it would not pay for an amateur to obtain, especially when you can get a bag ready fitted with a tap for 45s.; this would be an extra strong one, made of three-fold thickness of stuff, and would hold sufficient gas for over two hours' exhibition. It is sold by Messrs Archer & Co., 43, Lord Street, Liverpool. The following are the quotations of a few of the leading firms for a bag of about 10 ft. capacity. It is a difficult matter to give an accurate statement of the exact cubic capacity of a gas bag when filled with gas, as the wedge shape renders them peculiarly liable to bulge outwards, thus rendering it somewhat troublesome to accurately gauge their cubic capacity. A cheap bag, measuring 36 in. × 32 in. × 24 in., is sold by Messrs. Perkin, Son, & Rayment, of Hatton Garden, for 45s.; and Messrs. Noakes & Son, of Nelson St., Greenwich, make a cheap bag 36 in. × 32 in. × 24 in. for 48s.; this can be had in strong white twill for oxygen, and black for hydrogen. Messrs. Humphrey & Co., of Stanhope St., Birmingham, sell a black rubber bag of three-fold thickness, fitted with a padlocked gust tap, and measuring 36 in. × 30 in. × 24 in., 50s.; and Mr. Walter Tylor, of 48, Waterloo Road, S.E., charges 52s. 6d. for a bag of similar dimensions. Messrs. Woods' (74, Cheapside, E.C.) price for a bag 36 in. × 32 in. × 24 in. is 70s.; and 72s. 6d. is asked for a similar sized bag by Messrs. Watson & Sons, of 313, High Holborn. If you simply require the bag for home use, you would find it much more economical to construct a wooden or metal gasometer, or vessel in which to store the gas. In construction these are somewhat similar to the ordinary gasometer of the gas-works, consisting of a cylinder, bottom upwards, sliding within a cylinder, which is filled with water in order to make it gas-tight, the requisite pressure being obtained by means of heavy weights placed upon the top of the inner cylinder or suspended from its sides. With reference to your last question, it is difficult to say how long a lime should last, as so much depends upon the skill of the operator. One operator might use one or two limes during a single entertainment, whilst another exhibitor would find one more than sufficient. With an oxy-calcium jet it is sometimes possible to use a lime a second time, provided that it is kept in a tightly corked bottle away from the atmosphere; but with a mixed jet this cannot be done, as the unused lime will crumble away.—C. A. P.



Gas Bag.

**Bookcase.** — G. H. (*Burton-on-Trent*). — Mr. Adamson gave, some time back, a drawing and a few details of a dwarf bookcase (without doors). Search the indexes. The mortise and tenon joint is the one generally adopted to unite the "cross bars," but halving will be strong enough for the purpose. These two forms of joint have been so frequently described that it is really unnecessary to again sketch them. If I do not note your assertion that although you "are pleased with WORK, but one has to wait such a while for an answer," you may, perhaps, believe that I intentionally disregarded it; therefore I must entreat you to watch and count each week the number of letters acknowledged as received, and then compare them with the number of answered letters which limited available space permits to be printed, and you will—or ought to—understand why *some*—not *all*—queries are held over for a while.—J. S.

**Wood-Carving Tools.**—A. W. A. (*Bilston*).—The tools should be sharpened on the inside, and ground on the outside. The angle should be very acute. It would be a guide if you were to get one properly set by a carver, as you would then know better than by any amount of written description. In case you do not know any good carver, I daresay

Fig. 1. Fig. 2.

Angles for Tool Sharpening.

if you sent a tool to Urquhart & Adamson, 13 & 15, Bold Street, Liverpool, they would do what is necessary for a small sum as a favour, if you mention this Magazine. If you prefer to try for yourself, the illustration (Fig. 1) herewith will give you some idea of the angle to which carving tools should be set, as compared with that of the ordinary chisel (Fig. 2).—D. D.

**Photo Tent.**—R. H. (*Bradford*).—Procure four wooden uprights, ash by preference, 8 ft. 6 in. long and 2¼ in. in diameter, slightly tapered towards one end, and the other pointed and shod with iron to drive into the ground; an iron peg put through the pole just above the shoe, and projecting about 1 in. on each side, will be of assistance in fixing the poles in the ground. Two of these poles are intended for the back of the tent, and should be provided with holes protected with iron plates near the top, so that a roller background can be made to work in them in the usual manner. Into the top of each pole an iron pin is driven, leaving 3 in. projecting, through which a slot is made in order to receive a small pin to secure the whole together when set up. Four rods, either wood or iron, sufficiently long to leave a space of 8 ft. by 6 ft. clear between the uprights, and perforated to fit over the projecting pins at the top of each pole, will keep the framework in position. The distance from front to back should be about 6 ft. The whole arrangement is exceedingly simple, and can be pulled up and rolled together when done with. In use, the canvas covering will be permanent overhead, one or other of the side pieces being open according to the light required. The appearance of such a tent will be, when in use, as accompanying

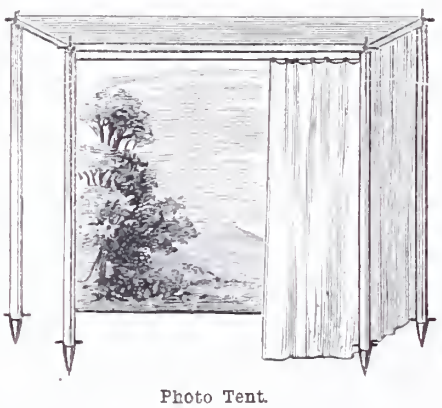


Photo Tent.

diagram. A curtain in front that can be pulled across at will, running easily on a rod, will be found a help in arranging the light. If the rod worked in a socket, so that the curtain could be pulled inwards or outwards as well as across, so much the better.—D.

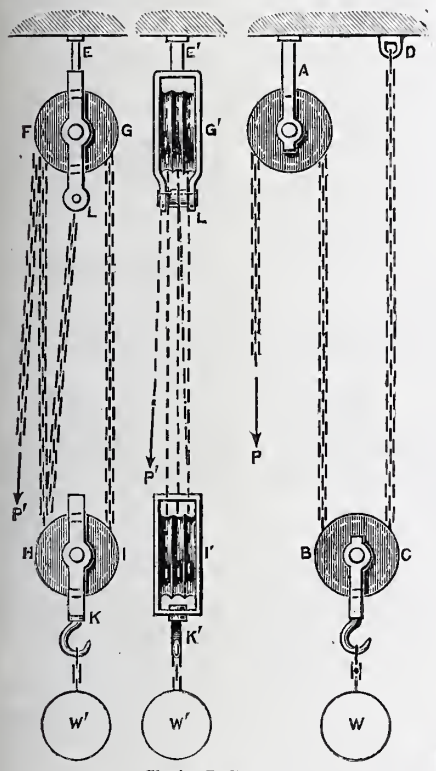
**Carriage Crests and Monograms.**—J. L. G. (*Norwich*).—The method of doing this and the kind of paper used to paint them on is, I believe, a trade secret. They are painted with oil colour on prepared paper. The crests, letters, or ornaments must be, of course, painted on the paper the reverse way, so that when turned over on to the panel, they will transfer right-handed in proper form. The shading of the crest or letters that should show on the face must be painted on the paper first, and the ground colours or gold put on last. Colours are sold ready for use in tubes; if too thick, thin with turpentine. To transfer the painting, you must be careful, and go all over it with gold-size and copal varnish made up in equal parts, taking care to keep well to the outer edge, with a small pencil, or camel's-hair will do. The gold-size and varnish must not be laid on too thickly, but just enough to cover. If the crest or monogram is not properly covered, some of the paint will stick to the panel and the rest draw away with the paper. When the gold-size and varnish is on the "tack"—that is, when it is nearly dry—it is ready to transfer to the panel. The panel should be first "flatted" with pumice-powder, and a pad with water to dull the surface and take the nibs off. Wash off clean, and dry with chamois leather. After getting the centre of the panel, strike with the chalk line a horizontal and a perpendicular line; thus having your chalk line struck, you will find on the back of the transfer a horizontal and perpendicular line crossing at the centre of it, which, when placed on to the panel, must come exactly over the chalk lines; then you will have it exactly square. Take care to exclude any air, and gently rub it with a small piece of cloth, so that all parts may adhere equally. Then with a wet sponge sop the paper until it moves, and gently draw it away. Pat the painting with the sponge wrung dry, wash off, and dry with chamois leather; take care not to rub too hard: and in two hours it will be ready for varnishing all over. Should you desire to varnish sooner, use more gold-size to the varnish that you transfer with; but on no account use gold-size alone, as it will cause the paint to crack and flake off after a while, and your job will be spoilt. There is another kind of transfer which is painted on very thin paper. These are treated in a different way. The back of the paper is done over with gold-size and varnish mixed, and when nearly dry is stuck on the panel; then the whole of the panel is varnished over. But this does not make such a nice job as the process described above, as it always shows a little projecting from the surface; but it is very handy, and always shows right handed—the way it is painted. I tried an experiment the other day which I found answered very well. That is: on a piece of ordinary note-paper I designed a monogram of three letters in lead-pencil, then glazed it over with ordinary gum, which, of course, should be clean and transparent. When dry, I commenced painting in the pencilled letters, which were still visible, beginning first with the shading—of course, the reverse way to that in which I wanted it to show when transferred; finally painting on the ground colour, or laying on the gold or silver leaf last. Thus you will see I have a coat of gum between the monogram and the paper, which, when wetted on the back, moistens the gum; then the paper was drawn away, leaving the monogram on the surface of the panel to which it was to be applied. Crests, ornaments, etc., can be treated in the same manner. These will have to be stuck on with gold-size and varnish mixed, and transferred in the same manner as explained in the beginning. The transfer method of heraldry is a quick and convenient way for some coach-painters and those who do not possess art and skill to paint them direct on to the panel, or wish to send them off by post. In the usual course of direct painting, herald painters first make a "pounce"—that is, they sketch the design on a piece of paper, then prick with a pin or needle all the outlines; next they get the centre of the panel, and strike with thread and chalk—called a chalk line—a perpendicular and horizontal line. They then place the "pounce" on the panel: then with pad—that is, powdered whiting tied up in a piece of fine muslin—they dab lightly the "pounce" or perforated design, then they raise it carefully; that will leave on the panel the outlines of the crest, etc., in white. They then commence to paint in colour to the lines, or size and lay on the gold-leaf and then shade it. Thus, you see, whilst you are painting on the paper to be transferred you could paint direct on to the panel with less trouble and better effect. The heraldic transfer materials can be obtained at Whittingham & Wilkins', Long Acre, W.C., and at Leigh Anderton's, heraldic painter to the trade, 67, Vine Street, Newton Heath, Manchester. By sending stamped envelope, they will forward you list of prices, etc.—C. W.

**Accumulator Cells for Electric Lights.**—J. C. H. (*Dublin*).—The number and size of accumulator cells required for an electric light installation are determined by the following considerations. (1) Volume of current required to light the lamps. (2) E.M.F., or pressure to force the required current through the lamps. (3) The number of hours it is intended to use the cells for lighting the lamps. Considerations 1 and 3 must guide us in the size of the cells, and the number of plates in the cells, as the volume and duration of the current will depend upon the capacity of the cells, it being estimated that 1 sq. ft. of positive plate surface will yield six ampère hours of current. Your ten lamps, of 8 c.p. each lamp, will take 280 volts of current to light them. Twelve lamps will take 336 volts of current. Find out the total resistance of the lamp circuit, employ one cell to each two volts of pressure required, and this will give the number of cells to be employed. Multiply the volts of current by the number of hours the cells are wanted, divide this by the voltage of the cells used, and you will then find the desired capacity of the cells. I think you will need 9 E.P.S. L-type 15-plate cells. These have a larger capacity than the 11-plate and the 7-plate cells. In charging these in series you should employ a current of not less than 10 ampères at a pressure of not less than 20 volts. If you had given me the size and type of your dynamo, I could have told you whether it would be practicable to charge the cells with it or not. Thin plates such as you mention are not safe to make the grids for large cells.—G. E. B.

**Ebony Stain.**—TREACLE PUSHER.—If you are, as your *nom-de-plume* indicates, a polisher, surely you must be aware that home-made black stains are not so good as those which are bought ready made. As you live so close to London, you will be able to buy the stain for little, if any, more than it would cost you to make it, besides getting a better article. If you are determined to try what you can do, I am afraid I cannot recommend anything to surpass the old recipe of a decoction of logwood chips and vinegar in which some steel filings have been left for a time; or, if you prefer to do so, substitute a solution of copperas for the vinegar. Good

proportions are 1 oz. each logwood and copperas in a quart of water. Apply hot. Then go over with the vinegar after the first is dry. Repeat till the stain is dense enough.—D. A.

**Chain Pulleys.**—DIPLOMAS.—Your question is rather vague, but I suppose you wish to know how to calculate the increase of lifting power gained by the use of pulley blocks, and upon this assumption I answer you, using the accompanying diagram to make my remarks clear. In the first place it must be understood that the increase of lifting *force* is gained at the cost of speed, or distance passed through in a given time. Work done is a *force* or *weight* acting through a *distance*, and *work* cannot be increased or diminished by any machine whatever. I shall not consider loss by friction of pulleys, etc., as that would complicate the matter without helping us. Suppose you pull on a chain with a force of 50 lbs., and you pull the end of that chain (keeping the same pull upon it all the time) through a distance of 10 ft. You will then have done work equal to 50 multiplied by 10, equals 500 ft. lbs. Now, if it had been a pull of 10 lbs. through 50 ft., the total work would have been the same, and so the total work may consist of any two numbers representing respectively force and distance travelled; so long as when multiplied together they make 500, the resulting work will be the same. The same argument also applies equally to any other quantity of total work done, but we see that the greater the force




Chain Pulleys.

applied, the less will he the distance passed through, and the less the force, the greater will be the distance passed through. Suppose with a pull of 50 lbs., you want to lift 800 lbs., the pulleys and chains must be so arranged that you pull in 16 ft. of chain, while the weight lifted rises 1 ft.; because 800 lbs. × 1 ft. = 800 ft. lbs., and also 50 lbs. × 16 ft. = 800 ft. lbs. Having described the principle concerned, I will now show the application of it. In the diagram, P indicates a force or pull applied to a chain in the direction of the arrow shown. If the chain merely passed over a fixed pulley at A, and had a weight at its other end, that weight could not exceed P, because in that case the only change which occurs is a change of *direction*, the force P and the weight would travel at the same speed, and neither gain nor loss of power would occur; but if the chain is carried round another pulley, B C, and up to a fixed point, D, and the weight W suspended from the pulley B C, there will be a difference of speed between P and W. The pulley B C rises and falls with the load, and such combinations as these are called blocks and falls, the upper pulley or set of pulleys attached to a fixed point being called the block, and the lower one the fall. Now, to raise the load W one foot, each side of the chain A B and C D must be shortened 1 ft., therefore the chain A B C D must be shortened 2 ft. by pulling that length of chain over pulley A, from which it is evident the force P must move 2 ft., while the weight W moves 1 ft., therefore the weight W may be twice the force P, for if P = 50 lbs., and W = 100 lbs., then 50 × 2 = 100 ft. lbs., and 100 × 1 = 100 ft. lbs. It will be noticed that the load lifted is equal to the lifting force multiplied by the number of lines of chain side by side, the hauling chain P, which is wound to slack, not affecting the result. A side view of a block and fall, carrying three loose pulleys on each, is shown at E, F, G, H, I, K. The top block is fixed at E. The chain passes from P round the top and bottom pulleys successively as shown, and is fastened to the top block at L. A front view is shown at E', G', I', K', and W' is the load to be lifted. It is seen that between the block and fall there are six lines of chain, each of which must be shortened a foot to raise the load W' 1 ft., therefore 6 ft. must be pulled over by the force P, which will, therefore, travel 6 ft. for 1 ft. rise of the load, the weight of which may be six times the pull P. From this we get a very simple rule to find the power of a block and fall. To find the weight that can be lifted by a given pull, multiply the pull by the number of lines of chain between the block and fall; or, to find the pull necessary to lift a given load, divide the load by the number of lines of chain between the block and fall. There are some pulleys called "differential" pulleys of special construction, and should you want to know how to calculate any particular kind, I shall be happy to inform you on receiving particulars. The above applies to all general cases. By combining two or more sets, the power is increased more rapidly: thus, if instead of hanging the load W' direct on the hook K, a similar block and fall were interposed, the power at the hook would be multiplied six times, and the total increase would he thirty-six times P.—F. C.

**Frosted Gold.**—H. H. W. (*Pimlico*).—From a dull surface (produced by polishing with water of ayr stone, and either bluestone or powdered pumice and water, the next step is to either gild or colour the article. Mr. Bonney will tell you about gilding, and I think you will find some information about colouring in "Shop" of No. 19, Vol. I. of WORK, page 301. Once it is gilt or coloured, the thing to do is to scratch-brush it. For that you will require a pretty powerful foot-lathe, some scratch-brushes, and some arrangement to allow a mixture of beer and water to dribble over the brush and the work, while the brush is rapidly revolving. It is this process that is most in use—and it wants a workman who has had experience to get a good surface—and, in fact, this is a special thing, and in our workshop all large surfaces of coloured gold are sent to the gilder to scratch-brush. A scratch-brush on a small polishing lathe will not produce the required surface anyhow. There is another kind of dull-coloured surface sometimes used for Etruscan work, which is nothing but the colour left just as it comes out of the colour-pot. I do not suppose you want that, nor the method followed in Birmingham, which is that of a sand-blast made to impinge on the work. The results by this method are very good, and certainly give an 18-carat appearance to a 9-carat article—for a time. This answer does not do more than indicate the methods, I am aware, but for further information the Editor will have to capture a practical gilder. I, a goldsmith, have not found it worth following up, and writing as my experience dictates, my reply is: "Don't try it yourself" unless you are going in wholesale for gold work.—H. S. G.

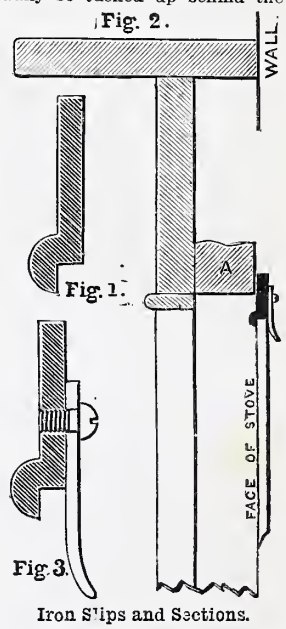
**Galvanising Staples, etc.**—HOLLY READER.—To do galvanising in a small way such as you inquire about, you will want an iron pot or vessel to contain the molten zinc—say about 10 lbs. or 12 lbs. The articles to be galvanised should be, directly after forging, placed in a hot pickle of *killed* spirits; if you can boil them a few minutes it will be all the better. Anything that you can wire together and do several at a time, do so. Use plenty of sal-ammoniac on the zinc. Take the articles out of the pickle, and gently place them in the molten zinc; do not rinse the articles in water before putting in the zinc, or it will sputter all about; but the spirits will not have that effect. Keep the articles in motion till they are thoroughly hot and well covered; then take them out and shake them, and throw them into sawdust. For very small things you might make a kind of wire ladle to hold them whilst in the bath. You can tin wrought-iron goods in the same manner. With regard to enamelling iron, it is beyond an amateurs' skill, as it requires special knowledge and training, only to be got by actual experience.—R. A.

**Phonograph.**—C. T. B. (*Derby*).—An article on the above subject is in the Editor's hands, and will appear when room can be found for it in WORK.

**French Polishing and Mount Cutting.**—C. M. J. (*Perth*).—It would be impossible in the space devoted to "Shop" to answer your query fully as regards French polishing. Ere this appears in print, you will have noticed, if you read the paper carefully, that the subject is already being taken up in a series of articles, the first of which appeared in No. 105, March 21st, and in No. 108, April 11th, to be followed by others, which will give particulars such as will, if followed closely, enable you to obtain a polish such as you have seen on sewing-machine tops as French polished; though, strictly speaking, many of them are not French polished as we use the term, but are polished on a foundation of oil-varnish: a process that requires a large number to work on to make it worth one's while to adopt. Dull polishing is obtained by dusting over the polished surface with fine emery, and well rubbing with a soft rag or brush in the direction of the grain. Sometimes a little linseed oil is used with the emery, and should be done after the final "bodying up," in place of "spiriting out." Mount cutting has been treated on in Vol. II. in "Shop," pages 207, 668, 683; gilding mounts, 207; mount-cutting tool, 669.—LIFEBOAT.

**Designs for Inlaying.**—A. W. (*Hackney Road*).—H. Zilles & Co., 24 to 26, Wilson Street, Finsbury, have some excellent designs for inlaying, but if you want them for furniture they are not altogether in the styles most commonly met with. If you want them for your own use, and not for sale in the ordinary trade channels of your neighbourhood, they are everything that could be desired. Should you prefer to have them in the Italian or prevailing fashionable style, you cannot do better than apply to Mr. Busschotts, Park Lane, Liverpool. He has the largest stock of Italian designs in this country for fret-cutting and inlaying. If you want special designs to your own sizes, you will have to get the patterns drawn out for your own use, or you may be able to get them from some marquetry cutter in your own neighbourhood.—D. A.

**Repairing.**—A. V. H. D. (*Holloway*).—You should not in any case repair defective stoves with wood. You can buy at most of the large ironmongers what are called "Stove Slips." These are slips (of various widths and lengths) of cast iron, supplied for the purpose of making out a stove to a different size to what it is made, and so adapt it to an existing mantel. With one of these slips I think you will be able to get over your difficulty. Fig. 1 is a section of a slip which will suit your purpose, and if you cut it so that it will just go between pilasters, you will find it can readily be tucked up behind the smoke joint, A, Fig. 2, until it gets into position shown, and the only thing that remains to be done is to keep it there. This can be done by screwing two thin iron clips on the back of slip, as Fig. 3; by turning these clips round so that they are parallel with slip until it is tucked into its place, you can pass your arm through the register hole of stove and reach these clips, and pull them into the position shown in Fig. 3, and this will effectually hold the slip in its place. A little plaster of Paris smeared with the hand over the back of slip when it is in its place will help to improve matters. If you find you cannot reach the clips with your hand, drill a small hole in end of clips, and tie a piece of string on end of each, so that by guiding the strings through first, the clips can be pulled down in this way. I should advise you to make a pattern in wood first, and try it that way, and then, in the event of your not being able to buy exactly what you want, it would do to cast from. Your next question as to who the parting garden wall belongs to, and who is responsible for its repair, is a question that very often crops up, and unless it has been specified in the lease, can only be settled by law, there being no clause in the Building Act to cover this particular case. I think you will find the matter generally stands in this way—viz., that if you want to repair, and your next-door neighhour is indifferent if it is repaired or not, you must pay, and *vice versâ*. This is one of those cases where a little give and take is very desirable.—E. D.




Iron Slips and Sections.

**Knotting, Splicing, and Working Cordage.**—H. W.—I would willingly tell you in what numbers of WORK the successive articles on this subject will appear if I could, but it is not possible for me to settle anything of this kind in advance.

**How to Make a Garden Barrow.**—L. P. B. (*Kew Gardens*).—Full instructions on the above, both as to size, construction, etc., will be found in No. 68 of WORK.

**Bleaching Silver.**—W. H. (*Reading*).—W. H. will find this matter dealt with on p. 60, No. 108, Vol. III. of WORK.—H. S. G.

**Emigration.**—PRÆTORIA.—Apply to John Pulker, Esq., Emigrant's Information Office, 31, Broadway, London, S. W.

**Fret Machine.**—J. B. (*Derbyshire*).—I have given other correspondents in "Shop" the information you seek. Refer to back numbers.

**Jewel Case Catches.**—H. A. (*Forest Hill, S.E.*).—These can be obtained of Mr. Child, Meredith Street, Clerkenwell. If the particular sort are not in stock, then get Mr. Bibb, West Street, St. Martin's Lane, to give a quotation to make them. A suitable piece of leather can probably be obtained at Deed & Sons, 91, Oxford Street, or at F. Cooper's, 107, High Holborn, London.—H. S. G.

**Magnetic and Electric Belts.**—J. O. (*Hednesford*).—The electric belts described on page 827, Vol. II. of WORK, in reply to G. F. R. (*Woolwich*), cannot be compared with the belts advertised at 5s. 6d. each, as these may be magnetic belts, made up of permanent magnets sewn on to the belts, and these do not give *electric* currents.—G. E. B.

**Electric Belt.**—W. H. C. (*Homerton*).—G. F. R. (*Woolwich*) inquired for an *electric belt*—that is, a belt to generate a current of electricity. I described such a belt on page 827, Vol. II. of WORK. This belt will generate a current of electricity if moistened with sour sweat or with dilute vinegar. In that description you will read—line 16 onward—"solder a length of wire braid to a copper disc of one pair, then pass it (that is, the length of wire braid) through the belt, and solder the other end to the zinc plate of the *next* pair, and so on." You will thus see that you will need as many lengths of wire as there are plates in the belt. The plates of a pair are opposite each other. The belt you have is, probably, a *magnetic belt*. These appliances only do good when *adapted* to a person's needs. I am investigating such appliances just now to discover their value as remedial and curative agents.—G. E. B.

**Marine Boiler.**—R. A. F. (*Shepherd's Bush*).—You do not state for what description or size of engine the boiler is required. From the size of boat, I judge you may put in a boiler of vertical type, 5 in. in diameter, and about 10 in. high. The fire-box inside may be 4 in. diameter and 3 in. high. From the top of the fire-box you may carry up a number of ¼ in. diameter tubes through the water space to a space whence the chimney springs, or you can carry up a 2 in. diameter vertical flue, and place a number of cross water tubes in it, crossing each other in all directions to present surface to the hot gases of combustion. These tubes may be ½ in. to ⅝ in. in diameter, and should be slightly inclined from the horizontal, to facilitate the circulation of water through them. Another form of boiler which presents advantages in heating surface consists of one or two coiled pipes to contain the water, and upon the surfaces of which the hot gases strike. These coils should communicate at top and bottom with water chambers, preferably of cylindrical form. Copper is the proper material to use, and it must be used for the pipes, but if the expense is in question, the shell and fire-box may be made of sheet-iron. The joints should be strongly brazed together, and the boiler tested with water pressure before you put it under steam. I do not think you will find a charcoal fire successful, and advise you to use a lamp or paraffin burner instead. Unless you have a blast, the charcoal will burn too slowly to make steam, and if you do have a blast you will find great difficulty in keeping your fire stoked. Your boiler should carry a steam dome, safety-valve, and water-gauge.—F. C.

**Making Catgut.**—WORKONIAN.—I am not acquainted with any book devoted to this industry. It is a very dirty one, but those who follow it in my district admit that it pays fairly well, and takes very little capital. The materials—the sheep's "ropes"—are bought from the butcher, and cleaned by turning inside out and well washing with *cold* water. All fatty matter is scraped off. A set runs to from twenty to thirty yards. The gut is twisted whilst "green," and just as we see twine twisted at a rope-walk, one end being fixed, and the other attached to a bobbin set in motion by a larger wheel. A size made from parchment scraps, etc., is afterwards rubbed over the gut, and it is dressed down with a cloth; this gives a finish, as well as serving to keep the twist in place. The smaller intestines serve for making the thinner strings. My neighbours sometimes make gut up to ½ in.; this is done by twisting several strands of intestine together. Bleaching is considered to weaken the gut.—S. W.

**Electro-Plating Outfits.**—E. C (*Wells-by Sea*).—The Gassner dry battery, and any dry material required for electro-plating and electro-gilding, can be supplied you by my brother, who advertises in WORK under the style of Bonney & Co., 19, Avenue Road, Lowisham, S.E. He undertakes to supply jewellers and amateurs with small electro-plating outfits.—G. E. B.

**Induction Coils.**—J. L. (*Canning Town*).—A series of articles on induction coils are in course of preparation. When these appear you will learn how to wind the secondary wire of your coil. A coil to give 1 in. spark should have 1 lb. of No. 36 silk-covered wire as a secondary coil. The primary should be two layers of No. 18 silk-covered wire. All other parts of your coil are right. See that the secondary wire is well insulated. To guard against possible faulty places, run the wire through melted paraffin wax before winding it on the primary, and baste each layer with the wax. You may wind on the secondary in three divisions, but the wire must be continuous throughout, and wound on in one direction only. The coil will be improved by a condenser of fifty sheets of tin-foil placed underneath the base.—G. E. B.

**Electric Bells.**—G. P. (*Edinburgh*).—You will find full instructions on making electric bells in WORK, Vol. I. A series of articles on "Burglar Alarms," including details of electric bell construction, appeared in Nos. 12, 18, 20, 27, 31, and 33. All back numbers are in print. You may also pick up several ideas from previous answers to correspondents in "Shop." Read these first, then if you do not clearly understand any part, or wish for further advice, write again, and I shall be pleased to help you. You will find an idea for an electric time alarum in No. 32, and several illustrated ideas in Vol. II., on pages 157, 175, 226, 416, 582, 699, and 723.—G. E. B.

**Fixing Chalk Drawings by Sprinkling.**—R. O. (*Handsworth*) can do this with isinglass dissolved in water, taking up his size with a camel-hair brush, and getting his "spurts" by using a comb. An old way of fixing chalk is with *warm* isinglass size, applied at the back of the paper.—S. W.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Soldering Delicate Gold Articles.**—H. S. G. (*Battersea*) writes, in reply to NORTHERNER (see page 734, Vol. II.):—"NORTHERNER asks for a few hints on this matter, as he has failed in an attempt to solder the thin bezel of a watch and has melted it. The cause of his failure may have been that the solder was of too good a quality, although that is but a poor excuse, for a workman should watch all his work for indications of overheating all the time that he is trying to solder one part. If the solder is not in fault, as it well may be if the bezel was from a Geneva watch, then there was probably dirt or grease about somewhere, either on the bezel, on the solder, or mixed with the borax. In fact, any impurity will hinder soldering; therefore one must always take care to have everything clean and free from dust or grease, and be very particular to scrape the solder bright, as well as the edges of the work where the solder is to run. I think I should have annealed and boiled out the bezel before scraping and applying the borax, then I should have given myself a fair chance to succeed. As to soldering delicate articles generally, to be successful in that class of work is not given to everybody. Success depends (after proper preparation of the work, cleanliness, etc.) on the ability to control and direct the flame of the blowpipe. Flames to solder with are roughly divisible into two—pointed and spread: the latter is what is wanted here. It is produced by holding the point of the blowpipe a short distance away from the flame—say, ¼ in. to ½ in.—and then blowing with a very gentle and regular blast so as to envelop with a quiet flame a large portion of the article until the solder runs or the work begins to show signs of sweating, when, of course, no more heat should be given. If the foregoing is not minute enough in its details, then write again."

**Dry Battery.**—F. A. (*Portsmouth*) writes, in reply to ELECTRIC (see page 14, Vol. III.):—"I think the following will be of use to you for a dry battery: Oxide of zinc, ¼ lb.; plaster of Paris, 2 lbs.; chloride of zinc, 1 lb.; water, 3 pints; zinc and carbon to be used as elements."

**Enlarging Drawing.**—A. N. F. C. writes, in answer to J. W. (*Edinburgh*) (see page 14, Vol. III.): "To enlarge, multiply, to diminish, divide, each side by the square root of 2 (=1·4142...., the nearest fraction to which in common use is 1⅖)."

**Wood-Slicing Machine.**—DEXTER HANDY writes, in reply to W. H. (*Belfast*), who asks (see page 782, Vol. II.) where he can procure a machine for slicing wood as thin and clean as that used for bandbox making:—"La Maison Arbey, Cours de Vincennes, Paris, make such machines, and if W. H. does not hear of a maker nearer home, he may like to apply to the above-named firm. They make a fine machine which will slice wood up to ·005 metre thick by 1 metre long and ·35 metre wide—in our measurements, say ⅛ in. thick by 39 in. long by 13¾ in. wide."

**Draught Board.**—T. C. R. (*Liverpool*) writes, in answer to J. W. M. (*Driffield*) (see page 782, Vol. II.): "Take a sheet of paper size of glass, mark width of border from each edge, and allow ¼ in. for rabbet of frame. Tick off upon inside lines number of squares, and connect points. This will give plan of board, and when placed underneath glass correct guidance for painting. For simplicity and good effect take lamp-black in oil, thin with varnish and turpentine, and by the aid of straight-edge and lining-pitch run all lines upon glass as seen through it. For width, say, squares 1 1/16 in., border ⅞ in., and ⅜ in. band running through centre for relief or other work, as fancy dictates. When this is dry, proceed to lay in alternate squares white and green of medium depth; the border a brown leather, cigar, or fawn colour: care being taken to make colour cover solid, or it will want re-coating, as in the case of the white, and a coat of this pigment spread over the whole will give additional solidity, and act as a preservative. For frame, procure plain moulding. Stain this walnut and varnish, or German mould from picture-shop, which is very cheap, but not so durable or consistent with use, in this case being faced with composition, and liable to chip, showing the white underneath. Four shillings should cover cost of above, presuming painting done by oneself, and tools to hand. There would be no difficulty in fitting boards to legs; and any handy joiner would give estimate for so simple a construction."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. M. F. (*Elginshire*); C. R. (*Paris*); C. W. T. (*Manchester*); APPRENTICE; CARVER; PERPLEXED; C. G. M. S. (*Dezon*); A. E. S. (*Glasgow*); CONSTANT READER; B. O. (*Stoke-on-Trent*); CUTLER; T. R. (*Middlesbro'*); P. P. (*Manchester*); J. B. W. (*Manchester*); T. B. (*Manchester*); F. P. (*London*); T. H. (*Bradford*); W. A. D. (*New Brompton*); CONSTANT READER; AQUARIUM FOUNTAIN; BOOKWORM; W. B. R. (*South Norwood*); J. M. (*Wanstead*); H. B. (*Brighton*); A. C. (*Burnley*); ANXIOUS; F. B. (*Tamworth*); PIANO; M. F. C. (*Enfield*); A. G. (*Sheffield*); M. P. (*Manchester*); B. CO. (*Colchester*); J. R. (*Wednesbury*); T. B. S. (*Newport-on-Usk*); SPENCHEST); ASPIRANT; P. M. F. (*Falmouth*); W. O. (*Whitefield*).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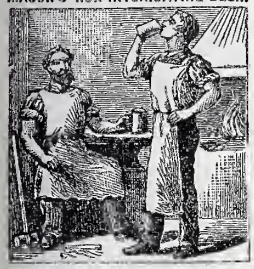

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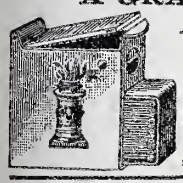

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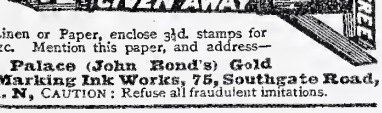


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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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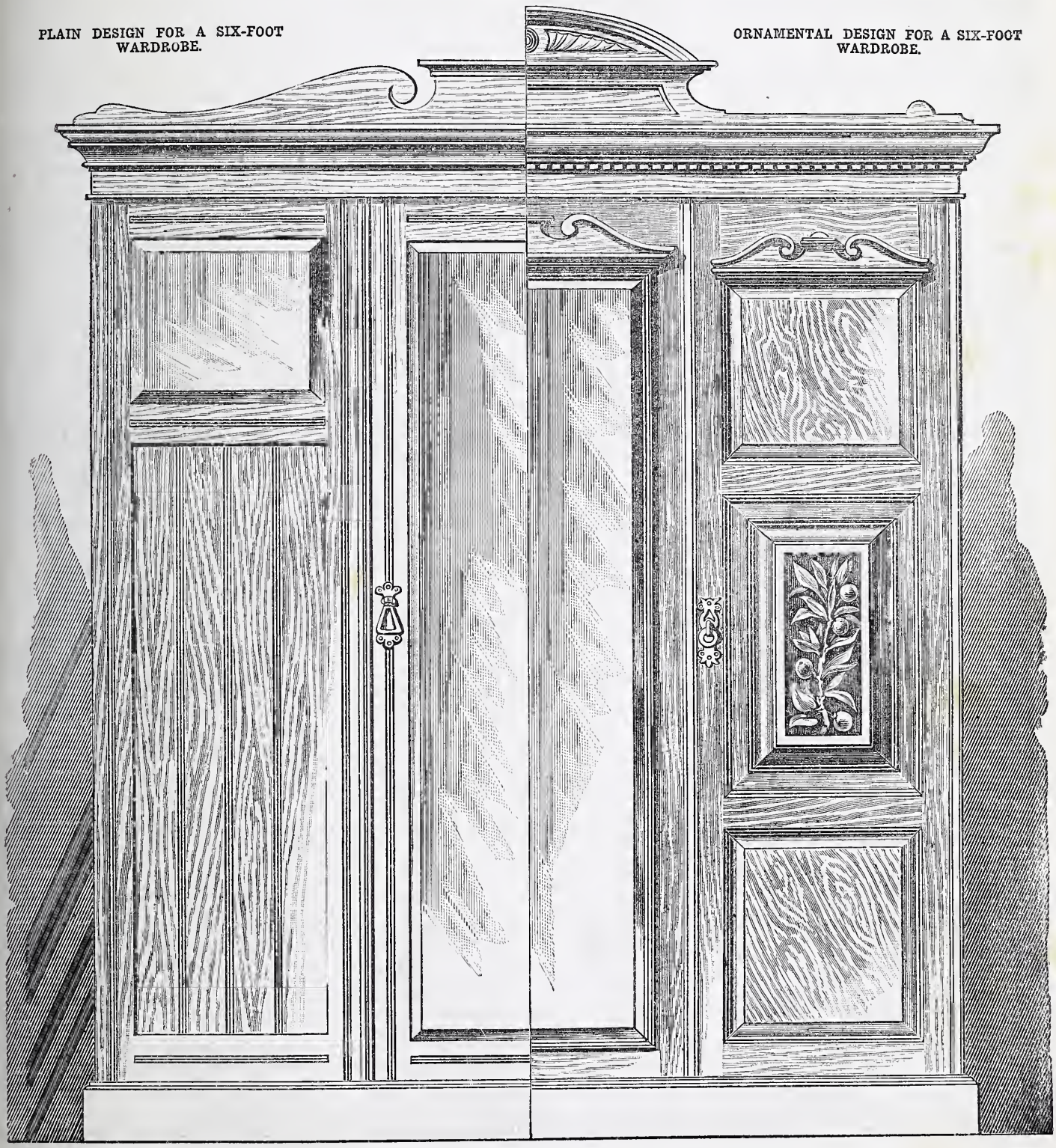
PLAIN DESIGN FOR A SIX-FOOT WARDROBE.

ORNAMENTAL DESIGN FOR A SIX-FOOT WARDROBE.



## HOW TO MAKE A SIX-FOOT WARDROBE.

BY AN OLD HAND.

Introductory—Size—Size of Ends—Parts Forming Wardrobe, Drawers, Trays—Hanging Part—Bonnet Box and Drawer—Hooks—Shelf—Lining—Plinth—Cornice—Doors—Short Trays and Drawers.

The construction of a large wardrobe is a job not to be undertaken by the novice; therefore the following suggestions are offered more for the consideration of the expert workman, who, while thoroughly proficient in the manipulative part of joinery, is not altogether at home in making up articles of furniture, than for those who do not understand the use of tools and the necessary joints. The amateur and the beginner are warned that the following remarks will require reading between the lines if they are to be of any benefit, for I do not so much wish to write detailed directions as to endeavour to represent what may be regarded more in the light of a friendly workshop chat over the bench between two experts in joinery, one of whom may never have had his attention directed to wardrobes. But perhaps one of the good old school of artisan—or shall I not rather call him a tool-using labourer?—who objects to the new-fashioned notions of letting people know so much in "these 'cre papers" may repudiate the notion that a quill-driving creature can tell the practical man anything worth knowing. We all of us know such types of individual, unpleasant to work with, and not, as a rule, quite so clever as he assumes to be. Well, I do not address my observations to him, and only make them in the hope that they may be useful to some of those younger members of my trade—that of a cabinet-maker—who do not object to learn. Everyone of them will know that to say everything that might be told about a 6 ft. wardrobe would take a long time, and I can barely touch the general outlines. For instance, I shall assume that the reader knows how to set out work, make doors and drawers, and the manipulation of the tools required, so that nothing need be said about such details.

Although the size of the wardrobe has been stated in the heading of this article to be 6 ft., there is no reason why a similar article of furniture should not be made either much smaller, or, on the contrary, much larger. The width stated is, however, a good standard or average one, and when a "three-door, long-tray wardrobe" is mentioned, the size that most of those in the furniture trade will conclude it to be is that named. As limits for wardrobes of this construction, 5 ft. and 8 ft. for the smaller and larger may be given; but probably more of them are made 6 ft. wide or thereabouts than of all the other possible measurements put together.

The height of such a wardrobe, whatever the internal fittings may be, will to some extent depend on circumstances, and the following considerations may be some guide to the maker:—That of cost must not be omitted, for, unfortunately for the turning out of really good articles of furniture, it is of prime importance, and "cheeseparing" must be practised sometimes both in work and material if a job is to pay. Now, a wardrobe is a big thing and swallows up some stuff, so that it may be necessary to reduce the quantity as much as possible, not only by keeping the height down, but also the depth from back to front. Why, by this means 4 ft. of stuff can be saved in the ends alone by having them 6 ft. 6 in. by 1 ft. 6 in. instead of 7 ft. by 2 ft. As there are four ends—two inner and two outer—and it may fairly be assumed that these latter are solid, here is a possible saving at once. True, rather extreme measurements have been taken for the ends, but neither of them would be regarded as unsuitable. Increased height adds importance to the work, but it should be remembered that, if it is excessive, convenience may be sacrificed to appearance, for the most convenient wardrobe is undoubtedly that in which most of the contents can be got at without mounting on a chair or steps.

For a 6 ft. wardrobe, a good ordinary size for the ends may be stated as about 6 ft. by 1 ft. 8 in. With a cornice 6 in. deep, or a little more, and a 5 in. plinth, we thus get the total height over all, exclusive of pediment, of about 7 ft. A reduction of 6 in. would make the wardrobe a low one, while, to use the language of our friends of the hammer and rostrum, an addition to the same extent would make the article "noble and massive." The size having been determined on, something will have to be said about the construction, which is by no means difficult to those who can handle their materials. Now, as I have suggested, this—or, indeed, any other form of three-door wardrobe—may be fitted up in what is probably the most popular form of arrangement among buyers, viz., that with sliding trays and drawers extending across two-thirds of the width, and the remaining third being a hanging cupboard.

So far as cabinet work is concerned, there might be no difficulty in making the wardrobe in one piece, but as it would then be inconveniently large and very difficult to remove or get into many ordinary rooms, it is generally—I may say invariably—made in parts. The three-door wardrobe with long trays and drawers is therefore nothing but a collection of parts fitted to, and to a certain extent independent of, each other. For all practical purposes it may be considered that such a piece of furniture consists of five parts—viz., the three principal portions of the carcase, the plinth, and the cornice. Of course, in addition to these are doors, drawers, and trays.

Two-thirds of the wardrobe being occupied with the latter, were one case made to hold them both, the size would be inconveniently great. This two-thirds, or, to put it in other words, the part which is enclosed by two of the doors, is therefore made in two portions, the lower one containing drawers and the upper the sliding trays. The former is nothing but a perfectly plain chest of drawers, while the latter is even simpler, as the trays simply slide either on slips fastened on to the ends of the case, or, better, by means of slips fastened on the ends of the trays and fitting into corresponding grooves in the case. May I here suggest, for the benefit of any "Curtain Road" furniture maker—or rather, dealer—who may see these lines, that good cabinet-makers in "the country" do not altogether appreciate the extremely shallow trays which London trade makers put in. I have known more than once these to be taken out and replaced by good deep trays such as are generally supplied in Scotch wardrobes. Yes, I know all about the reasons for shallow trays—price and all that sort of thing—and that the makers would not get any extra consideration when selling on the "buzz" in or near the Road, but the fact remains that the common London-made wardrobe is in regard to trays not of the best, and I suppose it is within the province of Work to give a few hints even to metropolitan readers. I do sometimes think that we in the country—by which I mean the cockney's definition—can often give them hints as well as receive them.

The parts containing the drawers and trays must fit together accurately, and are secured to each other when the wardrobe is made up by screws. Only one end need be solid, for the other, as well as the two tops, are not seen, and may be (as they generally are) of pine.

The hanging part is merely a plain cupboard behind the third door, and may be of pine except the outer end. The inner end of it and of the other two portions are, when fitting up, screwed together.

The fittings inside the hanging cupboard vary, but are usually of a very simple character, and it will be sufficient just to indicate arrangements that are often adopted.

Where ladies are concerned—and they generally are in connection with wardrobes—the bonnet box or drawer is usually considered indispensable. The bonnet box which will no doubt occur to most readers as being commonly seen is the familiar and not indestructible bandbox; but, as behoves the cabinet-maker, he must make something more substantial—in fact, he must make something to contain bandboxes. For this purpose the "bonnet box" or drawer of a wardrobe is usually made sufficiently deep to hold several of the others; and, indeed, I do not remember of any lady having ever complained of one being too deep. If it is made to hold two layers of bandboxes, there will not be any complaint on that score; but if made much deeper, the hanging space might be inconveniently diminished thereby.

When a plain drawer is made, there will be no difficulty in its construction, but on several accounts a drawer is not so convenient as a box. This is hardly more than a trade term, for in a strict sense the receptacle is not a box. In one form—and that perhaps the simplest as well as the most convenient—the top is a fixture or shelf enclosed below, with a fall-down front or door hinged at the bottom, and secured at the top with a spring catch.

A very similar construction is that in which the front is fastened and the shelf or lid is hinged near the back. In this case, things which may be on the shelf have to be removed before access can be gained to the interior of the box.

Another form of construction, and one entailing more work, is to make the top in the form of a sliding tray, which must be drawn out to get at the inside of the box.

It is entirely a matter of fancy on the user's part which is the best form to adopt, and, so far as the maker is concerned, a question of cost and which he thinks will suit his customers best.

Leaving the lower portion of the cupboard, let us turn to the top. Hooks here are regarded as indispensable. They are usually fixed in a row on the back and both ends,—or, as we should say, "all round"—and are fastened first on to rails, which are then secured in their places. As the back is seldom thick enough to hold the hooks, a rail must be used there; and it is better, though not so necessary, to have them on the ends. When a really first-class job is wanted, the rails on which the hooks are fastened are made to slide in and out. Above the hooks a shelf is often placed; but as the space for hanging might then be

made too short, it is generally found only when there is no bonnet box below.

It may be useful to mention that the hanging compartment is seldom supposed to be finished till it has been lined—a glazed, striped lining being generally used for this purpose. Though it is more the work of the upholsterer—generally only a young one—than of the cabinet-maker, the "jobbing hand" may be glad to know that the lining can be stuck on with strong paste applied to the wood, from which any ochre colouring—and there generally is some to disguise the pine in wardrobes bought in the neighbourhood already indicated—should be thoroughly washed off first. Lining is not a difficult job.

The plinth and cornice have been sufficiently mentioned, but it may be well to say that the latter should be fairly heavy in appearance, as shown in the illustration, which is drawn approximately to 1 in. scale, and should not consist merely of a slight moulding. To facilitate fitting together of the various parts, blocks should be fastened on to the top and bottom of the carcases, and fitting into the corners of the plinth and cornice.

The doors may be hinged within the ends or on them, the method, of course, being determined beforehand. When hinged within, the end must be thickened up for the trays to pass. The centre door—of which, by the way, the panel is generally looking-glass—may be either hung with centre hinges let into top and bottom, or with ordinary butts. In this case both ends of the hanging compartment project to an equal extent, and the hinges are fastened to the inner one, the edge of which should be faced up to match the rest of the outside.

To discuss the whole matter of hingeing wardrobe doors would, however, require considerable space, and no doubt enough has been said to enable any practical man to do what is necessary. If not, perhaps he will kindly state his difficulty for answer in the "Shop" column.

With the remark that a wardrobe of exactly the same external appearance may be made with short trays and drawers in one or other—usually the centre—of three carcases, these few hints on a 6 ft. long-tray wardrobe must be brought to a close, leaving the intelligent worker to make such modifications as may seem desirable to him.

## TO CLEAN WALL PAPERS.

BY E. W.

Stale Bread *v.* Dough—The Dough: How Made and How Used—Useful for Ceilings—An Example.

The value of stale bread for the purpose of cleaning wall papers is very generally known, and its service more largely requisitioned than that of all other substances. It is splendid for the job, and deservedly in favour, but in many respects is not equal to the comparatively unknown "dough" process. This latter is cheaper, quicker, leaves no dust or crumbs about, and, with moderate care, will make an equally good job with a far less expenditure of labour. The dough for this purpose is simply a mixture of coarse flour and water, the coarser the flour the better, of rather stiffer consistency than for a pudding. About 1 lb. or 1½ lbs. of flour will be sufficient to clean the walls of, at least, one good-sized room, even though the paper be very dirty. The loose dust on the walls should first be removed by a soft broom or brush, and then the lump of dough passed lightly over the paper, when it will be seen to remove the dirt in its path as effectively as an indiarubber squeegee removes liquid mud from an asphalte road. The dough in use works soft, and in consequence it will be found desirable to have some flour in a bowl to roll it in occasionally. If not intended to wash the ceiling, it may with advantage be treated the same as the walls, though, if thus done, it will not, of course, have the brilliant whiteness of a fresh-washed ceiling. By this means I have, in less than an hour, well cleaned the walls and ceiling of a room 14 ft. by 12 ft. by 8 ft. The walls and ceiling were very smoky and dirty when I began, and the walls showed in very pronounced patches the parts that had been covered by pictures, pier-glass, furniture, etc., but when finished they presented an evenly clean appearance suggestive of new paper; the ceiling also looked very clean and presentable, though previously blackened by smoke. Certainly, for simplicity, ease, cheapness, and the facility with which this work can be done by anyone without any previous experience of such, this method of cleaning must commend itself to all who are actively desirous of securing a clean, attractive, and healthy home.

## APPLIANCES FOR WORK TO BE MADE BY THE WORKER.

BY B. A. BAXTER.

Guide for Dado Groove, used for Grooving for Partitions—Trough for Planing Blind-Lath Edges—For Piano Small Work—Zinc Templates for Mortises, Contour of Mouldings, etc.—Suggestive Value of Articles on Beehives in "Work"—Mitre Templates of Various Kinds—Mortises to Pattern—Boring Collars—Setting out for Dowelling—Advice to Watch a Polisher or Carver—Fixing Small Hinges.

For grooving across a board with a dado plane, the benefit derived from the use of a guide is not to be despised; the guide may be a piece of ½ in. wood having a straight edge, and it may usually be fixed with a bench holdfast, which, though it cannot be made by the wood-worker, is one of the most useful additions to his bench that he can possess (Fig. 25).

In cases where grooves are to be made at regular intervals, a piece of wood, having affixed to the underside of it a piece that fits the groove last made, will be useful; all that is needful is to be sure that the strip fitting into the groove is parallel with the edge which guides the plane, and that it fits the groove accurately (Fig. 26).

The "trough," used to reduce blind laths, etc., to a uniform width, ought to be mentioned as suggestive, though blind laths are cut so accurately now that the trough is not required for that purpose (Figs. 27, 28).

Very much akin to this is a contrivance used by pianoforte makers to plane hammer-heads, etc., to the exact thickness. As some readers are aware, the small parts of pianos are made by shaping lengths of wood cut across the grain to the desired figure, and then cutting slice after slice off by means of a circular saw. This plan to plane the parts to accurate thickness merely consists in fixing on a piece of wood two strips of the proper thickness so that the edges of the trying plane move upon them, while the articles to be planed are placed between and therefore in the path of the cutter (Fig. 29).

It may not be too obvious to mention the great utility of zinc templates cut to the figure of a rebate or a moulding, cheap and useful, and easily cut with strong scissors, saws, or chisels and gouges.

Various grooved or rebated pieces of wood which are useful to hold long, thin strips while being planed or rounded merely mentioned will suffice, although appliances suitable for all purposes will never be fully described; reference here to the papers on beehives and appliances will show what I mean: it is not necessary (perhaps not allowable for me) to speak of the merits of those papers, especially *this* feature of them.

Appliances rendering chisels more accurate in action and results strictly might include planes, by a stretch of licence, for a plane *is* merely a chisel so fixed in a block of wood that its angle is constant and its penetration limited; but for chisels merely, help is required to enable the worker to make the best use of them. The template for mitres is perhaps the most useful and best known (Fig. 30).

A diagram is here given of a template for cutting applied mouldings to ornament a panel; this template will serve for both sawing and finishing with chisel, and is made so that the moulding just fills the groove in the template (Fig. 31).

A template for stop-chamfer work is useful and easily made; the intersection of the angle of 45° on each face of the wood gives a facet equilateral and therefore equiangular, if the template and the material are accurate.

For making mortises, etc., for forms, door-frames, and anything beyond the usual scope of a mortise-gauge, it is useful to make model mortises on a piece of wood that can be applied to the work, and there is this advantage, that the same strip will do for the marking of the tenons as well (Fig. 32).

I remember well being led to this by being engaged with another in making forms, and my comrade would not or could not see the advantage of making all the similar parts interchangeable, so as he made the mortises, I had to make every standard a separate fitting.

For boring, we can help ourselves in obtaining uniformity of results by easily contrived expedients.

First as to the depth, we can of course bore a hole with the bit itself, and the piece of wood forming the depth gauge only needs to remain on the boring tool and to extend from the collar of the brace to the wood being worked on; in the case of centre-bits or other boring tools larger than the shoulder of the brace, two pieces of hard wood can be notched to fit the stem of bit and screwed together on it at the position desired (Fig. 33). Here, however, I feel compelled to make a digression, to tell of a countersink which also acts as a depth-gauge, useful to all who bore for screws; it is of steel with a hole in the centre and a cutter wound round the hole in a spiral form; it has a screw to adjust and fix it on to any pin, spoon, or nose-bit, not exceeding the size of the hole in centre. I am told that it will work satisfactorily with any bit, though considerably smaller than the hole in centre; this is because the adjusting screw brings the cutting edge into prominence. It is to be had at all first-rate tool warehouses, or will be soon, on account of its utility. I saw it at Melhuish's.

But to return to our home-made appliances: the need of some help to accuracy in dowelled work is so great that most workers

who make anything in which dowels play any important part are glad to have assistance. Let us suppose that a joint is dowelled with three dowels, we know that the thoughtful worker will not put them in line, or too close together.

Let us imagine a thin veneer or a card or piece of sheet metal is interposed between the pieces of wood to be joined, three pin-holes bored in the thin wood or metal can easily be transferred to either face of the joint, and so the distance apart of the three dowels may be equal each to each in both pieces to be joined; but if there is also a stop or a guard to one edge of the gauge, not only will the distance apart be correct, but the distance from the edge will be ascertained, and if the end needs to be flush, then a stop on the end will materially help accurate boring (Fig. 34).

There are many other expedients which may be adopted with advantage, but they are too numerous to mention here.

It is often instructive to see how a carver or a French polisher will make rough but efficient arrangements for the holding of his work, but I may mention a trifle which I have found very useful: it is merely a turned pin having a square-shouldered head, $\frac{7}{8}$ in. in the stem, and about 3 in. long, the head about $1\frac{1}{2}$ in. in diameter, and about $1\frac{7}{8}$ in. long; the $\frac{7}{8}$ in. portion is tapped, and the holes in the side of the bench are also tapped to fit. One or two holes on the top of the bench are also bored and tapped, and this little arrangement alone (or with the aid of a piece of wood in which the turned pin moves freely—that is, with a hole just large enough to clear the screwed portion) forms a simple and most useful help in cutting shoulders, sticking mouldings, and other similar works; used in the sideboard of the bench it not only supports the board, but also holds it to the bench. If thought desirable, the piece of wood just mentioned can be made 12 in. long, and a thrust screw fitted to one end: it then becomes in effect a hand-screw, and the bench one of the jaws; but I have found the simpler form sufficient for so many varied wants that the last-mentioned arrangement has been discarded. This is shown in Fig. 36, but the piese of wood is omitted, the head of the screw is shown round like a mushroom-headed screw, and the side of the bench is shown in a flat or horizontal position instead of a vertical position.

For fixing small hinges uniformly on a number of small boxes, a piece of zinc folded to a right angle having holes just where the screws for the hinges ought to be put has been very useful, enabling a lad to place hinges with little trouble to himself if greater trouble had been required, he would not have supplied it (Fig. 35).

All these are mentioned as being suggestive, and if anything here mentioned proves to be useful, the writer will have his reward but if this paper should lead anyone to try and devise some special aid to help accuracy and uniformity, then he will have had the greater satisfaction of helping the reader to help himself in a very true and real manner. It is, in short, in indicating to the wood-worker how he may facilitate his work by the adoption of some small contrivance that the value of this paper lies.

In point of fact, in carrying out any kind of work, and especially work in wood, it is surprising how the worker may help himself by resorting to some dodge or other similar to those which have been described above and in the preceding paper on this subject, and in this opinion I am inclined to think no practical man will be found who will refuse to concur, when he looks back over the extent of his own experience.

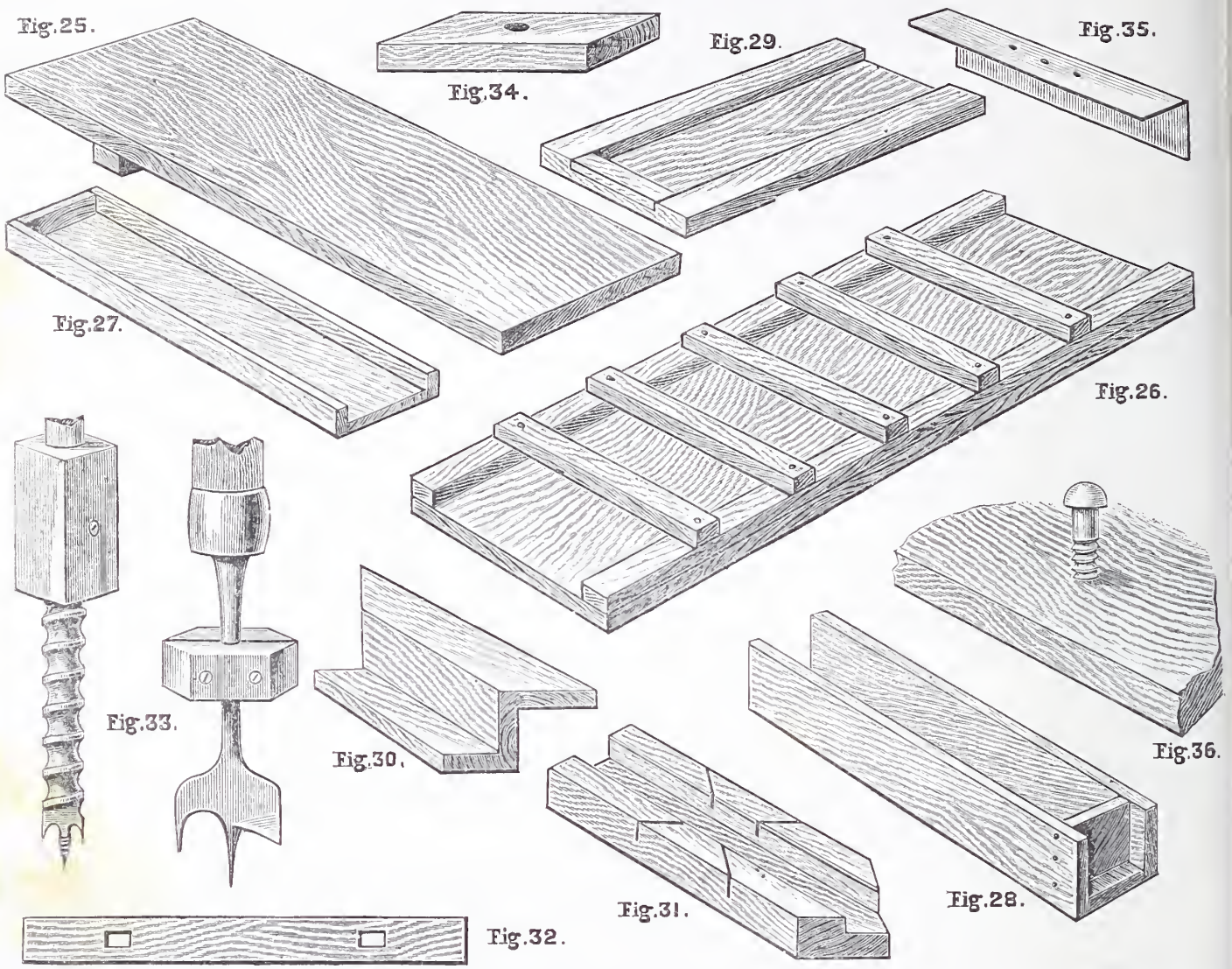



Fig. 25.—Guide for Dado Groove for Equal Distances. Fig. 26.—Guide to make Grooves for Pigeon-Holes. Fig. 27.—Trough for Planing Edges of a Number of Thin Strips. Fig. 28.—Trough for Edging Thin Stuff (such as Venetian Blind Laths) to a width. Fig. 29.—Trough to Plane Small Things to a Thickness. Fig. 30.—Template for Mitres. Fig. 31.—Template for Mouldings. Fig. 32.—Template for Mortises in Form Seats. Fig. 33.—Suggestions for Boring Collars fixed on Centre-Bit and Twist-Bit. Fig. 34.—Gauge for Dowels to limit their Projection to desired length. Fig. 35.—Zinc Gauge for hingeing Thin Boxes. Fig. 36.—Turned Pin useful for Side and Top of Bench.

## HOW TO MAKE A THERMOMETER.

BY J. G. LISTER.

KINDS OF GLASS — THEIR ADVANTAGES AND DRAWBACKS — APPARATUS AND MATERIALS REQUIRED—CONSTRUCTION OF TUBE—FLUIDS EMPLOYED—FILLING WITH FLUID—CLOSING—GRADUATION—FREEZING POINT AND BOILING POINT—HOW OBTAINED.

[T will be well perhaps to preface our remarks on the operations necessary to the production of a thermometer with a few general observations on the nature and uses of different kinds of glass tubing.

Tubes are made of three kinds of glass: viz., lead, soda, and potash or hard glass, according to the principal ingredient, besides silica, present. Each has its special advantages, and each its special difficulty of manipulation. Soda-glass is soft and easy to work upon, but is liable to crack during subsequent cooling. Lead-glass is a little more difficult to handle, and in inexperienced hands is likely to be marred by the production of unsightly blotches of reduced metal, but is much less liable to crack during cooling. Potash-glass is very hard, and will resist great heat, hence it is more difficult to manipulate, but is not open to the same objection—cracking—as soda-glass or reduction as in lead-glass.

Now as to details. The apparatus required will be a lamp, preferably a Bunsen, blowpipe, small glass or earthenware basin, saucepan, small file ("three-square"), and a small funnel; and as materials some glass tubing, mercury or methylated spirit, and a few pieces of ice. The tubing should be what is called thermometer tubing, usually sold at 2s. per lb. under the numbers 33, 34, 35, and 36. Of this, ¼ lb. will be ample to make half a dozen thermometers, including failures.

Having all in readiness, we commence by cutting off a length of 14 to 16 in. of tube by means of the file: first making a notch, and then by a sharp pull separating the portion. The end of this short length must now be softened in the blowpipe flame, and continually rotated until the hole closes, and about ⅛ to ⅜ of an inch is thoroughly softened. Then blow into the other end, using the muscles of the cheek only, until a bulb of the required size has been produced. At about 2 in. from the other end of the tube soften a small portion (about ½ in.), and, by means of a steady pull, cause the diameter of the tube to contract to such an extent that there is only the very finest of capillary tubes joining the two portions. This must be done with a firm but gentle hand; and while the tube is still soft, bend it to an acute angle with the greater length of the tube. Now break off the shorter length about the middle of the constriction, and the tube is ready for filling.

The fluids usually employed are coloured alcohol (methylated spirit coloured with any aniline colour; a small piece of copying-pencil serves very well) or mercury, though for most purposes the latter is preferable, for the following reasons:—First, it is opaque, and hence is readily seen; secondly, it does not wet the glass, and there is less error due to surface tension; thirdly, its co-efficient of expansion is large, and its specific heat is very low (·033 : *i.e.*, it requires less than $\frac{1}{30}$th of the heat required by water to make it expand to the same extent); and fourthly, its boiling point is high (662° F.), and its freezing point is low (— 38° F.), thus giving it a very great range of temperature.

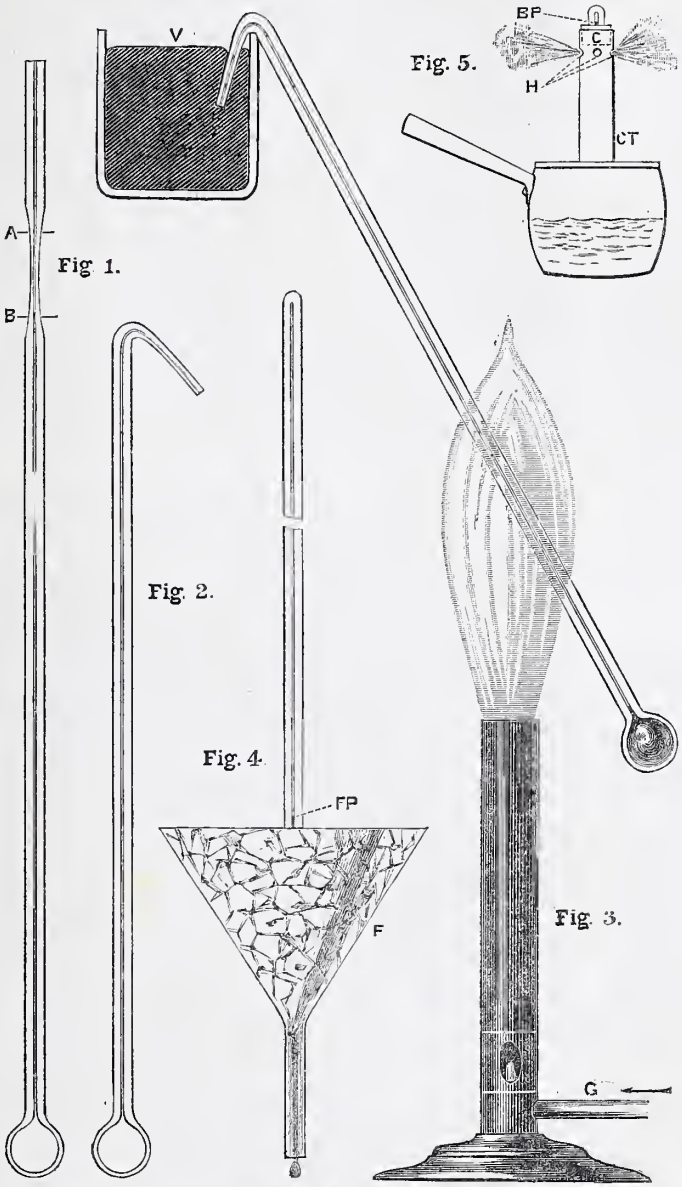



Fig. 1. Fig. 2. Fig. 4. Fig. 3. Fig. 5.

**Fig. 1.—Tube drawn out ready for cutting at A and bending at B. Fig. 2.—Tube bent ready for filling. Fig. 3.—Bunsen Lamp for expelling Air—G, Tube to Gas; V, Vessel holding Mercury. Fig. 4.—Mode of obtaining Freezing Point—F, Funnel containing Melting Ice; F P, Freezing Point. Fig. 5.—Mode of obtaining Boiling Point—C, Cork; C T, Cardboard Tube and Temporary Lid; H, Holes for Escaping Steam; BP, Boiling Point.**

We are now ready to fill our tube with liquid. Place some mercury in the small dish, raise it on a support of some kind, and hang the tube by the bent portion over the edge, so that the open capillary end dips under the surface of the mercury. Now gently heat the tube, to expand and drive out some of the enclosed air. Remove the lamp, and as the small amount of remaining air contracts, some of the mercury will be forced into the tube by atmospheric pressure. This must be repeated until the whole of the tube and bulb are filled with mercury. (If any mercury should stick in the tube, a few gentle taps with the finger-nail will generally cause it to flow downwards.) The final operation consists of removing the tube from the vessel, and heating the bulb *and* tube so as to bring the mercury near, but not quite to, its boiling point. This will cause it to expand, and will further drive out any imprisoned air, so that the tube will contain nothing but mercury and mercury vapour. Now, whilst the tube is still being heated, hermetically seal the capillary end by fusing in the blowpipe flame (taking care to *immediately* remove the lamp from the tube), and our thermometer is made, and it only remains to graduate it. Of course, in the final stage two sources of heat are necessary—one to heat the tube, and the other to use with the blowpipe; for the latter, a No. 12 tallow dip serves excellently.

Now as to graduation. The first thing is to obtain two fixed points: viz., boiling and freezing points (of water). To obtain the latter, which is usually got first, the tube must be inserted in *melting* ice, and a mark made on the glass just at the lowest point to which the mercury recedes. To obtain boiling point, the tube must be placed in the steam from boiling water, and a mark made on the tube at the highest point reached by the mercury. To do this, we must make sure that the *whole* column of mercury is in the steam. This can be done by replacing the lid of the saucepan by a piece of cardboard with a hole in it, in which is inserted a tube about 1½ in. diameter and 10 in. long, with a bored cork in the upper end, and a hole in the side to allow the steam to escape. By this means the whole of the tube and mercury will be kept at the B.P.

We must now decide what kind of thermometer we wish, Celsius (or Centigrade), Réaumur, or Fahrenheit. If Centigrade, then divide the space between B.P. and F.P. into 100 equal divisions, or 50 if great accuracy is not required, and each will be a degree (or two). If Réaumur, then divide into 80 equal parts. If Fahrenheit, divide into 180 equal divisions. Mark freezing point O° in C. and R., and 32° in F. If greater range be required, continue the divisions above B.P. and below F.P., taking care, of course, to put the correct numbers thereto.

The tube is usually let into a piece of wood, and held in the slot cut for its reception by small metal bands, or it may be secured by wire to a metal plate or even to a piece of cardboard, a hole being cut in either material for the reception of the bulb. The graduation should be made on the wood, metal, or cardboard to which the tube is attached, after determining boiling and freezing points on the glass. As this merely requires careful division of the space intercepted between these points into degrees, no instruction on the *modus operandi* is needed.

## SOME WORDS TO WOULD-BE PATENTEES.

BY "AN INVENTOR."

INTRODUCTION — SPECIFICATIONS IN THE LAW COURTS—EMPLOYMENT OF PATENT AGENTS—AMENDMENT OF BAD PATENTS—SEARCHING—HELP AFFORDED BY THE PATENT OFFICE—FIRST THING TO BE DONE — PROVISIONAL SPECIFICATION — COMPLETE SPECIFICATION — PROVISIONAL PROTECTION: ITS MEANING, USE, AND EFFECT—PUBLIC USE OR KNOWLEDGE—UTILITY—FIRST AND TRUE INVENTOR.

HAVING read the papers written and remarks made in Vol. I. of WORK by "C. C. C.," page 545; "Minerva," page 446; "Patentee," page 574; "Loco," page 766; and "A Consulting Engineer," page 694, and being sure that WORK is intended to teach and show people how to do things themselves, I propose—being one who always prefers to do a thing myself if possible rather than to get it done by others—to add and explain in this article certain matters that as yet have not been touched on.

I read the article of "C. C. C." at the date of publication (Nov. 16th, 1889), and came to the conclusion that he was an intelligent amateur who had picked his knowledge up from popular works, and his experience of getting specifications passed through the Patent Office; therefore it is not at all surprising that he should make a mistake or two; but this much must be said in his favour—viz., the information and instructions that he does give are sufficient to draw up a *valid* patent, providing the article, or process, described is new and useful, and that the applicant is the first and true inventor.

It is quite a new doctrine to me that a patent specification should have to go through the Law Courts before being considered a "success." True, such an one stands on a better and different footing, but as "prevention is always better than cure," a specification so drawn that no one dare challenge it in the Law Courts is, in my opinion—and, no doubt, is also in that of everyone else—a more "successful" one than one drawn with *a point to argue on*, on purpose to find work for lawyers, patent agents, etc., to pocket fees, and so harvest some of the fruits resulting if the invention turns out a success. The great drawback to employing patent agents and other professional men in drawing up legal documents is, that while they take reasonable precautions to do the work so that it will stand the test of the Law Courts, they always leave a point or two open to argument. This invites litigation, and while a lawyer will not go into Court if he has no point to argue on, he will readily do so if he has, and the fees are forthcoming.

There is another drawback against employing a patent agent — viz., he always gives the address of his own office as the address of the patentee, if he lives in the United Kingdom of Great Britain and Ireland, no matter in what part. He does this on purpose to intercept any communication intended for the patentee, so that if it means a sale of the patent, or a licence, they can put their fingers on, in the shape of the inevitable "commission." This proceeding is not strictly a legal description of the patentee, and is one I should like to see "sat on." It passes, however, on the ruling "that everything is to be construed in the most beneficial manner for the advantage of the patentee," and the Courts will not annul a patent except for very good and sufficient reasons.

In one of the papers to which reference is made above nine heads are given under which a patent would be considered "*bad*," but they are given in such a way as to convey the impression that a "bad" patent is a *worthless* patent. Now, this is not so. Everyone of these bad points can be amended after sealing of the patent, and so it can be made a "good" one. Further, an unnecessary piece of advice is given, that, when an inventor has drawn up his specification, with drawings, to the best of his ability, "he should *at once*, as he will *then* be in the position to do so, institute a most *careful* and analytical search through all the specifications *relating to the subject*, in order to ascertain how far his invention or improvement is novel, and how far it is not novel, so that he may protect himself and define and obtain his rights by lodging *proper documents*." What "proper documents" is he to "lodge," I wonder? What is to prevent someone else, either in this country or any other in the International Union, from applying for a patent and taking priority over him while the inventor is making his "most *careful* and *analytical* search?" and how is he to examine anything on which a patent has been applied for, *anywhere in the world*, for ten months previously, which will, perhaps, render his patent void through anticipating his invention?

It is implied that this searching should be done by a properly qualified, professional patent agent, therefore I am not at all surprised that it is not said or hinted how or where a search can be made; I will, however, supply the omission further on.

It is hardly fair to say, "that apparently the best qualification for employment in the Patent Office is the least possible acquaintance with, if not a total ignorance of, all matters relating to patents and the kind of work that has to be performed." No doubt this "thrust" at the Patent Office has been given because the officials try honestly to carry out the Act of 1883, and do all they can to assist inventors applying for their own patents. This has been a very sore grievance with professional patent agents, and they got the thin end of the wedge in, with the Act of 1888, which provides for the registering of the present and the exclusion of new patent agents, as well as giving the Comptroller power to reject specifications if not drawn up properly, instead of sending them back to be amended; but as the Act says he "may" do so, and does not say he *must*, I have not heard of any being "rejected," but all are sent back to be altered, if anything amiss is found in them. As it is, instead of charging the officials with "ignorance" or incapacity, I think they are wonderfully well trained for their work, considering the vast variety of subjects they have to deal with.

When anyone has invented anything they consider of value, and they have reason to believe it is *new*, the very first thing they should do, is to apply for a patent, and lodge a "provisional" specification (forms A and B cost £1). The first thing to consider and decide on is the Title, or name to give the invention, which must indicate the *nature* or subject of the invention. The Act of 1883 says only one invention can be included in one patent, but it also says, the validity of a patent must not be questioned on the ground that more than one invention is covered by it; hence, if the title is made wide enough, so as to embrace a whole host of things, they can be all included in one patent—patent agents do *not* point this out to their clients—thus you can call your invention "Improvements in Domestic or Household Implements or Applianees," and proceed to describe improvements in sewing, washing, wringing, or knife-cleaning machines, or any other thing used in the house; or, under the title of "Improvements in Agricultural Machinery and Appliances," you can protect improvements in every kind of machine or tool used in the farming industry; care being taken, in the specification, to call it *one* invention, simply dividing it into *parts*: for instance—the first part of this invention relates to improvements in reaping machines, etc.; the second part of this invention relates to improvements in thrashing machines, etc., and so on.

The Provisional Specification should only describe the *nature* of the invention; the more brief and vague it is the better. "C. C. C.'s" instruction to draw it out in full, as if a "Complete" Specification, is, I venture to think, a point on which he has "gone wrong," though drawing it in the manner he advises would not render it void, but it does lay the patent open to objection, as there is nine months to complete it in, during which time any improvements can be added, and claimed in the Complete Specification. Now, if in the meantime someone else should apply for a patent on the same thing, and his particular development of the invention is in the complete one, and not in the provisional, it is open for him to say it was got from him, and that if a patent was granted it should be only on the lines of the "Provisional." I don't know that he would succeed, though Sec. 4 of the Act of 1888 says he shall—the point has not been decided—but it is a debatable question, and might mean a lot of trouble and worry; while if the invention is only *described* in general terms, without drawings, it would be next to impossible to say the invention set forth in the Complete Specification was different to what is described in the Provisional.

Now, while only a short description is necessary in the Provisional Specification, a full description, full and sufficient directions for performing or carrying into operation, and a full statement of claims, with drawings, if necessary, must be given in the Complete Specification. In a properly drawn Specification, all three of these conditions or requirements are drawn separately, but as it seldom happens that a new thing requires a totally new mode of performing it, it is mostly sufficient to describe an invention, and direct in what manner it is to be performed, jumbled up together, as such a course saves paper and writing. The statement of claims *always* comes last.

The only conditions to be observed in drawing up a Complete Specification is to state clearly what you mean, avoiding all use of legal phrases. The simpler and clearer it is drawn the better; describe the invention clearly, pointing out the parts that are new and those that are old; then describe how to perform it—that is how to make or use, in such a way that anyone acquainted with the subject can, from the Specification alone, go and make, or perform the same. It is not necessary if a part is to be cast or turned in a lathe, etc., to explain how to cast or turn, unless something peculiar is to be done that an ordinary caster or turner would not know of.

It was said by two of the writers named above, that such should be so drawn and explained that at any future time, "any person" from them alone can make the article or perform the process. This is not so; it is quite sufficient if you merely

describe how the *new parts* are to be performed; you can even assume that everyone knows all about something described in a patent just granted.

The claims should also be clearly stated, and it is better to claim too much than too little, as it is much easier to disclaim than to make new claims. In claiming, all new parts can be claimed separately, so as to prevent such being used by anyone else; and such parts can be claimed in combination with old parts.

If all these are done clearly, and in such a manner that your *meaning* is clear, you have done all that the Patent Laws—not "Patent Office" please, as given by "C. C. C."—require. "The most experienced patent agent can do no more"; and such a Specification will always pass unscathed through the Law Courts on the question of drawing up. There are, however, a great many matters that affect the validity of a patent outside the question of drawing—that were not touched on by "C. C. C."—that require to be understood by every inventor, chief of which is the meaning and effect of the various terms used. I will take first:

*Provisional Protection:* its meaning, use, and effect. Before the year 1884 we had to lodge a Provisional Specification with our application for a patent, which was granted on such Application and Specification, on condition that a Complete Specification was filed within six months. We thus got our patent almost first, and we held all the rights of a patentee. But as the contract with the Crown was for what was described in such Provisional Specification, we could not insert or claim anything in the Complete one that was not mentioned in it. That has all been altered by the Act of 1883. We now get our patent on the "Complete" Specification, the Provisional one merely taking the place of the Caveat, under the old law, and by retaining the same appellation causes so much confusion. Few people seem to know or have any idea why the present form of Provisional Protection exists, or its real value to an inventor. Before the passing of the Act of 1883, very many complaints were made about the injustice suffered by inventors, in this country, in comparison with the United States of America. In that country an inventor has two years, after first publication, in which to apply for a patent: this gives him a chance to perfect his invention before patenting it; while in this country he could neither previously make it public or improve it, after applying for his patent. Several Commissions were appointed by Parliament to inquire into, and report on, the United States Patent Laws, and such Commissions pointed out that inventors in that country suffered very greatly, inasmuch as the *first* inventor alone had the *right* to the patent, and this without any regard as to when he invented the matter; so that if an invention proved to be valuable, the Law Courts were occupied for years deciding the claims of the various claimants. Some have run twenty years: notably the "Drive Well" patent; while the Telephone patent has been in the Courts testing its validity ever since it was invented. And as the temptation to copy a known invention, and bring up witnesses to swear to it, is very great, when a large sum of money is at stake, and the difficulties of detecting such frauds, it was agreed that such a principle could not be adopted in this country; therefore, while adhering to the strictly English principle of "first come, first served," it was provided in the Act of 1883 that when a person has conceived the idea or outline simply of an invention, he can apply for a patent, lodging simply a Provisional Specification, to enable the Comptroller to identify the invention with the Complete Specification. He then becomes provisionally protected—that is, as his patent is dated from the day of application, he takes priority over all other subsequent applicants; and Sec. 14 protects him from the consequence of publication or piracy, providing a Complete Specification is lodged within nine months, or ten months for £2 extra. Now, while this Provisional Protection gives the inventor no patent rights whatever—which "Patentee," page 574, contends it does—it protects the inventor in a very material manner: first, it gives him nine months to perfect, test, and mature his invention; secondly, it assures him a patent against all comers; and thirdly, it gives him seven months' Provisional Protection in the United States of America, and almost every other civilised country that has Patent Laws, all for the one fee of £1, payable to the British Patent Office. In all the countries comprised in the International Union, patentees have the same rights they have here, but of course they must apply for patents, if they want them, in those countries within seven months; but when they do so, they can have their patents dated back to the same day as the British one, and thus take priority over any subsequent applicant even in his own country. Foreign inventors have the same privileges or rights here, and not a few have already walked over British inventors; so while £1 will make an invention as safe as it is possible to make it, by following the advice given to first "search" at a cost of 21s. a day, an inventor may be forestalled. If an inventor feels safe about his invention at the end of nine months, he can abandon the first one and lodge another application, with a Provisional Specification, providing he has not made the invention *public*, which is termed:

*Public Use or Knowledge.*—This is quite sufficient to invalidate a patent, no matter how drawn. The principle on which this works, is that if an inventor makes his invention known to the public, there is no need to grant or offer him a patent to induce him to make public his invention—it would be equal to making one a present and then asking for payment. Nor is a man entitled to a patent for what the public already knows of, uses, or can get to know in this country; but such publication must disclose sufficient knowledge how to make or perform the invention to one who understands the subject. If the invention is an article put on the market in the way of trade, it may be assumed that all who get one, can take it to pieces and copy it; but if no one has had such an opportunity, and that it would be impossible to make sueh articles or perform the invention, there is no publication such as is necessary to invalidate a patent: not even if the very identical articles are described in a patent specification; for bear in mind the patent is granted in exchange for the disclosure of a *practical* mode of performing the invention, so that if no practical mode is disclosed of performing or producing the invention, the patent will not only be void, but it will not operate as an anticipation of a subsequent patent that does disclose a practical mode. This question was settled in the House of Lords (see "Betts *v.* Menziers," 10 H. L. C., 117). So what an inventor should do when he finds a prior patent has been taken out for his invention, is to examine if the disclosed mode of performing it is practical; if not, he can claim everything shown in it, as a just reward for his *practical* mode. As a great many patents are only for "paper" inventions—that is, inventions that have never been worked or tested in a practical manner—the chances are great that they are failures, *i.e.*, impracticable. Some people also consider that *ideas* are inventions and patentable. An invention may be, and often is, the result of an "idea," but it must be a realised result, with all the details of carrying it out, so as to serve a useful purpose. If it fails in this, it is no "invention," or patentable, so that an inventor can get his "ideas" from anywhere he likes.

*Utility.*—This also is necessary to support a valid patent—that is, it must serve some useful purpose. It is often set up as a plea against a patent that is being worked, which is absurd, as the mere fact of its being *worked* is proof that it is "useful"; but it is a good defence against an impracticable patent, the owner of which is trying to levy blackmail, under the charge of infringement, on a subsequently successful and useful patent.

*First and True Inventor.* — This is a matter on which a great deal of misconception prevails, especially as it means one thing in this country and another in America. In the United States, it means the first person who actually works or produces the invention. It really means in law, the person who first conceives the idea, but the Courts draw the line as above, as it would be absolutely impossible to test a man's *mere word* in any way, so that the Patent Laws would have been a farce. In this country, it means the first person who imports it from abroad, no matter how he obtained it, or who in this country having *bonâ fide* invented it himself, *first applies for a patent on it.* If he has obtained the invention by fraud, or "picked it up," being the invention of someone else in the United Kingdom, he is not the first and true inventor, nor entitled to a patent. Thus, if he is an honest inventor, or importer, and is the *first* who applies, he takes priority over all others, no matter how long they have been keeping their inventions secret.

I must reserve further remarks for another and concluding paper.

## MEANS, MODES, AND METHODS.

### To Raise Bruises in Wood.

Often in working soft wood, such as pine, etc., anything falling on it, or it getting knocked, produces a nasty bruise, which to plane out would reduce the wood, and, in many cases, would not be practicable. It is not generally known that bruises can be raised up again level with the surface by pouring in the hollow "produced by the bruise" methylated spirit, and setting it on fire, not allowing it to burn itself out, but blowing it out before the spirit is exhausted (or it will burn the wood). It will be found in most cases that the bruise has come up level with the surface; but if badly knocked or bruised, it will require more than one application of spirit, always blowing out the light after the spirit is burnt away. Bruises of nearly every description can be raised in this way. H. H.

### A Safe Way of Hanging Pictures.

Occurrences are frequently being recorded of the falling of framed pictures, and the narrow escapes of bodily injury therefrom. Lately, a picture fell in an undesirable way in a room of the house wherein I live; a small boy fortunately having, the moment previously, passed over the spot whereon it fell.

From this and similar incidents, I have been induced to give my humble attention to some simple means of preventing, as far as is possible, the likelihood of an accident occurring to any precious member of what we are told is the evolutionised ape family.

As the method I have adopted is simple, and requires so little extra labour, no reason remains why it should not be given a trial. It consists of nothing more than the use of *two* cords, or a single cord doubled to answer the purpose of two, instead of the use of but one cord. Fig. 2 gives a back view of a frame supported in such a manner, and Fig. 1 a side view of the same. If the rings are large enough, by all means have two cords; if not, then it will be sufficient to carry one cord through and tie it around each ring and to itself.

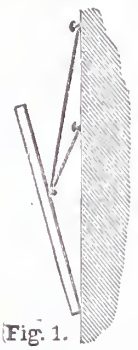


Fig. 1.

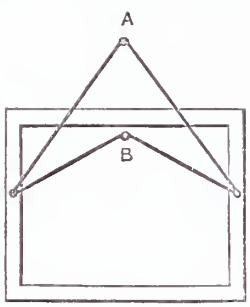



Fig. 2.

**Fig. 1.—Side Elevation of Picture and Cords. Fig. 2.—Back Elevation of ditto.**

Difficulty will be experienced in hanging pictures thus, as I can testify from personal trials. Perhaps the best way will be to use a prop whose length shall be sufficient to allow enough to project beyond the bottom of the picture to handle, while its top end is in contact with the lower loop for the purpose of hitching it on to its destined nail. To ascertain the accurate distance to fix the two nails apart from each other, place the two loops of the frame as in Fig. 2, and measure the length of the space between points A and B.

If pictures are supported in this manner, the top cord will be relieved from bearing so much weight as it would otherwise be compelled to; but should it chance to break, the lower cord will prevent the picture from falling, and *vice versâ*. J. S.

### To Clean Glass.

An excellent way to clean glass, especially adapted for picture glasses, glass cases, windows, etc., is as follows:—Procure a *clean* bottle, and put in one part of strong ammonia, and add about eight parts of *clean* water. Cut a groove down one side of the cork, and, replacing it in the bottle, we have a supply of liquid, which can at any time be sprinkled on the glass we wish to clean. If the glass is very dirty, we shall want two dusters, and sprinkling a little of the liquid on the glass, and wiping it with a duster, the dirt, etc., will be easily removed; after which, a few more drops sprinkled on and a clean duster, the glass will clean and polish up beautifully. H. H.

## MASONS' WORK.

BY MUNIO.

Tools and Appliances used in Masons' Work — Scaffolding — Hoists and Cranes — Centres—Mortar, Cement, and Concrete —Foundations—Setting Out.

**Tools and Appliances used in Masons' Work.**—The tools used in masons' work are the walling hammer (Fig. 10), for hammering and dressing walling stones; the trowel (Fig. 11), for spreading the mortar; the jointer (Fig. 12), for drawing the joints, and for tuck-pointing. A bit-hammer is also used for dressing stones. It is a short hammer, with a mortise hole at one or both ends, into which bits of various shapes can be fixed. A kevel, which is a hammer similar to a walling hammer, but much larger, is used for cutting and breaking up stones. Iron wedges of various sizes are used for cutting stones; they are fixed in grooves, and struck by the kevel. The points of the wedges should not touch the bottom of the groove, or they will fly out when struck; and, to get a clean cut, a crowbar should be laid solidly under the stone.

A plumb-rule is used for plumbing angles; a level for levelling stones; a line for walling; and straight-edges and rules of various sizes are used, but these need no description.

The mallet (Fig. 13) is used for dressing stones; the point (Fig. 14) is used to knock the rough off stones; the chisel (Fig. 15) is used for drafting: they are made from $\frac{1}{4}$ in. to 1 in. broad; the boaster (Fig. 16) is used to level the surface of a stone; a broad tool, similar to a boaster, but $3\frac{1}{2}$ in. or 4 in. wide, is used for tooling. The hammer and punch (Fig. 17) are used for roughing off hard stone; the pitching tool (Fig. 18) is used to knock off the edge of a stone to a line: it is only used on hard stone; the claw tool (Fig. 19) is used on limestone and marble; the lead mallet and lettering tool (Fig. 20) are used for cutting letters: the tool is $\frac{1}{2}$ in. in diameter at its widest part, and the edge is spread out; they are made in various sizes.

The chisels are sharped in a smith's fire, and are tempered to various degrees of hardness. For soft stones they are drawn out thin, and made moderately hard; for hard stone they are not drawn out so much, and tempered harder. After being sharped, the edges are rubbed on a stone till quite straight. The mason ought to learn to sharp his own tools.

The drag (Fig. 21) is used for levelling down the rough in Bath stone; it is a piece of steel plate, with teeth on one side; they are made of various forms, and with teeth of different degrees of fineness. Teeth saws are used on Bath stone and magnesian limestone. Plate saws without teeth are used on Portland stone, marble, and granite: they are fed with coarse sand and water. For sawing large blocks, tooth and plate saws, from 5 ft. to 7 ft. long, are used: they are fixed in frames similar to a joiner's turning saw; the frame is suspended by a rope passing over a pulley, with a balance weight at the opposite end. A handle is fixed at each end of the frame, and the saw is worked by two men. A groove is cut as a guide for commencing saw-cut.

In large works, steam-sawing, dressing, and moulding machines are used. Marble and granite, after being sawn, are polished with large cast-iron plates, fed with sand and water, which are revolved upon them; these plates are called laps.

The stone-pick (Fig. 22) is used for broaching. A hammer, called a diamond hammer, is also used for broaching. It has six or more steel points fixed in mortise holes in the face, and is hammered over the face of the stone.

The granite hammer (Fig. 23) is used for knocking up granite; it is also dressed by the mallet and chisels, and axed by a tool similar to a short thick hammer with a broad point, called an axe.

Squares, bevels, straight and circular rules of various kinds, are used for marking stones, a piece of hard black shale called "black," or thin pieces of hematite iron ore, being used to draw the lines. Measuring laths, gauges, zinc and wood moulds, iron crowbars, and rollers are also used.

The Lewis (Fig. 24) is used for hoisting stones. It is in four pieces, fixed together by a pin and cotter. A dovetailed hole is cut in the stones, in which it is fixed. Clips or grips are also used for hoisting. They consist of two large hooks, with a ring fixed in each. They are connected together by a chain passing through the rings. The hooks are let into holes at each end of the stone, and the tendency of the chain pulls the hooks together, and causes them to grip the stone.

**Scaffolding.**—The scaffolding used for ordinary works is made with poles 20 ft. to 30 ft. long, fixed 10 ft. to 12 ft. apart. Ledgers are fixed horizontally to the poles by scaffold cords; the ledgers are 7 in. by $2\frac{1}{2}$ in. On these are laid the putlogs, which are $5\frac{1}{2}$ in. by 3 in., with one end resting on the wall. On these are laid the scaffold boards, which are deals, 9 in. by 3 in.

**Hoists and Cranes.**—For hoisting stones up to $\frac{1}{2}$ ton in weight, ledgers are fixed about 10 ft. above the scaffold at both sides, and resting across these a strong frame about 9 in. wide is laid. An iron rail or bar is fixed on the top of the frame at each side, and a carriage with four grooved wheels runs on the rails. To this a pair of pulley-blocks is hung, by which the stone is lifted, and is run to its place on the wall by the carriage. The rails are turned up at each end, to prevent the carriage running off.

For heavier stones, shear legs are used. They are made of strong poles, 20 ft. to 30 ft. long. They are lashed together at the top, and the bottom ends spread out 10 ft. or 12 ft. They are kept perpendicular by two long guy ropes fastened to the top, and put round posts let into the ground at the bottom. A pair of pulley-blocks with a fall rope or chain is slung from the top, and the weight is raised by a crab-winch (Fig. 25). In order to take the strain of the guy ropes, the rope is brought round a block fixed at the foot of one of the legs, called a "snatch-block" (Fig. 26).

When a building is of great length, a hoist similar to Fig. 27 is used. This is made of squared timber fixed on a strong frame, in which two grooved wheels are fixed. These run on a single iron rail, laid the full length of the building. A cross-head, with a pulley at each end, is fixed on the top, over which the fall rope passes. A crab is fixed on the frame for hoisting, and the hoist is kept perpendicular by two guy ropes. Sometimes a small steam hoist is fixed on the frame instead of the crab.

Derrick cranes (Fig 28) are also used for hoisting. They are fixed inside the building, and the jib is arranged to sweep round the walls. When the building is too large for one jib to reach round, two or more are used. They are fixed on the various floors as the building is carried up.

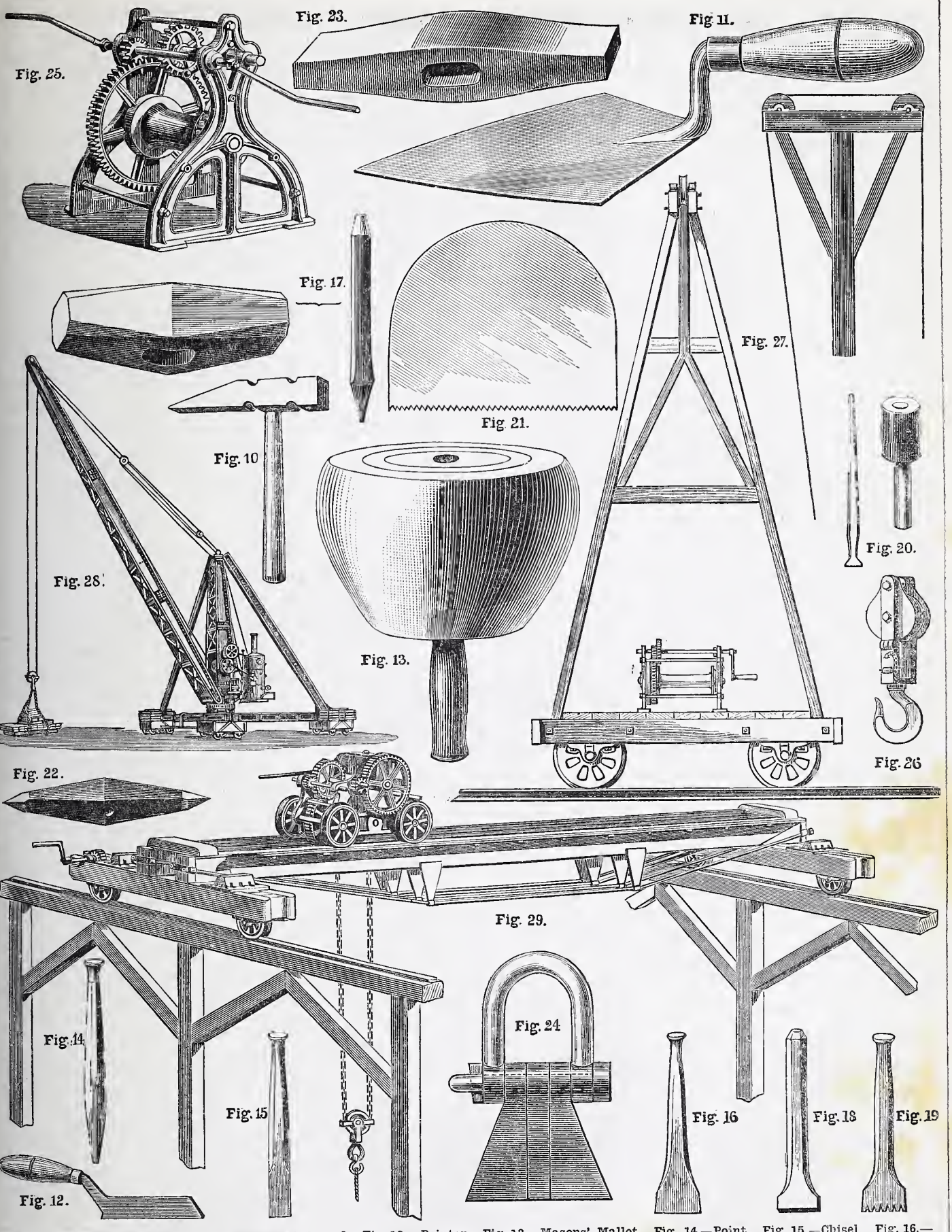



Fig. 10.—Walling Hammer. Fig. 11.—Masons' Trowel. Fig. 12.—Pointer. Fig. 13.—Masons' Mallet. Fig. 14.—Point. Fig. 15.—Chisel. Fig. 16.—Boaster. Fig. 17.—Hammer and Punch. Fig. 18.—Pitching Tool. Fig. 19.—Claw Tool. Fig. 20.—Lead Mallet and Lettering Tool. Fig. 21.—Masons' Drag. Fig. 22.—Stone-Pick. Fig. 23.—Granite Hammer. Fig. 24.—Lewis. Fig. 25.—Double Purchase Crab-Winch. Fig. 26.—Snatch-Block. Fig. 27.—Hoist. Fig. 28.—Derrick Crane. Fig. 29.—Overhead Travelling Crane.

When a building is very large, and the stones are of great weight, the overhead travelling crane (Fig. 29) is used. It is mounted on iron rails laid on strong timber framing, formed of baulks 12 in. square, and strongly braced and stayed. The crane is moved lengthways by gear wheels, and the crab on the top is either moved by gear wheels or pushed by the men walking on the platform. The framing is generally fixed half the height of the building at first; and when the building is brought up to that level, it is raised.

**Centres.**—Centres are also used by masons for turning arches. Those for bridges, or arches of large span, must be very strongly made, and fixed on firm supports. In all cases, wedges, or some means of slacking the centres as soon as the arch is keyed, should be provided; and in removing large centres, the ribs should be well stayed, as many serious accidents have occurred when the centres were suddenly released.

**Mortar, Cement, and Concrete.**—The mortar, cement, and concrete used in masons' work is similar to that used by bricklayers, and is fully described on page 183, Vol. II.

**Foundations.**—The foundations for walls should be neatly squared out, and the bottom made level. When the ground has an inclination or slope, the foundations should be "stepped," and the bottom of the trenches kept level. A drain should be laid from the lowest point of the foundation, to carry off the water. When soft or wet places occur in the foundation, the trench should be carried down to firm earth, and filled with concrete, and a drain laid to carry off the water. In large buildings a bed of concrete is often laid over the whole of the foundations, on which the footings are laid. The turf and vegetable soil should be taken off the whole of the interior of the site; and where wood floors are laid, a layer of concrete or asphalte should be laid over the surface, to prevent damp arising.

Excavations for cellars, basements, etc., should be accurately marked out, and squared down to the bottom, and a drain laid from the lowest point, to clear them of water. After the walls are built above the surface of the ground, the trenches should be filled in, and well rammed down.

**Setting Out.**—In setting out a building, centre lines should be stretched both ways. These should be accurately squared, and fixed in saw notches cut in the tops of pegs driven well down; all walls can then be gauged from these. Interior walls should all be gauged from the centre lines, and not from each other, so that any error may be more easily detected.

A fixed level should also be set up. This may be the floor or base line, and all levels may be taken from it.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 26.—"ARDENBRITE" LIQUID GOLD.

If any reader is inclined to ask what "Ardenbrite" is, I can tell him that it is a duly registered trade mark, and a distinguishing name applied to some excellent so-called liquid gold, metallic enamels, and metallic paints used for decorative purposes, and manufactured by Messrs. T. Pavitt and Sons, 70, Southampton Row, London, W.C. If I am further asked the derivation and meaning of the term, I can only reply that I believe it to be an imposing, but at the same time playful, way of disguising the Queen's English by making "hard and bright" appear as one word "Ardenbrite," inasmuch as the words which may be assumed to be its original source fairly describe the durable and brilliant qualities of the materials to which it is applied. To take the three principal forms of Ardenbrite in order, the "Ardenbrite" Liquid Gold, which, if I remember rightly, is the oldest of the three, does not tarnish, and washes well; its makers claiming for it that it lasts three times as long as real gold leaf. Be this as it may, its effect is brilliant, and the surface, when hard and dry, presents a highly finished appearance. It is very generally used by the trade for decorative purposes in theatres, tea-rooms, and public places of resort, and by the principal railway companies in the United Kingdom, and the most important lines of ocean steamers. To those who do any painting and decorative work at home it will prove invaluable. It can be applied with excellent effect to any material whatever, even to leather, for it is much used for decorating and renovating ladies' slippers in its various colours—gold, silver, red, and green. It may be obtained of all artists' colourmen, chemists, oilmen, etc., in jars at 6d., 1s., 1s. 6d., and 2s. 6d. It is used without any preparation beyond stirring it well up, and it can be applied with an ordinary paint-brush. For trade prices, application should be made to Messrs. Pavitt & Sons. The liquid enamels manufactured by Messrs. Pavitt & Sons are another form of Ardenbrite. These are sent out in gold, silver, copper, green, steel, and red; and by their aid the surface of any material can be quickly covered with a brilliant coating of metallic enamel which dries within half an hour; and which, when perfectly dry, is permanent and washable, and requires no varnishing. It can be applied over paint or varnish without removing the old coating. Last in order come the Ardenbrite Enamel Paints, which are supplied in white, vermilion, blue, sage-green, primrose, and black. These are said to produce by the application of two coats a surface like china, which dries perfectly hard in six hours. I think I may fairly say that those who use Ardenbrite in any or all of its three forms will not fail to be satisfied with it.

### 27.—WOOLHOUSE'S "MEASURES, WEIGHTS, AND MONEYS OF ALL NATIONS."

This is the seventh edition of a book that I have used for purposes of reference for many years, and I am glad to meet with it again in its revised and amended form. It was written originally by Mr. W. S. B. Woolhouse, F.R.A.S., F.S.S., etc., and is published by Messrs. Crosby Lockwood & Co., Stationers' Hall Court, Ludgate Hill, E.C. It supplies the means of readily converting the standard, linear, and square measures of one country into another, as well as the measures, weights, and moneys of all nationalities, and "the comprehensive principles which influence the fluctuations of exchange are also briefly stated, and correct rules given for computing the sterling value of coins and bullion. Not the least valuable portion of its pages are those devoted to an exposition of the measures of time, pertaining to the Gregorian, Hebrew, and Mahometan calendars, with a table of the principal epochs. To almanack makers this portion will prove especially useful. Besides a large variety of miscellaneous and interesting information on other matters, the Appendix gives particulars of the new Weights and Measures Act, 1889; a reliable account of the weights and measures of Japan and China; and full and authentic information on the subjects of Wire and Plate Gauges, and, more especially, in relation to the new Imperial Standard Wire Gauge, which was legalised by an Order in Council in 1883. The volume, which forms one of Weale's Rudimentary Series, has been much improved by being issued in a neat cloth binding—a considerable improvement on the old style, in which the edges of the boards of the cover were flush with the edges of the paper.

### 28.—SCREWS AND SCREW-MAKING.

Nothing seems to come amiss to the Britannia Company, Colchester, which, not content with a good reputation for making engineers' tools and appliances, and lathes and machinery of every description, seeks to do a large second-hand trade in goods of the same class, and, lastly, to pose as the publishers of some strictly technical works. The latest of those is a book entitled "Screws and Screw-Making," with a chapter on the milling machine. It claims to be "a complete treatise on screw-making in all its branches, embracing most recent methods, and containing the reports which originated modern standard screw-threads." The nature of the work will be best understood from a brief summary of its contents. After a preliminary chapter showing the different kinds of screw-threads now in use, the writer proceeds to describe the Whitworth, American and Swiss systems of screws, and the British Association screws. This is followed by instructions and remarks on chasing screws by hand, screw-plates, dies, and taps, and cutting screws on the lathe. Then comes the consideration of arithmetical rules for calculating wheels, a table of change-wheels for screw-cutting, and an explanation of the difference between, and mode of cutting screw or spiral wheels and worm wheels. The volume is brought to a close with remarks on screw-making, various tables of screws, and an account of the milling machine and some of its best types, as stated above. The work has a good though not very copious index, and is rendered all the more valuable by having bound up with it about 104 pages, which contain notices and engravings of the leading specialities of the Company, and form as good a price list of the Company's tools, machines, and appliances as any man need have. I must not omit to say that the price of the book is 3s. The writer has done his best to collect and epitomise all necessary information on the subject; and those who desire to make it their study, either for acquiring a knowledge of it for trade purposes or for competitive examinations, will not fail to find the volume, as far as I can judge from a cursory examination of it, both useful and reliable.

### 29.—PATENT SIMPLEX FIRE ESCAPE.

The fire escape that bears this name has been patented by Mr. William Petty, 4, Straithmartine Terrace, Drayton Road, Leytonstone, Essex, who makes the apparatus, and will supply it and fit it up in the houses of those who may wish to avail themselves of the means of escape it affords in cases of fire, when it is impossible to quit the house in the ordinary way, and egress must be sought through an upper window. The escape itself consists of a long canvas shoot or bag, open at the upper end, and having another opening near the bottom. The lower end is closed by an ornamental metal disc and locking gear, the purpose of which will appear presently. This bag, when compressed into its smallest compass, is contained in a metal case, which is placed in the ceiling of the room in which it is to be used, between two joists that are immediately over the window. Thus it lies completely out of sight, the only visible sign of its presence being the metal disc with which the opening in the ceiling is closed. The upper end is attached to a stout and strong piece of rope, whose other end is securely fastened to the joist. Should there be occasion to make use of it, the only thing to be done is to throw up the lower sash of the window and pull the cord attached to the disc in the ceiling. This brings out the bag, which must be thrown through the window, and is caught and held steady by someone standing below. The mode of descent is to enter the bag at the top and slip down it to the opening at the bottom, whence an easy exit is obtained. The bag itself is made of fireproof canvas, so that it cannot be injured by flames issuing from the house below the window from which it has been thrown. For nervous or frightened women or children it seems to afford a safe means of escape.

THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letter from a Correspondent.

**Rate of Circular Saws.**—A Woodworker writes:—"If a man lays out £10 or £12 in a machine, he expects that machine to turn out an extra amount of work to repay him. Therefore, when a man buys a hand-power circular-saw bench, he expects more work done with it than with a hand rip saw; and as I think the speed of a circular saw and feed of timber may be reduced in proportion to the power, and be an advantage, we will try, as briefly as possible, to see what advantage there is in a circular saw being driven by hand over a hand rip saw. The standard speed of a circular saw driven by steam and other power is about 3,000 revolutions per 12 in. saw per minute; and the rate of feed in cutting timber one-third its diameter, about 15 ft. per minute; and the power required, near 1½ H.P. Now a man, being calculated to be about ¼ of a H.P., turns a wheel 4 ft. or 5 ft. in diameter at the rate of 30 revolutions per minute, which is a good speed for a man to turn. From this wheel a 12 in. circular saw is driven, the speed multiplied 10 to 1; that is to say, the saw makes 10 revolutions to 1 of the wheel: then 10 times 30 is 300, the number of revolutions the saw makes in a minute, which would be ⅓th the speed of the saw driven by steam power. Now then, if the feed of timber to the saw driven at 3,000 revolutions is 15 ft. per minute, the feed of the timber should not be more than ⅒th of that with a saw running 300 revolutions per minute, which would be at the rate of 18 in. per minute. Again, in calculating 8 men to 1 H.P., and 1½ H.P. being required to drive a 12 in. circular saw at the above speed and feed, a man would be but ⅛th of that power; therefore the feed needs to be reduced at least to ⅓th of 15 ft., which would be 15 in. per minute. Again, when a saw is driven by steam, by keeping the steam up to a certain pressure the same power may be maintained for any length of time. But it is not so with a man; after turning the wheel a short time his strength diminishes, and the power exhausted is not more than ⅛th, and perhaps much less when the rate of feed has to be reduced in proportion, the feed being 12 in., and perhaps much less, per minute. Now then, we take a good hand rip saw, properly sharpened, and in a 3 in. deal it should advance at least ½ in. each stroke, making 40 strokes per minute, which is not very fast; it rips 10 in. per minute. But how much easier does the man with the hand saw rip the 10 in. than the man who turns the wheel drive through the 12 in. or 15 in.? The man at the wheel will not turn many minutes before he wants to rest and dry the sweat from his brow, and while he is resting the man with the hand-saw is still at work, at the same time having a civil chat with a friend or shop-mate. Now, taking all things into consideration, I contend that if the hand rip saw is properly worked it has an advantage over the circular saw driven by hand. I should like any reader of Work who is an employer and has a hand circular-saw bench, when he has a deal of ripping to do, say in 3 in. stuff, to get both circular and hand rip saws in good condition, and set two men at work, one at the wheel and the other at the hand saw, and see at the end of three hours which saw has the advantage—neither man to be relieved during the three hours—and report in the 'Shop' corner of Work. It must be remembered, too, that to work the circular saws satisfactorily two men are required."

### II.—Questions Answered by Editor and Staff.

**Lettering on Carts and Waggons.**—C. W. (*Worcester*).—Writing names on carts and waggons is a very simple affair, as plain block letters are generally used for all country rolling stock. I have painted some dozens of railway waggons and carts in times gone by, and I always used ordinary paint, thinned out from time to time with a little turps, as for common work of this kind, and a lot of it to do, speed is everything, and the more simple the diluents the less likely one is apt to go wrong. I think this is where you are in difficulties, as I frequently suffered from the same cause myself. In putting the last coat of paint on the cart or waggon, it is made to contain as much boiled oil as possible, so that it may dry with a good gloss, and also keeps out the weather better. Now, this surface is fatal to good lettering, as the letters will keep "cissing"—*i.e.*, running into ragged edges. This may sometimes be prevented by using nearly all turps in the colour you are writing with, by rubbing the surface with a little turps or by wetting with a leather. If this will not rectify, then repaint the part where letters are to go, write them, and when dry, varnish. If your paint runs down your brush, you either use it too thin or you are using long lining pencils instead of writing pencils, or you get your pencils too full. Do not dip your pencils into a pot of paint—rub some out on a piece of glass, and take the colour off of there.—H. L. B.

**Staining Walking Sticks.**—H. S. (*Graffham*). You do not say what colour you wish to stain your sticks of holly, hazel, and ash, or whether you have stripped off the bark or retain it. I can only presume that you have stripped off the bark, and wish them stained the usual brown or black, then French polished or varnished. A useful brown stain can be made by dissolving 2 oz. of asphaltum in nearly ½ pint of turpentine: give one or more coats with a piece of soft rag, or sponge, till you get the required shade. If this cannot be readily procured, thin some Brunswick black with turps. When dry, French polish, or give several coats of spirit varnish; but I fancy in your case you would find it better to give them a coat or two of patent knotting. For the black sticks, procure some black aniline dye, sold in penny packets, or use black ink; rub well till you have a black ground, then give one or more coats of black enamel. How to make a stick out of a cabbage-stump is, I think, beyond us. If you have a particularly fine one you wish to preserve for ornamental purposes, you might clean and well dry it, then give a coat of some clear varnish, such as copal.—Lifeboat.

**Pantograph.**—T W. (*Sleekburn*).—Apply to any toy dealer or fine art dealer for a Pantograph.

**Cement for Aquarium.**—J. J. B. (*Twickenham*). —See pages 351 and 750, Vol. II.; also Indexes to Vols. I. & II.

**Parlour Clock.**—R. H. (*Accrington*).—The only thing I can suggest is to drill a hole in the case opposite the hour you wish it to ring, stop the hole with a cork, and let the end of a wire from one end of your battery go through the cork sufficiently long enough to catch in the hour hand. You must bend it down so that it does not touch the minute hand; let it lie on the face of the clock, rising from it a little, so that the hour hand must drag over it. Let the other wire from battery go to bell, and wire from bell to one of the legs of clock case; by bending the end of the wire over which the hour hand passes in the direction the hand goes, you can have the bell ring for an hour or more if your battery lasts out. You can buy a bell and battery for a few shillings from any electrician, or you can buy the material and make up your own bell, etc. You will find other methods in back numbers. To stop it ringing, simply disconnect a wire from the bell or battery, and put it on again when you go to bed.—A. B. C.

**Grandfather's Clock.**—Bowton Lad.—If it is only the pivot broken off, you might turn another one on the end and put in a long bush; if it is broken in the middle, the only thing is to put a new piece. The pallets in the old English clocks are often brazed on, and sometimes riveted to a brass collet, which is soft-soldered on the shaft. French clock pallets are generally fitted on a square, and so can easily be shifted, as you say, by gently tapping with a light hammer. The cost of a new pallet shaft will depend entirely where you take it, and may vary from 2s. to 5s.—A. B. C.

**Verge Watch.**—Verge.—I can confidently recommend Messrs. Haswell & Sons, 49 & 50, Spencer Street, Clerkenwell, and Grimshaw & Co., 35, Goswell Road, Clerkenwell, for repairs and conversions. But good verge workers are very scarce, and I doubt where you could get it done as it used to be fifty years ago. Messrs. Haswell converted an old verge for me a few weeks ago, and made a splendid job of it; and although I always do my own verge repairs, I have no doubt they would do it to your satisfaction.—A. B. C.

**Clock Conversion.**—Old Clock.—To make a chime quarter clock from an eight-day English and two twenty-four hour clocks is, in my opinion, an impossible job, as the plates are not large enough for the extra train of wheels; and it is a thousand to one that the wheels and pinions would not be the proper number and size. Then it would require all new dial-work, and unless you have had some previous experience you would find it very complicated. The only thing I can advise is to fix up one of the twenty-four hour movements as a quarter arrangement, as set out in an article in Work some few weeks back. The only drawback is, you would have to wind it every six or seven hours.—A. B. C.

**Lantern.**—E. O. S. (*Rye*).—E. O. S. writes:—"Which is most in fault when a picture shown from a magic lantern is capable of focussing either sharp in the middle or sides, but not the two together, the objective or condenser? Mine is a £6 6s. lantern and lamp."—With a lantern of the price named, and by the maker he has mentioned, E. O. S. ought not to find any very great difficulty under proper conditions. At the same time, the maker does not guarantee the instrument to be in focus in the centre and margin at the same time if a short-focus front-lens is used, for the simple reason that it is impossible. Still, there ought to be a fairly sharp picture. Is it possible that in taking out the lenses to clean them they have been replaced wrongly? If so, then that may account for some confusion of rays. Or has E. O. S. properly adjusted the lamp? There is an exact position, which must be found by trials, where the best definition can be procured. If after every precaution I found the definition hopelessly bad, I should return the instrument to the maker, who, I have no doubt, would properly adjust it.—O. B.

**Bootmaking.**—E. J. S. (*Maidstone*).—This is a subject which will be thoroughly dealt with in the next volume of Work.

**Wood-Carving Patterns.**—W. H. R. (*London, E.*).—The figures in the Index refer to the pages of each issue of Work, and not to the numbers themselves.

**Theatrical Posters.**—A. L. S. (*Glasgow*).—An article is in hand.—H. L. B.

**Graining Cheap Furniture.**—J. M. (*High Harrogate*).—You evidently wish to know how the cheaper kinds of furniture are painted and grained; but, of course, there are many ways in which this is done, in order to bring the goods within the means of people who have but little cash to spare. In the first place, furniture can be painted and grained by the same methods as are used for all other kinds of woodwork; but it is very seldom any high-class work of this kind is put upon furniture, as it is only the cheapest goods which are so treated, as you yourself must know. If you wish to grain in the ordinary way, then the following books will be useful to you: (1) "House Painting, Graining, and Marbling," by E. A. Davidson, 5s. (Crosby Lockwood & Co., London); (2) "The Art of Graining and Imitating Woods," £1 11s. 6d., shortly to be raised to 2 guineas (G. Sutherland, 15, St. Ann Street, Manchester). The latter will be the most complete work ever issued on this subject. I will now describe how the very cheapest kinds of furniture are "got up" in this way, and as it is only known to a few, the process—although I cannot commend it—may prove of general interest, as by the substitution of patent size for oil paint in the first coats, the element of cheapness, as well as a rapid method of manipulating the various processes, is thereby attained. The method consists of mixing up "patent" or glue size with the best gilders' whiting, the size being used moderately strong; this is stained to required shade for the ground colour, such as with venetian red for mahogany, with yellow ochre if for oak, etc., etc. The furniture is coated with this mixture whilst hot, and *is well worked into the wood*. If one coat is not enough, give two. Finish off with a coat of clear size. The graining can now be done upon this in oil colours, rose pink and a little black being mixed with it for mahogany or rosewood; umber and ochre for oak, etc. When it is wished to imitate maple wood, it is best to give the goods one coat of oil paint over the sized surface got up with the priming *white*. It may be thought that this work is not lasting, but it is said to withstand hard wear for years; personally, however, I cannot say, but bedroom furniture, not having much rough usage, is said to last any amount of time. Patent knotting on a sized surface, or the knotting first and size afterwards, in conjunction with enamel colours, is much used in large furniture factories; also the size and whiting process, with one coat of paint on the top for painted furniture. Deal furniture, finished in patent knotting, if carefully done, has a good appearance, and may be either varnished or French-polished afterwards, but for this style the furniture requires to be well made.—H. L. B.

**Wire Blind Writing.**—A. V. W. (*Cheltenham*). —Mark the letters out on the blind in pencil, and then go over them with parchment size; they may then be painted or gilded in the ordinary way. Gold paper letters may be fixed to blinds in the following manner. The gold paper—the best—is coated at the back with strong gum, like postage stamps, but with a much stronger solution. When dry, the letters are drawn, or traced, at the back, and cut out with sharp scissors. They are then wetted at the back and stuck upon the wire gauze, or zinc, the words being previously set out on the blind in the usual manner. The gilt paper may then be varnished over with copal, or any clear, hard-drying varnish, which will enable them to be washed at any time. In varnishing the letters it is necessary to carry the varnish a little over the ledge of the letters, thus preventing the damp from getting at the back of them. (From the "Art and Craft of Sign-Writing.") Wire blinds may be cleaned as follows: Take some methylated spirits in an egg cup, put in a piece of cotton wool, let it soak in the spirit, and set it alight. Then hold the parts of the wire blind over the flame. The old paint may then be brushed off. If the bores of the blind are choked up, remove by inserting a hot needle. When quite clean, varnish with white, hard varnish, and the wood frame with brown, hard varnish. To remove old letters from blinds without injuring the gauze, place that part of the blind which the letters are on upon a piece of wood, so that the gauze lies quite close to the wood. Then apply a solution of *pure* caustic soda with a common fibre brush. A very short time will suffice to destroy the paint and turn it into mud, which must then be washed away with plenty of clean water. The wood beneath the blind confines the solution to that part of the blind only where it is needed, and keeps it from running away.—H. L. B.

**Blow-Lamp.**—Vulcan No. 1.—In reply to your inquiries for a blow-lamp, or self-acting blow-pipe, that will braze ½ in. solid iron, and ¾ in. iron tube, and that will also braze a gold or silver ring, there are several that will do the latter. The one sold by Melhuish, illustrated on the cover of the Exhibition No. of Work, seems well suited for this class of work, but I have not had the opportunity of testing its powers. With regard to the brazing of iron, the

lamp most likely to do that is the Paquelin, fully described in WORK, No. 32, Vol. I., p. 505, and since then mentioned several times in "Shop." I must say that it is a severe test, and I am not at all certain that it would do it. It might under favourable circumstances—that is, that the parts to be brazed be supported on willow charcoal blocks, the work must be somewhere out of colds and draughts, and a deflector held over the top: it might then possibly do it. ⅜ in. iron I know it will do; the ¾ in. pipe would be harder still to do, if you mean gas pipe, and I am very doubtful about it. However, there is no more powerful lamp in the market at present, so it is Hobson's choice—that or none. I may say that the agents advertise it as giving 1,000 degrees of heat (see back page of No. 105, where price and other particulars are given).—R. A.

**Blow-Lamp.**—E. D. (*London, S.E.*).—See reply to VULCAN No. 1 above.—R. A.

**Bottle Lettering.** — FAIT ACCOMPLI. — The names on bottles, lamp glasses, etc., to which you refer, are cast on by the manufacturers at the time the articles are made. An amateur could not do it. —W. E. D.

**Saw Grinding.**—T. J. (*Handsworth*).—If T. J. would write to a good Sheffield saw-maker stating size, thickness, and number of saws he wants made, he would get them cheaper than he could make them. For the size T. J. states the price would be about 3s. or 3s. 6d. each, and as he requires a good number, no doubt he would get them for much less. Of course T. J. will know whether he can make them for less than the above price. There are various methods adopted for grinding saws. One is to place the saw between two revolving grindstones and grind until the hammer marks almost disappear. After which the saw is placed between face-plates, and while revolving is fed with emery. I believe there are improved grinding machines by Messrs. Eadon, Sheffield. By these machines saws are ground to a degree of uniformity which is impossible by other methods. In fact, concave, bevelled, convex, and saws of any pattern can be ground with the above machines to any thickness. —A. R.

**Leather in Binding.**—F. R. H. (*London, N.W.*). —You want me to tell you how to distinguish the difference between Levant morocco, Morocco morocco, and second morocco. Well, I can tell morocco when I see it, but really I cannot give you any information which will enable you to do so. The tooling has nothing to do with it.—G. C.

**Phonograph.**—J. S. (*Newcastle-on-Tyne*).—These instruments are not for sale, but are let out on hire. If you write to the Edison Phonograph Company, 60, Ludgate Hill, London, E.C., you may get some information.—W. D.

**Wax Cylinders.**—X. Y. Z. (*Bradford*).—They are cast in a special mould, which must be of a diameter sufficient to ensure them being slipped on and off the rotating cylinder.—W. D.

**Violin Bridges.**—J. M. (*Newcastle*) and other correspondents wish to purchase COMME IL FAUT'S violin bridge, described in WORK, Vol. II., page 810. COMME IL FAUT should advertise his address, etc., in WORK.

**Bookcase.**—T. M. (*Gateshead-on-Tyne*).—I can only ask you to search diligently the Indexes to Vols. I. and II., for designs of bookcases, in both the body of WORK and "Shop." You can easily adapt fretwork panels if you find a design the general appearance of which you feel satisfied with. See the three prize bookcases in Vol. I.—J. S.

**German Clock.**—J. S. (*No Address*) —See that the hook drops fair in the middle of the notches on the count wheel, and try each one. You may find perhaps that it catches just on the corner dropping in, and so goes on striking, or perhaps the wire that drops down and catches the pin does not drop far enough to catch it safe, or it may perhaps start off striking at the warn. See that when the stopping-pin is freed at the warning that the other wire is up high enough to catch the pin and hold it till they drop at the twelve.—A. B. C.

**Moulding Figures in Plumbago.**—NAP.—I can bring no experience to bear on this question, and doubt whether any other figure moulder could; but, had I the job to do, I should try mixing the plumbago (which would, of course, be in fine powder) with a like quantity of plaster of Paris. But before using the bulk, I should feel my way by experimenting on small quantities; for as a large proportion of plaster would interfere with the appearance of the plumbago, it would be well to use no more than would suffice to make the mixture set firmly.—M. M.

**Circular Saws.**—P. F. (*India*).—If P. F. does not know the whole art of saw hammering, my advice to him is not to attempt to temper his saw or saws. The following information I recently received from a well-known Sheffield saw maker, which will not only answer the question asked by P. F., but will give him and many other readers of WORK such information as will, no doubt, be very acceptable. To make a circular saw that will give satisfaction requires an amount of skill and much labour. The sheet of steel, after being rolled in the rolling mill, is placed between the jaws of a powerful shears and pared to its shape; then the holes are either bored or punched instantaneously with a steam hammer. Then it is put into a toothing machine and the teeth punched; after put into a fiery furnace, and when red-hot, is plunged into a large bath of whale oil—this is termed hardening, in which great care is to be taken. Then it is put into a furnace heated with hot air, and when properly heated, put into the whale oil; then taken out, and if too hard to file, put back into the furnace again and brought to its proper temper. The saw is now ready for the smith, whose duty it is to get the saw level or true by means of hammering. This hammering is done by the most skilled workmen—the art of hammering requiring considerable judgment. After the hammering, the saw is put into the grinding machine and ground to its desired thickness. The saw is further improved by being glazed with a special machine. Another method of tempering saws is to get the saw hot, plunge it into a mixture of oil with suet and wax, then take it out and heat it over a fire till the grease inflames. This process is termed blazing. The saw is then flattened while warm, and subsequently ground. A circular saw when at its proper temper should be a pale blue colour, which colour is removed in the grinding.—A. R.

**Bird Stuffing and Mounting.** — POLYITE JOINER.—There is a book edited by L. Upcott Gill treating fully with the art of Taxidermy. It is published by the *Bazaar Exchange and Mart*, Strand, price 7s. 6d. Ward & Co. also publish a book on bird preserving, price 1s.; this treats of skinning the birds, and is a very good book for a young beginner. With this book, and a few hours spent in the Natural History Museum, anyone could make a very good start. Waterton, in his "Wanderings in South America," published by Macmillan & Co., price 6d, gives full instructions for skinning and preserving birds for cabinets. Artificial eyes can be procured at Gardner's, 29, Oxford Street, London. As a preserving solution, corrosive sublimate can be made with eighteen grains of perchloride of mercury to ten ounces of water.—F. H.

**Castings.** — A CONSTANT READER. — Castings cannot be got up "nice and smooth" by the use of chemicals—that is, not to obviate the necessity for turning and filing. They can only be cleaned from adherent sand and scale. In the case of brass, this is done by immersion in dilute nitric acid—say, one of acid to eight or ten of water. An hour's immersion will suffice, after which they will be removed, washed in water, and dried in sawdust.—J.

**Tool Fitting.**—ARSENAL.—You can apply at the War Office, Pall Mall. But why not call at the Arsenal, and ask for foremen of departments? Little notice is taken of letters.—J.

**Tempering, etc.**—A. R. (*Blairgowrie*).—(1) Malleable cast iron *can* be welded by the same methods as wrought iron, but the joint is never safe, nor strong. As far as practical science is concerned, therefore, it is unweldable. (2) Welding cast steel is one of those jobs that every smith cannot tackle. The art consists in getting the precise temperature, which varies with steel of different qualities. *It should always be the lowest temperature at which it is possible to make the weld.* You must clean the surfaces as with wrought iron, but sand alone will not do for the flux, as is the case with iron. You must either use sand and burnt borax, or ground glass. (3) Temper drills, to bore hard substances, by plunging them into a block of *lead*, instead of into water or oil. Use paraffin to lubricate the drill.—J.

**Incubator Regulator.**—B. N. (*North Seaton*).—Look at the illustration carefully, and you will see that the well is open to the atmosphere. A little heat, of course, passes off, but no air, because it is sealed by the water which it moves up and down. The arm working on a hinge has nothing to do with the interior, and is fixed on the wooden top of the incubator.—C. M. W.

**Couches.**—LEMUR. — Couches like your sketch are generally made of walnut or oak, the framing part of beech, ash, or birch. Nearly all the wood that is seen is worked by the wood-turner and carver. Sizes of ordinary couch are about as follows, it being understood that there is no hard and fast rule as regards size. Length of couch on frame (not allowing for scroll projecting), 5 ft. by 2 in.; width, 2 ft.; height from floor to top of seat-frame, 11½ in. or 12 in.; height to the top of scroll from floor, 2 ft. 3 in.; height of back from floor, 23 in.; back about 9 in. shorter than seat. It should be framed up of 3 in. by 2 in. stuff, the rails tenoned into the legs; the round or elliptic end is sawn out in two pieces and dowelled together; the rails should be tenoned in the whole breadth at this end, and the legs allowed to stand up 1 in. for strength, the round end to be dowelled to the legs. The rails should all be kept back from the front of the legs ⅜ of an inch, to admit of the facing being put on, so that when it is on all will be about flush or level. On the front the scrolls are dowelled into the rails, and flush with them. These are made of 1½ in. stuff, same shape as the finished scroll. The carved scroll is then glued on in such a position that it forms a rebate on the inside edge, to allow for the stuffing, and a little over the other edge for the same purpose. The legs are turned out of 4½ in. stuff, and the squares cut down all round to make the turning project boldly. Two ¾ in. iron rods are put across the frame to give strength and hold against the pull of the webbing which goes across the frame for the stuffing; these are fixed in the following way: Holes are bored to receive the rods in the inside of the rails about ¾ in. deep; the length of rod is calculated for, and the rods are put in at the same time as the frame is glued up. The carved and turned pillar at the end of the back is out of about 3 in. stuff, and tenoned into the seat rail, and the rails which carry the spindles are the same width as pillar, and about 1 in. thick moulded on the edges to match the bottom moulding. A piece of 1 in. beech is glued on to the top side of the top spindle rail about ⅜ narrower on each side—this will form a rebate for the stuffing. These are dowelled into the pillar and into the scroll at the other end. The spindles go in with a pin at each end; the middle panel is dowelled in; all sharp edges should be taken off with a rasp to prevent cutting the stuffing materials. In cramping on the round end, it will be found of great service to cut a notch in the rails and in the shaped piece in order to get the cramp on to pull by. These pieces should be glued in again, and a bit of canvas glued over them.—H. H.

**Inlay Wood.**—OLD READER.—There are many kinds of wood used for inlaid centres of various articles of furniture. Amboyna is a yellowish wood of variegated shades, much used for inlaying. Satin wood also comes under the same head.—J. S.

**Binding.**—TYRO.—It is quite necessary to take out the old sewing in books to be rebound, and if you follow the instructions given in the articles you will be right. If you proceed in a proper manner, cutting the threads in the centre of each section, you will not damage your book. But if you rug and drive without cutting the threads, you will undoubtedly have torn leaves.—G. C.

**Castings.**—R. C. M. (*Bristol*).—Watch "Shop" for the answer to the above.

**Dulcimer Making.**—R. C. (*Tipton*).—You will find the article on "Dulcimer Making," in No. 31 of WORK, contains instructions for commencing to build that instrument.

**Removing French Polish.**—G. S. L. (*Hampstead*).—For flat surfaces, nothing better can be used than the steel scrapers as used by cabinet makers; for turned work use methylated spirits, though it can be nearly all got off by the application of strong hot soda water, to which has been added some oxalic acid; or, if a large quantity is required, use the following: ½ lb. American potash, ½ lb. soft soap, ½ lb. rock ammonia, 1 lb. washing soda, threepenny-worth of nitric acid, 1 gallon of water. Apply with a fibre or scrubbing brush, taking care of the hands. Swill off with plenty of clean water. When dry, oil and fill in; then repolish with clear polish to show up the natural grain.—LIFEBOAT.

**Fretwork Patterns.**—E. J. C. (*Kennington Park, S.E.*).—I advise you to search through Indexes to Vols. I. and II., not only to alight upon the information you are at present in search of, but also to gather several useful paragraphs relative to fretwork. Search the "Shop" columns more particularly for handy wrinkles.—J. S.

**Battery Plates.**—R. E. A. (*Portsea*). —The battery plates may be of any thickness from ¼ in. upward. The carbon plates may be ⅜ in. or ½ in. in thickness without any disadvantage other than taking up more solution space for the thicker plates. Very thin zinc plates are soon cut through by the acid, and very thin carbon plates are liable to breakage. Rolled zinc plates are preferable to those of cast zinc. The thickness of the plates did not interfere with the light from the lamp. The lamp did not light because either it alone, or its resistance, together with that of the connections, was too high for the current generated in the battery. The lamp must have a resistance not exceeding 8 ohms.—G. E. B.

**Repairing Incandescent Lamp.**—W. E. B. (*Birmingham*). —If the platinum loops are not broken off into the glass, you may make connection with them by soldering a scrap of No. 20 copper wire to each. You may even get at enough of the platinum wire to make a joint with the copper by carefully filing away a little of the glass around the end of the wire. Smoothly flatten one end of the copper wire to thin foil, and make of this a socket to fit the end of the platinum wire; then dip it in soldering fluid, and apply a bead of solder on the tip of a soldering iron.—G. E. B.

**Aquarium and Aviary.**—NOVICE. —The mahogany pillars you speak of would, in my humble opinion, be quite unsuitable for the purposes of your sketch. An article on a Wardian Case is in the hands of the Editor, and when published will give you sufficient instruction, with a little modification, to carry out your ideas.—C. M. W.

**Fountain.** — A READER. — A fountain worked by an electric motor can be obtained from The Maughan Patent Geyser Company, Queen Victoria Street, E.C. I believe it is a patented article, but I am not so sure of its efficiency. A description of a single self-acting fountain was given in WORK last year; this without ornamentation would suit your purpose. A great many readers of WORK have made this fountain successfully.—C. M. W.

**Amber Mouthpieces for Pipes.**—CONTRIBUTOR.—Amber mouthpieces can only be obtained at first cost from Austria, where the trade is chiefly in the hands of Jews, and is the speciality of a very limited area; no British house could compete with these makers. CONTRIBUTOR should consult a London directory for an importer's address. If he has access to the current and last volumes of a London periodical of limited circulation called *Tobacco*, he may there find information about the trade in question. Cut amber is costly; compressed or "moulded" amber less so, but how it is moulded is, we believe, kept a trade secret. The mouth-

pieces and trinkets made of it have, however, every property of amber, even to the electric one. "Parkesine" (an imitation of amber) was the invention of a Birmingham man. It has not been largely taken up in this country, but has found more favour with the French. Another imitation, now being manufactured in the United States, is "Silleroid." This latter has the disadvantage of being so inflammable as to be almost explosive.—S. W.

**Thermograph.**—J. F. (*San Remo*).—J. F. has designed a thermograph on the following plan. A spirit thermometer is delicately balanced like the beam of a scale; it contains also a short column of mercury, which the expanding and contracting spirit displaces—by so doing shifting the centre of gravity, so that it oscillates. One end carries a style. In front of the style is a cylinder which revolves once in seven days. It is intended to make the style record by a curved line the varying temperature. At this point he is confronted by a difficulty. If the style is replaced by a pen, there will be introduced, by the constant loss of weight, an error; also there will be friction and other evils which he points out. His hope has been that, by electricity and a chemically-prepared paper, he might be able to produce what he desired. He has tried potassium iodide, but without success. Now, the fact is, that a variety of chemicals are acted upon by electricity, but, unfortunately, J. F. hars the way by one condition, which is fatal, as far as I know, to success—that is, the paper must be *dry*. In all the processes known to me, moisture is necessary for chemical reaction. I have stated this much, as some correspondent may be able to suggest a method that I have not tried. There is a plan, however, which, I think, will be better even than a chemically-prepared paper, and which will in no way detract from the elegance of the instrument (a sketch of which is supplied me). It is to employ a small induction coil. Let one terminal of the secondary be connected with the metal pillar carrying the balanced thermometer; from the central pivot on which it turns, carry a small rod or wire which shall have metallic connection with the metal style. The other end of the secondary wire must be connected to the metal drum carrying the ruled paper, which should be a fine, smooth paper like "foreign post." As the current flows a series of small holes will be punctured in the paper, which on being removed may be used with an ink-pad, like one of the letter multiplying methods in use. This is the most perfect plan that I can suggest; by it there is no change of weight to shift the point of gravity; nothing to produce friction. J. F. asks for an opinion on his design, and says his critic need not be afraid of hurting his feelings. So far from passing an adverse criticism on his instrument, I think it a capital idea, and with the addition I have suggested, I believe it will make a most efficient electro-thermograph.—O. B.

**Charge for Battery.**—J. H. (*Manchester*).—Without seeing the battery, and in the absence of its description, one cannot well tell you how to charge it "completely." So many different batteries are, and have been, used for gas-lighting apparatus as to render a reply to your question a mere guess. If the gas-lighter is a small cylinder with a long rod projecting from it, there may, or may not, be a battery. It may be worked by a small machine. Tell me how the battery is made, and I will tell you how to charge it.—G. E. B.

**Electrotyping.**—H. G. W. (*Bath*).—The best book I know of on the subject is Watt's "Electro-Deposition," third edition, price 9s.; Mr. McMillan's "Treatise on Electro-Metallurgy," price 10s. 6d., is also a good book on the subject. A cheaper manual is Urquhart's "Electrotyping," price 5s.—G. E. B.

**Insulation for Coil.**—H. G. W. (*Bath*).—If you suspect the coil to be imperfectly insulated, immerse the whole instrument in melted paraffin wax, and keep it there until bubbles have ceased to come off from the wire. Running the wire through the hot wax, and basting each layer with it as the wire is wound on, will also improve the insulation. The efficiency of the coil will depend largely on the perfection of the insulation.—G. E. B.

**Coil for Vacuum Tubes.**—W. H. (*Pollockshaws*).—A wooden bobbin measuring 4½ in. by 1 in., with a body 1½ in. in diameter, having a ¼ in. hole in it, is altogether unsuitable for the purpose of forming part of either a shocking coil or one to illuminate vacuum tubes. The ends of this bobbin may be sawn off, and bored to fit the tube of a coil, but a wooden tube would be altogether unsuitable. Make a tube of $\frac{1}{16}$ in. sheet ebonite, 4½ in. to 5 in. in length, and ⅞ in. in diameter. Turn holes in the bobbin ends to fit this tube, and glue the ends of the tube into these. The tube may be made of strong thin paper, glued, and wrapped around a glass rod to the required thickness. When this is dry and hard, it may be slipped off from the rod and glued into the bobbin ends. The core, made of a bundle of No. 20 soft iron wires, will fit into this tube. Over the tube wind two layers of *silk-covered* No. 18 copper wire. Cotton-covered wire is not nearly so good. Over this primary coil of wire wrap two or three layers of tough thin paper, soaked in melted paraffin wax. See that the paper has no holes in it, and baste it well with the hot wax on the outside. *Fill up* the bobbin with No. 36 silk-covered copper wire, coated with hot paraffin wax, and wound on evenly throughout. If you use No. 32 you will not get such a long spark as that from No. 36. This coil may be worked with current from three or four pint bichromate cells, and will give a smarter shock than you will care to take across the hand whilst spanning the terminals of the secondary. If you care to use your No. 18 cotton-covered wire for the primary, and your No. 32 silk-covered wire for the secondary, you will only get a very mild shocking coil, but it will be useless for lighting up vacuum tubes.—G. E. B.

**Bent Iron.**—R. N. (*Grays*).—If you are anxious to commence, you may get some good designs and much information on the subject by joining the Home Arts and Industries Association, Royal Albert Hall, S.W. The annual subscription is very low. You may get materials of Clark and Hunt, 160, Shoreditch; they promised me some time ago they would keep it in stock. The tools required are few and inexpensive.—WORKER BEE.

**Re-painting, etc., Blinds.**—R. J. (*South Devon*).—The ordinary charge for re-painting, new tapes and cords, and re-fixing Venetian blinds is, in London, 4d. per foot superficial, but it should be worth more to paint the iron corrugated laths mentioned. R. J. has five large blinds, which at 4d. per foot would cost £3 1s. 2d. I should say the value of the work on iron laths would be at least 25 per cent. extra—£3 16s.—B. A. B.

**Stencils and Brushes.**—A BEGINNER.—A short paper on cutting stencils appeared in WORK, Vol. I. The best way of cutting is upon a piece of old plate-glass, flat upon table or bench. Use a sharp-pointed pocket-knife, and keep an oilstone handy to "ruh up" edge of knife every few cuts. Next to the foregoing, the main thing required is practice. With reference to the "dahbing" or "hrushing on" motions with stencil brush (Fig. 1), the former is most correct for all stencil work, and is the safest. In some cases the pattern will not look regular and one even tone if brushed on. Rubbing is often quickest for stencilling on a distempered ceiling-flat,

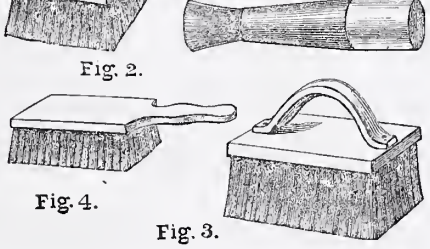


Fig. 1.

Fig. 2.



Fig. 4.

Fig. 3.

Stencils and Brushes.

and where we use thin distemper or flat paint, which is more of a stain than body; but care is always necessary to get clean work with brushing. Respecting stipplers and their use, I give you a cut of three herewith, Fig. 2 having reversible handle, and Fig. 3 bridge handle. They are used for distributing paint or vehicles in a perfectly regular manner, and for taking out paint-brush streaks. In use, the paint is first spread—a good coat—and then the work is at once stippled with the ends of bristles until a regular surface of a granular nature is obtained. See articles on "Plain and Decorative House Painting," Vol. I.—LONDON DECORATOR.

**Plant-Forcing Case.**—SOMERSET.—Full instructions for making a plant case warmed by artificial heat will be given in a future number of WORK, together with an efficient heat regulator.—C. M. W.

**Water Spray.**—WEEKLY READER.—In order to throw a spray of about 30 ft. of water from the tub in your garden you will need a strong force pump—a suction pump might readily be made in tin work—but I would not advise you to attempt a force pump unless you can work up solid metals; the better plan would be to use a long length of hose as a syphon direct into your cistern, and thus conduct the water to the points required; in a smaller spray, certainly, but quite as convenient.—C. M. W.

**Incubator.**—F. W. A. (*Peckham*).—If the water in your incubator is nearly boiling, you should have no difficulty in getting up the required heat in the egg drawer; there should be no brown paper in the bottom of tank; and the temperature should be taken at the line corresponding to *the top* of the eggs. If the temperature at this point is high enough you need not trouble about the heat an inch or two lower down.—C. M. W.

**Split in Violin.**—R. T. (*Galashiels*).—Carefully remove the belly with a knife which is not very sharp, lay it on a flat piece of board, and drive small tacks all round close to the edge of the belly; this done, take out a sufficient number of the tacks on one side to release the belly. The joint should then be sponged quite clean, and laid aside to dry. The edges should be covered with fresh glue, the belly replaced in its position on the board, and the tacks again driven in; then draw tightly across, from one tack to another, a piece of strong twine; you will thus be able to get the joint quite close.—B.

**Cast of the Foot.**—CRISPIN.—The mould, as well as the cast itself, will have to be made of plaster, and not, as Crispin supposes, of clay. He should invest twopence in Nos. 74 and 81 of WORK. In 74 (Vol. II., p. 349) he will find all about plaster and the way of using it; and in 81 (Vol. II., p. 578) are special directions for casting parts of the living human body. The way in which a foot may best be cast is there illustrated by a diagram.—M. M.

**Cost of Electric Bells.**—GLENIFFER.—The relative cost of fitting a six-roomed villa with electric bells, as compared with the old system of pull-bells, will depend upon the number of bells you may require. If you do not employ an indicator, you will have to put a bell to each room, and this will increase the cost. The total cost will be from £4 15s. to £5 for material. In a new house provision should be made for laying the wires in zinc tubing laid in the plaster. Best quality line wires are coated with rubber under the cotton, to resist the damp.—G. E. B.

**Gramme Dynamo.**—G. W. (*Bradford*).—It is not an unusual occurrence to find an amateur in trouble with a dynamo of his own construction. Some little point in detail is missed, and this ensures entire failure in the performance of the machine. It may be a slight fault in the insulation of the wires; a fault in winding or connecting the coils; a fault on or in the commutator; a wrong adjustment of the brushes, which are given too great or too little bend; or the machine is driven in the wrong direction. Probably either one or more of these faults exist in your machine. First, test the insulation of the wire by means of a battery and galvanometer. If this is all right, examine the connections—one may be loose. If these are right, try to run the machine as an electro-motor, with current from your other dynamo, adjusting the brushes until you get the machine to move at its best. It must now be run as a dynamo, in the opposite direction to that of its movement as a motor, and the brushes must be adjusted to meet the requirements of a dynamo.—G. E. B.

**Roofs.**—D. LE D. (*Ireland*).—In answer to your query as to whether shingle roofs are suitable for this country (Ireland), I should say no, bearing in mind that Ireland is always considered to have a humid atmosphere. I have never met with a case where they have been specified for new work, and the only experience I have had with them has been in repairing old roofs; and this, I think, you will find to be the general modern experience. The fact of their not being used much in modern building tends to show that they have not been found as good as other and cheaper methods of covering a roof. They are fixed in the same manner as slates or plain tiles, and are mostly made of oak.—E. D.

**Patterns.**—J. C. B. (*Great Ayton*).—I do not know of any other fire-proof solution. Nothing of the kind is used by founders. The patterns are simply varnished or painted, and put away in rooms removed from the workshops. As a rule, no fire is allowed in a pattern stores, and no naked candle, only lamps enclosed in lanterns.—J.

**Spring.**—T. B. (*Harwich*).—You go to work the right way, but perhaps the section at the bend is less than that in other parts, and this, together with the hole there, becomes a source of weakness. Then you must sacrifice some amount of elasticity to retain strength.—J.

**Paint for Cart.**—J. C. (*Belfast*).—To get a good and durable bright red for the wheels of your cart, it would be advisable (after well cleaning and preparing them) to paint them once with Venetian red pigment, and then finish with two coats of vermilion. In both cases it is best for such work, and where only small surfaces have to be covered, to mix the pigment with one-third japanners' gold size and two-thirds of turpentine until of working consistency. The Venetian red is sold ground in oil, and the vermilion in powder only. Strain the paint before using, and finish with two coats of pale carriage varnish. You will then get a durable job.—F. P.

**Bicycle Steel Castings.**—B. C. (*Nottingham*).—Malleable steel castings can be had of Forsythe and Millar, Broad Street, Bridgeton, Glasgow. Crucible steel castings of the St. George's Cycle Co., 293, Hampstead Road, London. Steel castings of Brown Brothers, 7, Great Eastern Street, London. Brown Brothers will send their catalogue, which has innumerable illustrations of steel stampings for cycles, both diamond and cross-frame safeties. These are quite good enough for the highest class machines.—A. S. P.

**Enamel Tricycle.**—J. C. (*Bedale*).—Any enamelling done at home must be put on with a brush, like paint. The tricycle should be well cleaned and smoothed down with emery-cloth or glass-paper. The process of applying the enamel should be done in a warm room, and the parts may be heated at the fire, when the enamel will flow more freely. Use the Club Hard-drying Black Enamel, and as it dries very quickly, put it on with a brush an inch broad, covering as much as possible with a brushful, and take care not to go over the same place twice. The above enamel can be had in 1s. bottles at any of the cycle shops. The above is the only method, except stoving or baking, and J. C. would have to send the machine to an enameller or provide a stoving plant, costing about £12.—A. S. P.

**Broken Fork.**—J. W. R. (*Westminster*).—Unless J. W. R. is a mechanic and acquainted with brazing, he had better give his machine into the hands of a repairer. If the fork is broken up at the crown, a new fork has got to be fitted the same curve and size as the other. It has got to be brazed on. If broken anywhere else in the length, it may be mended by fitting about three inches of a smaller-sized fork inside the broken one, the broken part being in the middle of the three-inch piece; the parts must be

well filed and fitted clean for brazing. A practical brazier could do this easily enough, but the job at home by a green hand would be a failure.—A. S. P.

**Advice on Emigration.**—D. A. T. (*No Address*).—You may do well in either Queensland or South Africa. The latter is more unsettled, and probably more rough, but wages are higher as a rule, and so are the expenses of living. I believe New Zealand has even a grander future than Australia in the near future; the conditions of existence will be easier. Do not wait for a job at your trade as wheelwright, but take the first that comes to hand that you can do, and look about you until you see an opportunity to work at your trade. Neither loaf about the towns longer than obliged, but get back into the country, and settle down in a good position on a main road; you may then soon get a little business of your own around you, which will increase in proportion to the rate at which people settle down in the district. For myself, I think I would prefer N.W. Canada, 150 or 200 miles N.W. of Winnipeg.—WORKER BEE.

**French Clock Snail.**—RICHARD III.—Before altering the snail of the clock, make sure the fault is there. See that your rack teeth are all straight, that none are longer than the others, and that none are thicker on the tops; next see that the pallet gathers up only one tooth at a time, then see that the rack arms are not loose; if this is all right, try round, and note which hours are wrong, and see if the rack falls too far or not far enough: if not enough, scrape or file the snail where the rack drops till it drops right; if it drops too far, take off the snail from hour wheel, or jumper wheel, and swell it out by hammering with a round-faced hammer, or you might stretch the point of the rack that rests on the snail till it drops fair at the hours where it used to be wrong. Then try round, and file the snail down at the hours where it does not drop sufficient. To make a new snail, mount a round piece of brass on your hour wheel, and put a pointed pin in the rack arm in place of the half-round or square one. Put the rack hook in the first tooth of rack, and hold tight with one hand while you turn the hour wheel, or jumper wheel, round, letting the pointed pin of rack rest on the piece of brass for new snail; now put rack hook in second tooth, and so on till you have the twelve circles on the new snail that is to be. Next put on the minute wheel, shake minute and hour wheel (if snail is on it), put on your minute hand, and see that the striking is let off at the twelve; turn the hand down to six, and hold it there tight while you let the rack drop the whole twelve teeth with the pin resting on the snail; press on it so as to leave a clear mark. Now turn the minute hand round an hour, and repeat the scratch till you have twelve radial lines, as well as twelve circles, on the snail (of course, if the snail is on a jumper wheel, you simply move one tooth of it and make your scratches). All you have to do now is to file out between two radial lines down to the first circle, take the next radial line and file down to the second circle, and so on till you have the twelve steps, then file the pin in rack tail half through, and your snail is done.—A. B. C.

**Cleaning Telescope.**—SCENERY.—There is no mystery in the matter. You may take the telescope to pieces and clean it. Use a soft cloth or chamois leather for the lenses, so as not to scratch the surface of the glass. The risk is lest, knowing nothing of the matter, you might fail to replace the lenses in their proper cells. To entirely avoid accident, you had better remove only one piece of tubing at one time, and clean only one lens at one time, replacing the lens exactly as you found it before you touch another.—E. A. F.

**Diapason.**—BRIXTON.—The pins for the long keys should be inserted near the centre; about five-ninths of the length of the key, measured from the front, would be about the usual position. The pins for the black keys should be about ⅝ in. behind those of the white keys. Any weighting that may be requisite can best be determined when the action is completely attached. As regards the length of the keys, that will be a question for you to determine, having regard to the position of your action. Any length that will work conveniently will suffice.—M. W.

**Grained Arches.** — M. W. (*Manchester*). — "Masonry and Stonecutting," by E. Dobson, price 2s. 6d., is as suitable a book as you can have; it is published by Crosby Lockwood & Co., but you can order it through any bookseller. There is an atlas of plates to it, which I think is included in the price named, but you must inquire about this. After procuring the book, if you examine any work in progress or completed, you will get a much better idea. There is also "Masonry and Stonecutting," by P. Nicholson, published at 28s., which I believe you might get second-hand from Batsford, 52, High Holborn, London, for perhaps 10s.; this is a larger book.—M.

**Colour Mixing.**—J. G. P. (*Crewe*).—First obtain a knowledge of the names of pigments, which you will find are not always synonymous with the colours. Dutch pink is yellow, verditer is blue, lake is not purple-blue always, but sometimes green, yellow, brown, etc., or you will find it as a pigment colour, with a chalk base, or body, for fugitive colours. Doubtless a colourman's catalogue will help you at first better than a learned treatise: as Heywood & Wilkinson, Battle Bridge, N., or Mr. Parsons, Long Acre, W. C. For books: "Painting and Painters' Materials," by C. L. Condit, E. and F. N. Spon, Charing Cross, London; or, "Artists' Manual of Pigments," by Standage, Crosby Lockwood & Co., Stationers' Hall Court. This last is a low-priced book, the first a costly one.—J. C. K.

**Camera.**—T. J. (*Sheffield*).—To give practical details for the construction of the apparatus you require would occupy too much space for these columns. It would be the better plan to borrow one of the pattern you most fancy, and copy it. Some scores of different kinds are now in the market, of varying degrees of effectiveness. The most simple are, as a rule, to be preferred, and less likely to get out of order. For smooth working and real effectiveness a quarter-plate, or 5 × 4 camera, enclosed in a case and with a good supply of light double dark slides, is as good as any. The back of this can be made to open and allow focussing, and the exposure made by a lever on the outside connected with an instantaneous shutter. The lens is a very important item, and should not be less than six inches in focus. Work with a large aperture, and give good depth of definition. The focussing, as well as the finder, must be arranged and worked from the outside of the case.—D.

**Tables of Weights.**—IRONMONGER.—Almost all engineers' "Pocket Books" contain these tables, so you have a wide choice. There is a book of "Engineers' Tables," price 1s., published by Messrs. E. and F. N. Spon, Strand, W.C., London, which might suit you. These weights are very easy to calculate, for a bar of iron 1 in. square and 1 yd. long weighs 10 lbs., and steel is 2 per cent. heavier.—F. C.

**Blowpipe.**—ROMEO.—Hydrogen can be burnt at the end of a brass tube, but this tube should not have any openings in it on the side, as in a Bunsen burner. You would have to make a large quantity of the gas, store it in a gas-bag or reservoir of some kind, and conduct it thence to the burner. I presume that you would make it by adding sulphuric or hydrochloric acid to zinc or iron, and the gas would not come off steadily enough or in sufficient volume to burn in the burner straight off. This flame would be hot enough to melt thick glass tubes, and thus there would be no need to make an oxy-hydrogen blowpipe. Your want of coal-gas prevents you making the hydrogen in a cheaper way; and considering the large amount of materials required to make sufficient gas, I think it will be cheaper for you to save up till you get the 6s. 6d., and then buy a French blast spirit-lamp, which I have found to work capitally. Hydrogen is explosive if any air be mixed with it; so collect a little in a test-tube, and, by applying a match to this, see that it is free from admixed air before conducting the gas to the reservoir.—F. B. C.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Pompeian Blue.**—CYANOS will be obliged to any reader who will give him the receipe for making the old Pompeian blue colour.

**Band-Sawing Machine.**—BON ACCORD writes:—"Will some practical reader kindly give me sketch and particulars of a Band-Sawing Machine, and how to construct it, with a wooden frame, to be used mostly for wheel work, to be driven by power?"

**Blast Gas Furnace.** — A. B. (*Manchester*) writes:—"I shall feel obliged for any information as to make and price of Griffin's Patent Blast Gas Furnace."

**Fretworker's Address.**—F. G. B. (*Hull*) writes:—"Will anyone kindly tell me the address of Russell, designer of fretwork?"

**"Desideratum" Fountain.**—AMATEUR writes:—"Can any reader of WORK give particulars of a self-acting fountain called the 'Desideratum,' with sketch of same? also instructions for making it?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Ferrules for Fishing-Rods.**—P. T. (*Kasan, Russia*) writes, in reply to TELESCOPIC (see page 812, Vol. II.):—"You can get ferrules for fishing-rods of any size, and in any quantity, from Messrs. S. Allcock & Co., Standard Works, Redditch. I suppose any other firm in the wholesale fishing-tackle trade can supply them, but I give the name of Messrs. Allcock & Co. because I *know* that they make the article wanted."

**Plane Iron.**—R. H. W. (*Lewisham*) writes, in answer to query from ONE IN DISTRESS (see page 522, Vol. II.):—"You might try the iron illustrated in *Carpenter and Builder* of June 27th; it has three broad grooves in it, and the inventor claims that it does not want grinding. This, if it is a practical invention, would be the cheaper; or a more expensive alternative, the machine sold by Melhuish or by Moseley for sharpening plane irons after the principle of a grindstone, with a stone that puts a finishing edge to the iron. It is turned with one hand, and has a rest affixed, which keeps the iron at the right angle for sharpening."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—CHICK; G. C. (*Hackney*); E. F. B. (*Liverpool*); H. B. (*Notts*); TURNER; H. N. (*Ipswich*); F. H. (*Streatham Hill*); E. E. S. (*Devon*); F. L. (*West Cowes*); IMPATIENT; A. R. (*Scorrier Saw Mills*); INCLINED PLANE; SEWING MACHINE; C. T. B. (*Chapel-en-le-frith*); T. F. (*Aberdeen*); PATENT BALL BEARING CASTOR CO. (*Leicester*); J. F. (*Boston*); P. H. (*Camberwell, S.E.*); W. C. G. (*South Norwood, S.E.*); E. M. C. (*New Humberstone*); G. A. B. (*Yorks*); B. MCC. (*Kilmarnock*); T. T. (*Harlesden, N.W.*); PUZZLE; G. E. B. (*Lewisham*); G. P. (*Fulham*); TABLETOP; J. M. (*Kilmarnock*); A. T. (*East Greenwich, S.E.*); J. T. B. (*Warrington*); F. D. B. (*Stamford Hill*); E. E. D. C. (*Crewe*); A. M. (*Glasgow*); E. D. R. (*Staffordshire*); H. O. H. (*Bristol*); H. R. J. (*Canning Town*); T. J. S. (*Tottenham*); R. L. (*North Wales*); SUBSCRIBER; C. T. (*Boston*).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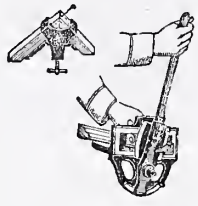

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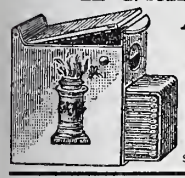

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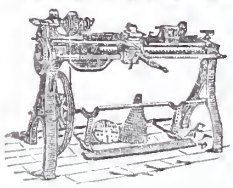
# HENRY MILNES,



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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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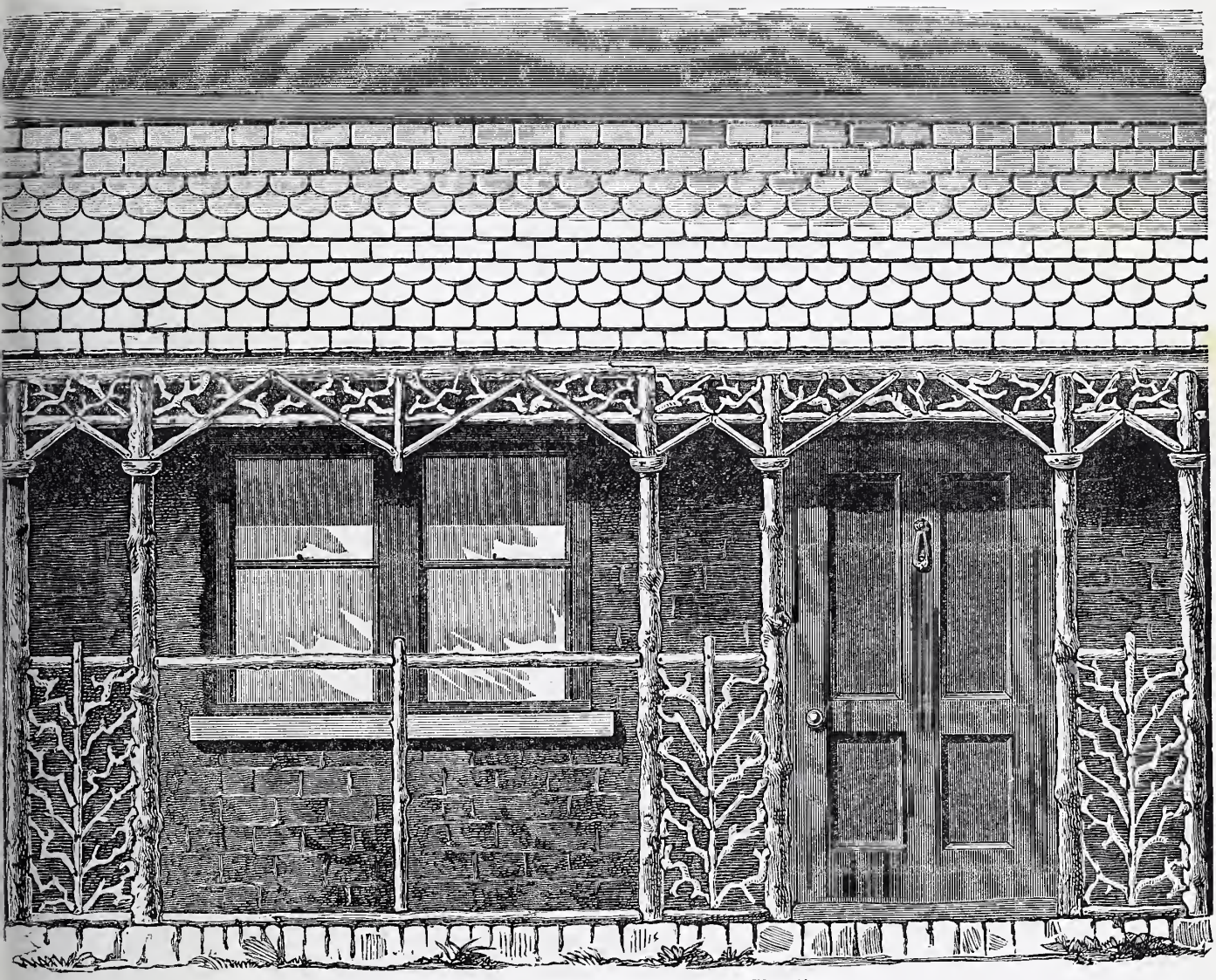


**A Suggestion for a Rustic Verandah—Front Elevation.**

### SUGGESTION FOR A RUSTIC VERANDAH.

BY ARTHUR YORKE.

GENERAL ARRANGEMENT AND MATERIALS—CONSTRUCTION OF FRONT—ROOFING—LINING OF ROOF.

*General Arrangement and Materials.*—The above elevation of a rustic verandah I have called a "suggestion" merely, for to arrange any definite plan, or to fix accurate dimensions, for an appendage of this kind demands some previous knowledge of the building to which it is to be attached. All that I can do, therefore, is to give a design that shall be easy of adaptation, and this, I believe, will easily be adapted to many houses of modest size.

The illustration is, I should observe, a front elevation, drawn to a scale of ½ in. to the foot. It is shown as a part only which may be extended to any required length at either end. As to the width, that indicated is 3½ ft. from the wall to the middle of the collar-posts, the eaves having a further projection of 6 in. For a cottage verandah the width given is a satisfactory one. It gives sufficient room for seats on a hot day, or for a promenade on a wet one. The width, as also the height, can easily be increased to suit a larger house. The verandah is supposed to be built on a raised platform of brick or stone.

All those parts, even the minor ones, which can be considered as belonging to the framework, are of straight natural wood, and by choice of larch; whilst the mere filling-in of rustic open-work is of small crooked stuff—probably oak or apple tree. The roof, as drawn, is of tiles; but of this I shall have to speak more particularly further on.

*Construction of Front.*—It will be seen that the collar-posts which support the verandah are arranged in pairs, so that 3 in. or 3½ in. poles will suffice for them. Their bases are supposed to be dowelled to the

masonry of the platform on which they stand; they are 6 ft. 6 in. high. Except at the entrance or entrances, a sill of half-stuff runs from post to post on the platform. At a height of 3 ft. 3 in. they are connected by a round bar of smaller material, and, again, by a second cross-bar of similar size to the last, at 6 in. from their upper ends. On the tops of the posts rests a lintel of half-stuff of larger diameter—say 5 in. The upper and lower cross-bars come opposite to the middles of the posts, but need not be mortised into them, for if their ends are cut V-shaped, so as to clip the posts, they can be nailed quite firmly. The lower cross-rail is placed at a convenient height for leaning upon. At a height of 5 ft. 6 in. caps are formed by simply nailing four pieces of quartered stuff round each post. The diagonal braces which start from above the capitals will be observed to pass in front of the upper cross-bars, to which and to the lintel they are nailed. The illustration sufficiently shows how the panels between the pairs of posts and the frieze between the upper cross-bar and lintel are filled with open-work of small crooked branches, which contrasts in a pleasing manner with the straight pieces of the framework. This open-work may be made available for, and will be found useful as, a support for climbing plants.

*Roofing and Lining of Roof.*—In so narrow a structure the rafters alone will suffice to keep all in place, without anything of the nature of a tie-beam being called for. These rafters will be of half-stuff, and for the given width a length of 5 ft. will be enough; this will allow of such a projection beyond the lintel as will give the eaves a width of 6 in.; the pitch will be rather less than a true pitch, but amply steep for the purpose. A piece of half-stuff nailed to the wall will support the upper ends of the rafters.

In forming the roof it is proposed to board over the whole space upon the rafters, and to nail the tiles or other covering upon the boards. For the non-professional workman this is much easier as well as much safer than the use of laths. It will also facilitate giving a neat finish to the inside. It is suggested that the inside should be lined beneath the boarding with rush matting. This is an inexpensive material; its brownish-green hue is pleasing to the eye, and it is so inartificial in appearance as to harmonise well with the natural wood. After fixing the rafters the matting is to be stretched tightly across them before the boards are nailed down. It is probable that the rafters will be arranged with intervals of about a foot between them, and to hold the matting more closely to the boards a strip of split rod may be nailed up the middle of each space, or strips may be nailed so as to form a simple ornamental pattern; an intricate one will not be desirable, as fixing it will be overhead work.

A neat, but less characteristic, ceiling may be formed by, instead of using the matting, painting the boards of a suitable colour and slightly ornamenting them with split strips of rod. In this case the boards should be planed. None will be better for this purpose than $\frac{3}{4}$ in. flooring boards, and these are commonly sold steam-planed on one side. Other ways of lining the roofs of rustic buildings are discussed in my paper on Summer-Houses, Vol. II., pp. 65 and 197 (Nos. 57 and 65). To these articles the reader can refer, but it must be remembered that a lining suitable for a summer-house may not be sufficiently neat for a porch or verandah.

In the same papers something is also said with regard to roofing materials, thatch being more especially commended in point of taste. A thatched verandah, however, would scarcely be desirable unless attached to a thatched cottage. Practically the choice lies between shingles, metal, and tile or slate. Shingle roofs have been spoken of in the first of the two articles above cited. A metal roof is, undoubtedly, that most easily fixed by an amateur, and should metal be used in this case, I should, as a matter of appearance, rather recommend black sheet iron than galvanised, and to keep it painted; paint stands far better on the black than on the galvanised surface. As a matter of taste, metal looks thin and poor, but it becomes less objectionable when painted; a deep, dull red would be the colour to be preferred. Perhaps, of all available coverings, nothing will look better than tiles, as drawn. Red or buff tiles will in themselves look best, but the choice must, to an extent, be influenced by the general covering of the house. It may be, if that is of slate, that small slates will come in most appropriately; but whichever of these coverings is used, the best finish against the wall will be with a "flashing" of metal, as shown.

## FRENCH POLISHING—BODYING IN.

BY D. DENNING.

THE BODY—BODYING IN ON CHEAP FURNITURE—PREPARATION OF POLISH—HOW TO MAKE IT—WHITE POLISH—BROWN POLISH—REMARKS ON THE POLISH OF THE MANUFACTURERS.

If it can, without conveying the implication that some of the details of French polishing may be performed in a careless manner, be said that one operation is more important than another, the remark applies specially to the "bodying in," as it is technically called, of the work with the polish. In ordinary English, bodying, when applied to the polisher's craft, or rather art, simply means coating the wood with a thin layer of the polish, evenly and smoothly distributed. On the way this is done the appearance greatly, and the durability of the shine or gloss entirely, depend. If the body is thin, the polish—by which is meant the gloss subsequently given to the film—may be beautiful at first, but cannot last, as the polish—this time the material is referred to—sinks or perishes. On the other hand, if the body is too thick, though the gloss may be all right, the work will not look well. It is apt to be "treacly" looking, and give rise to ideas of varnish having been used, besides impairing the pure tone of some kinds of wood. Therefore, let the novice be careful about the way in which he does the bodying, if he wants to excel in his work. It may be well to remind novices, or those who are not accustomed to see good work—or, shall I say? the highest degree of excellence to which polishing is capable of being brought—that many specimens that are seen are anything but good. Only in the best shops or houses, and on the best pieces of cabinet work, can the finest polishing be seen. Polishing on second-rate—even if substantial and sound—furniture is generally on a par with the woodwork. The lower this is in the scale the worse the quality of polish; therefore the gaudy and shiny-looking cheap furniture, which unfortunately is too often seen in all but the very best shops, etc., must not be taken as models to be copied in polishing. To meet the public taste, the price paid for polishing has to be cut down, with the result that inferior polish and less time are spent on the work than would be were excellence the prime consideration. I do not say that even the best materials and the expenditure of even more than the necessary time or labour will ensure good work in unpractised hands; but they are, at any rate, important factors, and amateurs and novices will be wise not to use either inferior materials, or to be unduly discouraged if their efforts are not as successful as might be wished.

With these preliminary remarks—and I am afraid some of my younger readers may think them of comparative unimportance, though they are not so—we may proceed on our course.

*Polish.*—As the quality of materials has been referred to, a few hints on the polish and its preparation will not be uncalled for, especially as so many readers of WORK are continually asking questions on this subject for answer in "Shop." Those who want a good recipe for polish will find the following thoroughly reliable, and neither I nor anyone else can tell them of a better—no, not even if it has been "in print." There may be cheaper methods of making a given quantity of polish, and there may be many giving more ingredients, but none of them surpasses, or is equal to, the simple mixture of shellac and methylated spirit. If any reader tries it, and does not find his work satisfactory, he must blame something besides the polish, for the fault will not be in it. It is just possible that some novices may think that they could manage better with a polish containing, say, half a dozen different ingredients, all of them weighed out and measured with the utmost nicety. If so, my advice to them is that they should ask any really competent French polisher whom they may meet with what he uses in his polish. If he thinks fit to be candid, he will admit that shellac and spirit form the best; but it is within the bounds of possibility that he will not care to say too much about his methods.

To make a good average polish, neither too thick nor too thin, about 6 oz. of shellac to each pint of methylated spirit will be required. The proportions vary according to the fancy of the polisher, and, perhaps, to some extent according to the nature of the work he is engaged on chiefly. Be that as it may, great exactitude in the proportions is not necessary, and I know more than one good polisher who makes his polish almost by guess-work. Of course, if it turns out too thick, the polish can be thinned by merely pouring in some more spirit, while if it is too thin, the deficiency can be made up by dissolving some more shellac in it. A rough-and-ready way of measuring the proportions is to put some shellac in a bottle, or say, for explanatory purposes, half fill it with the lac, and then fill up with ordinary methylated spirit. This is, perhaps, as good a method as any, so it will be seen there is not much trouble involved.

The shellac gradually dissolves, and the solution is hastened by an occasional shaking or stirring with a stick. As many directions, ostensibly published for the benefit of the amateur, recommend the application of heat—one of them which I read lately actually saying that the mixture should *be boiled!*—let me emphatically say that heat is not necessary, and that an attempt to boil the spirit would probably end in disaster. I prefer, as a rule, not to find fault with wha

has been written by others, and I only do so now in order to warn readers that the preparation of polish by heat is dangerous, and should not be practised except with the utmost caution, if at all. In confirmation of this, I may say that I have seen many policies of insurance covering furniture manufactories and shops, where, of course, polish is constantly used, and I think most of them —indeed, I cannot remember an exception —have had a clause to the effect that polish, if made on the premises, must be prepared cold. With this I must leave this part of the subject for the readers' personal consideration. If they are bent on using heat, they do so at their own risk, and must not blame Work for any disaster which may happen.

Two kinds of polish are used, one of them nearly colourless, and known as "white polish," the other darker, and known as "brown polish," or simply "polish." If unqualified by the word "white," this latter kind is always understood.

The white polish is made by using white or bleached shellac, while the other is made with ordinary shellac, either orange or reddish-brown.

Either polish may be used on any kind of wood, except where great purity of tint is required, and, roughly speaking, the white is to be preferred for all light woods, such as light oak, ash, sycamore, satin, etc., while the brown may be used on darker kinds. Even on these I am inclined to think that white polish is, if not better, at least equally good, the only ordinary furniture wood in connection with which a decided preference might be given to brown being mahogany. It will be understood that, when distinguishing between brown and white polish for dark woods, the higher branches of the polisher's art are being touched on, and under ordinary circumstances either may be used indiscriminately. We all know the old saying about doctors differing, and if the word doctor is taken in its literal meaning of "learned man," it may be conceded that men learned in all that pertains to polishing do differ to such an extent that the present writer, at all events, cannot in his person answer the question, "Who shall decide?" He, nevertheless, states his opinion, for which he has equally good reasons (to himself) as those who differ from him have for theirs. Is there not a couplet which wants to know—

> "Where can all this difference be
> 'Twixt Tweedledum and Tweedledee?"

and many a good polisher may, and does, think that any distinction between white and brown polish on dark wood is equally as unimportant.

However, as white polish may be used on dark, and must be used on light woods, if they are to be kept light when finished, and brown can only be used on dark woods, it will be seen that the white polish is the more useful of the two, so that those who do not care to keep both kinds may confine themselves to it. It costs a little more, from the slightly higher price of the bleached shellac; but the extra cost is a mere trifle—so small that it is hardly worth considering by those who only use small quantities, while those who have occasion to use polish in larger quantities can easily have both kinds.

But it may be asked whether the polish cannot be bought ready made, and if so, whether it is not equally good? The first question must be answered in the affirmative, but the second requires more consideration.

Undoubtedly, it would be too much to say that polish bought ready made may not be equal to that made from the recipe given, for there is nothing to prevent manufacturers using the same ingredients, and I cannot say whether many of them do not. At the same time, from the impossibility of knowing the ingredients in polish which is got ready made, there is always some risk attendant on its use, or perhaps it will be better to say, a degree of unreliability which is not experienced when one prepares his own. From the price at which some polish is sold, it is only a fair inference to suppose that something cheaper than spirit and shellac alone have been used; and without saying that good polish may not be bought, it is better for the user, when he wants something that can be depended on, to prepare his own. He knows then what he is using, and in the other case he does not. The bought polish may have nothing in it to prevent it being thoroughly good in every way—brilliance, clearness, and durability—but the fact remains that those who are best able to judge do, as a rule, prefer to make their own polish when they want to do the best class of work. Possibly there may be a certain amount of prejudice in this preference—and from a manufacturer's point of view this might be attributed as the sole reason—but then we are considering the question rather as consumers than as manufacturers.

Possibly many manufacturers, and some polishers, may even assert that the gums or resins they use in addition to shellac even improve the quality of the polish, when used with knowledge and discretion. I am not prepared to say that such additions—please note I have not called them adulterations—may not do so to a certain extent in certain directions—for instance, one gum may give increased elasticity, while another may harden the film—but for a good all-round polish, which can be relied on, there is nothing to surpass the one named. However, as all may not share this opinion, I hope on some future occasion to give several well-approved and frequently-recommended formulæ for forming other polishes, in order that those who feel inclined to do so may experiment for themselves. It will be found that shellac is the principal ingredient in them all, and that those who cannot polish with shellac and spirit alone will not be able to do any better with them; therefore, I hope no novice will remain under the impression that he will do better by-and-by, when he gets another kind of polish to work with.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

Crimping—Properties of Extending and Decreasing—Putting Together—The "Start" for the Latter—Turning Over—Squeezing Down—Various Meshes—Guiding Boards—The Slides.

The salient points connected with Mr. Bellamy's crimping machine consisted of the use of pairs of cog wheels, fixed after the manner shown in Figs. 19 and 20. A coil of wire was supported by the "swift" (described previously) facing the edge of the machine, the worker traversing the length of the shop, pulling the remainder of the wire behind him, which was finally cut up into the required lengths. The "crimps" were regulated according to the size of the wheels and the cogs thereof, and the distance apart from each other that they were fixed. In Fig. 19 the wheels are shown at a certain proximity to each other, and therein is also noted the crimps of the wire as a result of its being drawn through the wheels; while in Fig. 20 are shown the same sized wheels, but with larger cogs, and the same sized wire represented as passing between them, the result, in the latter case, being a longer crimp. If the crimps, however, are deeper or shallower than a certain limit, it will be impossible to place the wires together so that they may hold themselves properly. The wheels are so regulated as to be adjustable to various degrees of distance from each other, for the reason that allowance must be made for the various gauges of wire to be crimped between them as previously explained.

The Mr. Bellamy who carries on the wire trade in London, concerning whom I may be permitted to say a few words later on, has improved upon his father's ideas; but as the patent has been long expired, I cannot consider myself justified in giving either explanatory details or drawings of his improvements; nor, indeed, of seeking his permission to do so, for, were I to adopt the latter course, I feel sure he would, as a friend, hardly refuse, and my conscience then would accuse me of having taken a mean advantage of our mutual acquaintance.

"Putting together" is the technical term for crossing the wires over and under one another. The wires have to be cut into the required lengths by means of the shears, preparatory to being "put together." In commencing, one wire is placed across the bench as in Fig. 21, A. Another is then placed across it *at one end*, as in Fig. 22, B. Still further, a third, C, is fixed across in the same direction as, and exactly parallel to, the first, A. Here care must be exercised in order that the end of the third wire shall be level with the ends of the first and second wires—that is to say, when the wires are all "put together," the tops and bottoms of them shall in each case follow an imaginary straight line.

The fourth wire, D, is next put across in an exactly parallel line to B (Fig. 24). This method is continued until sufficient wires are placed over and under each other to assume an appearance similar to that presented by Fig. 25. This completes what is called the "start."

The usual practice is to place a weight of some sort upon the "start." The "putting together" can then be continued from either end—there is no necessity whatever to work at both sides alternately when the "start" has been completed—until sufficient length has been obtained. The workman can, if he has sufficient wire, make, by these means, dozens of yards of fencing in a comparatively short space of time.

My earnest advice to anyone who thinks he may wish to use this kind of work for some purpose or another is, unless he makes sufficient at the beginning, to always keep the "start" by him. When he has completed a length to suit himself, he should undo from the remainder the wires which constitute the "start," and lay them by for another time. It apparently appears a comparatively easy and simple matter to make the "start," but, in truth, this is a very difficult affair indeed—the continuance of "putting together" is decidedly very easy labour when considered in connection with "putting together" the "start."

Fig. 26 shows a section of crimped wires when "put together," and from this diagram it should be plainly comprehended how each wire crosses over and under its companions. It is essential, when making the "start," to

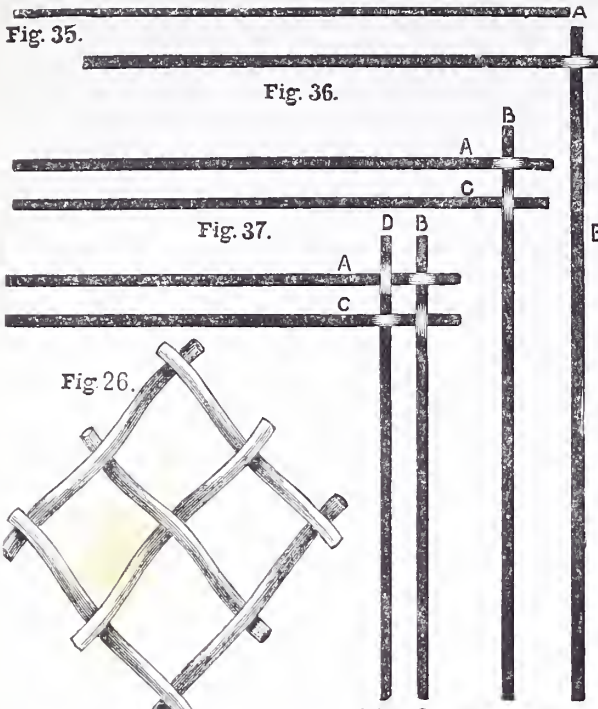



Fig. 35.

Fig. 36.

Fig. 37.

Fig. 38



Fig. 26.

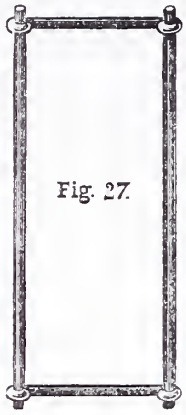


Fig. 27.

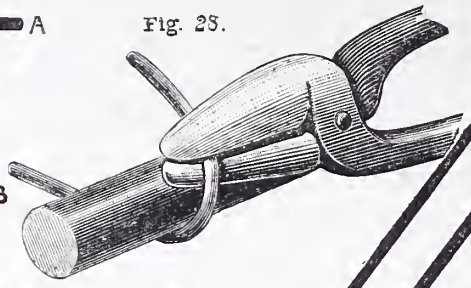


Fig. 28.

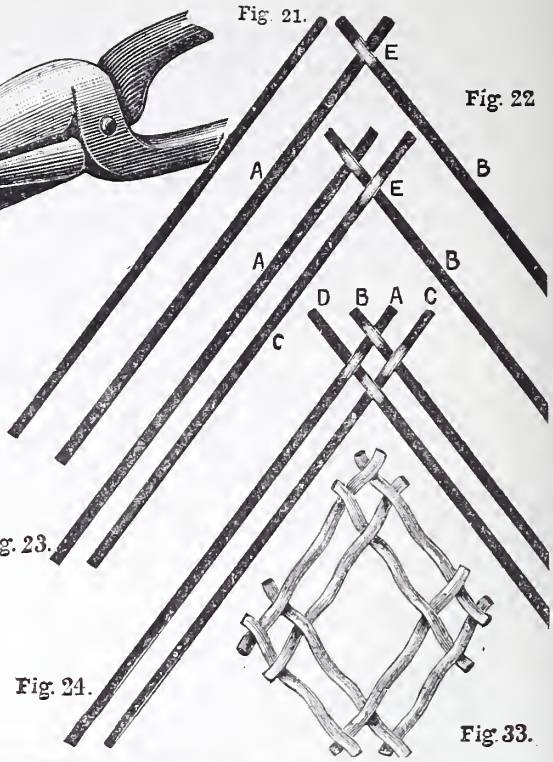



Fig. 21.

Fig. 22

Fig. 23.

Fig. 24.



Fig. 33.

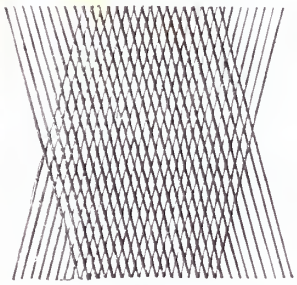


Fig. 31.

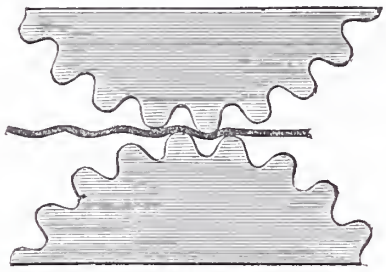


Fig. 19.

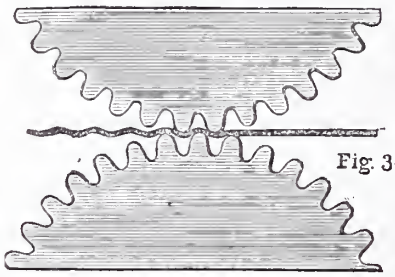


Fig. 20.

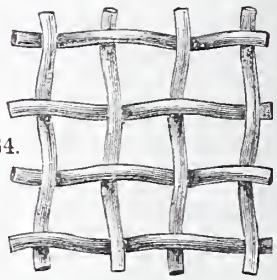


Fig. 34.

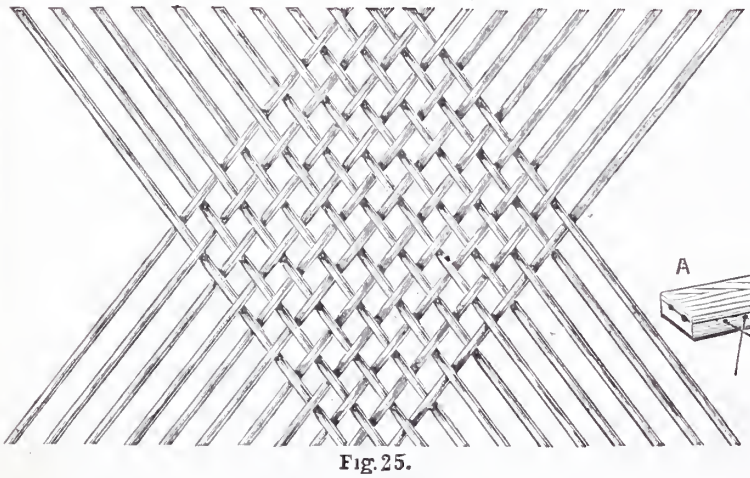


Fig. 25.

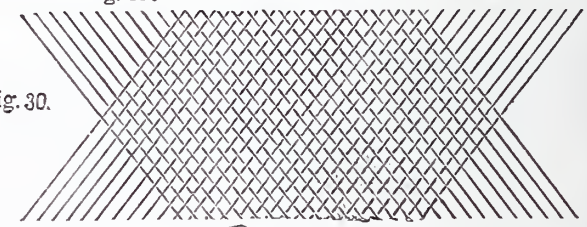


Fig. 30.

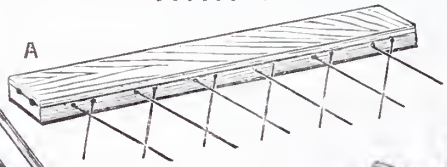



Fig. 39.

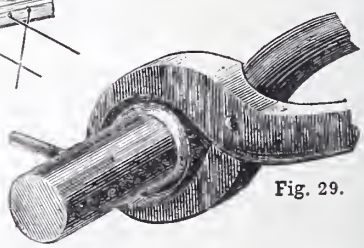


Fig. 29.

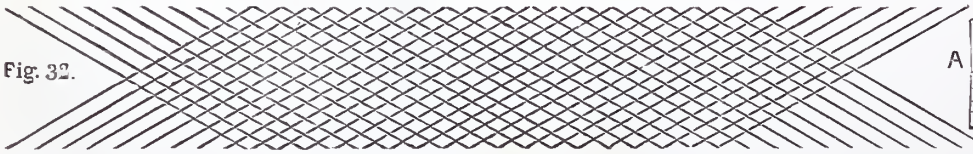


Fig. 32.

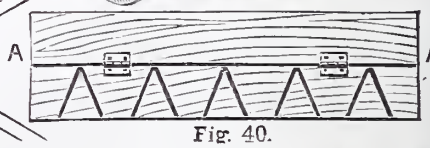



Fig. 40.

Figs. 19, 20.—Diagrams showing how Wires are crimped. Figs. 21, 22, 23, 24.—Diagrams showing Methods of "Putting together." Fig. 25.—The "Start," a Result of the Continuation of "Putting together," as in Figs. 21, 22, 23, 24. Fig. 26.—Section of Crimped Wire Mesh. Fig. 27.—A Frame. Fig. 28.—"Turning Over." Fig. 29.—"Squeezing Down." Figs. 30, 31, 32.—Diagrams showing how a Number of Wires when put together can be lengthened or shortened in Distance bodily. Figs. 33, 34.—Two more Forms of Crimped Wire Meshes. Figs. 35, 36, 37, 38.—Method of putting together Square Meshes; it is preferable to work from the Reverse Position to that in which the Wires are here placed. Figs. 39, 40.—Guiding Boards: Wires supposed to be crimped, but shown straight to avoid confusion.

allow the wires to project a distance beyond the points at which they cross each other (E, Fig. 22). The reason for doing this is that there shall be sufficient length to enable the worker to "turn over" the wires—*i.e.*, when the put-together piece is attached to a frame, the parts of the wires which come in contact with the frame (Fig. 27) should be bent over it by means of the pliers (Fig. 28).

When attaching the wires to a frame, temporarily secure them by "turning over" a wire here and there on each side. Then turn each wire up and partly over in consecutive order, and clip off, by means of the nippers, what may be considered superfluous. Finally, "squeeze down" each wire with the aid of the nippers or pliers, whichever may be considered the most convenient method. The use of the nippers for this latter part of the work will be found to be the best for the larger sort, but the pliers are to be preferred for the smaller descriptions. Fig. 29 represents "squeezing down."

It will be noticed that when crimped wires are put together they are capable of being stretched bodily to a great length and also closed together. The best illustration to name to most appropriately explain this stretching and diminishing is to allude to the groundwork upon which we remember to have been pleased, in our younger days, to have fixed imposing wooden soldiers, and of which the same idea is made use of extensively in connection with window blinds, etc. Fig. 30 shows a number of wires as when first "put together," and Fig. 32 the same wires when stretched, or, more properly speaking, extended; while Fig. 31 gives an idea of the same when closed together.

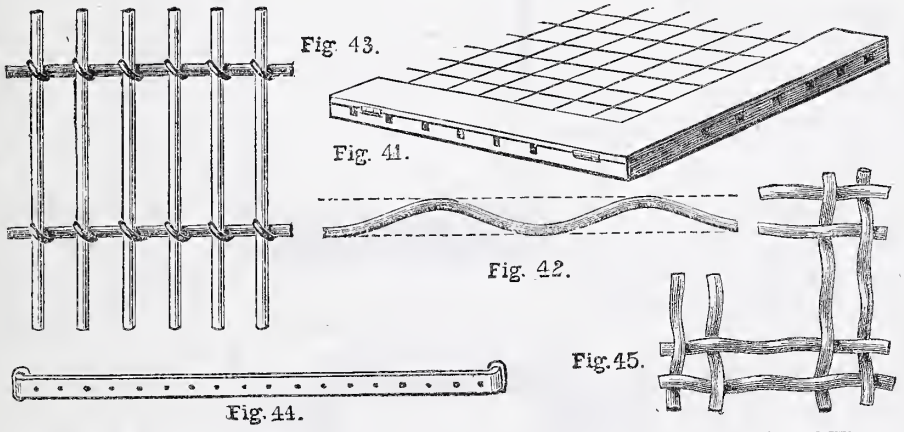


Fig. 41.—Guiding Board, Wire Straight instead of Curved. Fig. 42.—Section of Crimped Wire to explain use of Guiding Boards in Figs. 39 and 41; Fig. 40 is a Plan (open) of Fig. 39. Fig. 43.—Section of Laced Work. Fig. 44.—"Slide" used in making Mesh, shown in Fig. 43. Fig. 45.—Another Pattern for Interlacing Crimped Wires.

Sometimes the wires are fixed "two-and-two," as in Fig. 33. To do this, when the first and second wires are laid across each other, another wire has to be placed, in each case, on the outside of them, parallel, as in Fig. 24; the work is then continued in a similar manner as in the single wire mesh, allowing two or more crimps to intervene alternately.

Another mesh is the square one shown in Fig. 34. The only difference between the construction of this and the diamond mesh consists in the laying of the wires at right angles across one another, as shown in the progressive diagrams, Figs. 35 to 38, they being placed over and under each other in the same way as those composing the diamond mesh.

Sometimes "guiding boards" are used to assist in "putting together," but my practical friend does not advise their adoption, as they are sometimes rather awkward to handle, and when the worker has learnt to "put together" wires by their aid, he will wish he had striven to perform the work without any such assistance on the part of accessories, as the time occupied by a man in constructing a piece of work by these means will be far in excess of the time occupied by a workman in making the same sized portion by merely trusting to his dexterity of hand, without any "guiding boards." But these things may be considered by some to contain a mite of usefulness, so I must take this reason as my excuse for proceeding with a brief description of them.

In Fig. 39 is shown a section of one for use in connection with the diamond mesh. It is merely two boards, an inch or so in width, of a length considered desirable, and about ½ in. thick, together, with holes bored through it in the manner shown in Fig. 40. They would be hinged together, and secured with a hook and eye at each end. The wires are placed through this from the side marked A, either in the order already described—*i.e.*, across each other progressively—or else one set of parallel wires fixed first, and then the cross wires connected with them in the opposite direction. For the square meshes, a rectangular board, as shown in Fig. 41, could be used, also hinged, and with hooks attached to the ends.

The holes in these guiding boards should be, in width, the same as the gauge of the wire; but they should be in depth just sufficient to receive the crimps of the wires; by this I mean that the space occupied by the crimping, as indicated in Fig. 42 by the dotted lines, should be the same as the depth of the holes (Fig. 41), in order that the wires may be held in their proper position, instead of the crimps laying upon their sides, as they are apt to when being "put together" in the usual manner.

An extensively-used mesh is that shown in Fig. 43. The wires forming it are "put together" by the humble aid of an accessory which rejoices in the appellation of "slide." This appliance, I must say, is a very handy one, and its use is, contrary to that of the guiding boards, recommended. It is a very simple affair, and a sketch of it is given in Fig. 44. It is but a strip of metal or wood, with holes through it, and is secured to the bench. In "putting together" a piece of work of the pattern shown in Fig. 45, the long wires are placed through the slide, allowing the front ends of them to project for a short distance, and to them, at this part, is temporarily fastened a cross wire, which latter is finally laced to the long wires. The latter are then drawn partly through the slide, and cross wires laced at equidistant and, of course, parallel points to the first. When the first cross wire has been fastened, proceeding with the work is almost the same as if the wires were in a frame, for the opposite ends to those to which the first cross wire is laced being in the "slide," they are there restrained from closing together, or otherwise becoming inconvenient to handle.

It is a usual practice, with this description of work, to lace the alternate wires in an opposite way to the others, *i.e.*, the first, third, fifth, and so on, would be laced from left to right, whilst the second, fourth, sixth, etc., would be secured by the lacing wire travelling from right to left. Sometimes the middle one or two only, according to whether an odd or even number of cross wires are used, are laced in a reverse direction.

I said, a short while ago, that perhaps I should be permitted to say a few words concerning Mr. Bellamy, one of the sons of the inventor of crimped wire.

My many readers must certainly recall the fact, now I come to mention it, that in my numerous contributions to WORK during the past, I have never recommended or made allusions to anyone by name. This was not on account of my not wishing to do so, but for the sole reason that I was entirely ignorant of, and unacquainted with, anybody connected with wood-work who was worthy of more consideration than his fellows in that craft or trade. I do not mean to say that I do not know any good workmen, for I should be telling an untruth were I to declare so; for my trade acquaintances consist of both good and bad workmen—although I believe honestly that the majority of them belong to the former class. They are good "workmen," and good "men" without the "work"; and I must add, that although I think they are good men *without* the "work," I also think, paradoxically, perhaps, that they are *better* men *with* the WORK. Therefore, if recommendations were due to one, they were likewise due to the remainder; and to name the whole was entirely out of the question.

But, with regard to wire-work, I am placed in a different position, for I am only acquainted with the family of Bellamy and the workpeople whom they employ; therefore, I deem it not out of place to mention his address. I do not promise that he *will* satisfy everyone, nor do I say that he will satisfy *anyone*; but I *do* say that my belief is, that anyone and everyone who may apply to him will not meet with disappointment.

This is meant for those who may wish for any articles made in wire, and who do not care to construct them personally. His address is 40, Penton Place, Pentonville, London, N. I do not know that he would supply crimped wire in small quantities, but I have no hesitation in saying that reasonably large quantities would be attended to. It does not require an abundance of intelligence to understand this. In a shop where several people are at work, there is a chance of their time being lost, to a certain degree, if they are called from a large job to perform comparatively small ones.

The same with finished articles; if but one or two are required, I may advise the reader to communicate with me through

the Editor (with his permission), and I will see what I can do through the influence of a relative of Mr. Bellamy, who is in his employ, and who is always willing and ready to do a little "overtime."

Of course, straight wire can be obtained from several places; and, indeed, I do not think that any wire-worker, who may be in the same locality as where the reader may chance to reside, would refuse to supply him with crimped wire, for every wire-worker must have a crimping machine; the only difference being that that belonging to Mr. Bellamy contains a few improvements upon the others capable of saving his and his workpeople's time to a certain extent. But I see no reason why any reader should not "knock up" a pair of wheels to answer the purpose. In a former paper, I have given what I consider to be a sufficient description of the crimping machine.

## A SIMPLE BRACKET FROM SOUTH KENSINGTON MUSEUM.

BY URQUHART ARNOLD.

Small Things at South Kensington Museum—Art Work—Plain Bracket—Decoration of Bracket.

The remark that there are many wonderful things in the Museum at South Kensington may seem on an equality for triteness with that of the philosopher who assured his audience that he "admired Shakespeare's works because there was a good deal in them." Of course, we all know that nowhere in this country, at any rate, if in any other, are there so many art treasures collected together as at South Kensington. Naturally I take, perhaps, more interest in the wood-work there than in anything else, and, no doubt, so do many of the readers of Work; but I could not help thinking, as I was mooning away a few hours—as I am very fond of doing when I have an idle evening in London—that one sometimes misses many a lesson by neglecting the comparatively unimportant objects. I was started on this train of thought by noticing a small bracket something like that shown by Fig. 1. I only jotted it down roughly on a scrap of paper, and the drawing is principally from memory. It is such a very simple thing that it might appear to be too insignificant to say anything about it, and being from memory, as said, it may not adequately represent the original. It is, however, just on account of its simplicity that it is worthy of some notice; for we are rather too apt to exclusively devote our attention to the great masterpieces of work—such, for instance, as the Boule wardrobe in the Jones collection—instead of keeping our eyes open all round.

The bracket which occasions these remarks has not even the merit of being "very old"—a qualification which to many seems a necessity if a piece of art work is to be admired; neither is it costly, so that there is nothing, apparently, about it which distinguishes it in any way, or places it above the lowest level of mediocrity. That it is unique I do not say. It is even commonplace, if you like to call it so—nothing more than the application of artistic principles in the production of an ordinary little bracket, which can be made by any joiner with the commonest tools from a few bits of pine boarding.

When we talk of art work, or the production of anything artistic, are we not rather inclined to conjure up visions of æsthetic (I use the word in its popular or derisive sense) looking individuals, with sad-coloured garments, and a general air of unconth angularity, mentally struggling to bring forth something fearfully and wonderfully devised? I do not say anything new when I say that the simplest thing may, and ought to be, a piece of art work in the widest acceptation of the term. Decoration is not, in itself, a necessary feature of art workmanship. Lavish ornamentation is apt to be anything but artistic, unless applied with skill, which all of us do not possess. On the other hand, by due attention, most of us can produce things which, if not in the highest form of art, as applied to our several crafts, shall yet be artistic and true. My conception of art may be different from yours, but I hold that any article, if it be designed with due regard to its intended purpose, and be carefully made, is in the truest sense a work of art—I do not say a great work of art—and worthy of regard. The little bracket, I venture to think, fulfils these conditions. A bracket is to support something. Is not this one evidently designed to do so? Is it well made? The answer depends on the worker. If he is careless with the work it will not be.

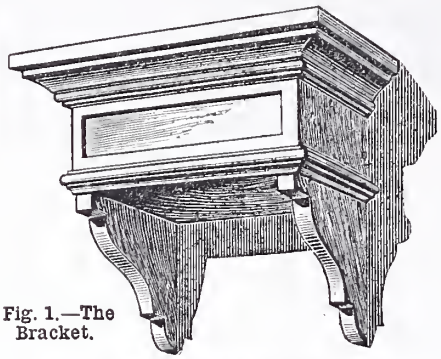


Fig. 1.—The Bracket.

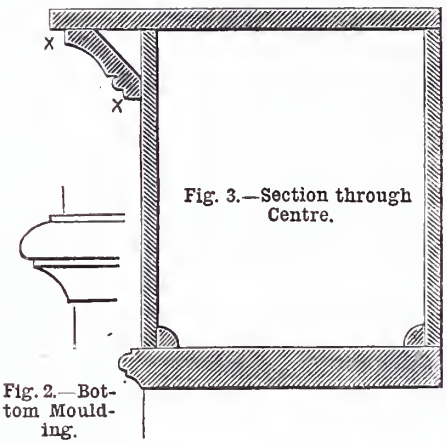



Fig. 3.—Section through Centre.

Fig. 2.—Bottom Moulding.

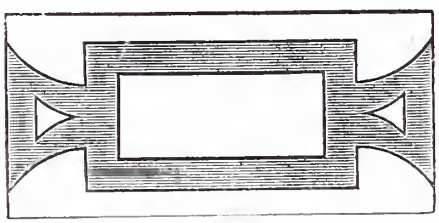


Fig. 4.—Gilding on Front.

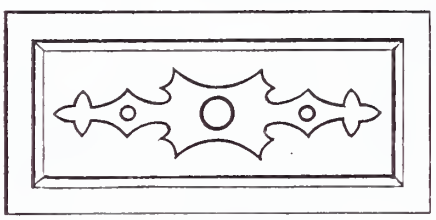


Fig. 5.—Suggestion for Inlay.

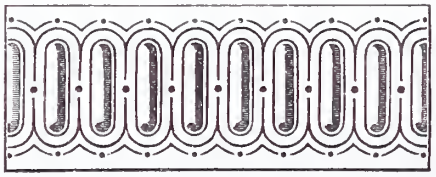


Fig. 6.—Suggestion for Carving.

Now I have done with my little homily on art, and we may turn to the actual making of the bracket, or rather, give a few hints about it. The construction is so simple that any boy almost could manage it; so that those who aspire to work in wood but do not know how, or have not the skill nor the tools to do anything big, may succeed with it. If they like to decorate the bracket afterwards, there is no reason why they should not do so.

Now, I do not pretend to say that the bracket in the Museum is made in the way I am about to suggest—I have had no opportunity of examining its construction, so that I cannot tell what it is—but there is no reason to suppose that it differs widely from that suggested here. The size, also, is a matter of secondary importance, for that can be altered or arranged to suit the requirements of the user. As shown in Fig. 1, the bracket is oblong on top, but there is no reason why it should not be square if that shape suits better.

The first thing will be to make a box, minus top and bottom, of, let us say, ½ in. stuff. On front and two ends of the upper part of this, plant a simple moulding, mitred at the corners. The bottom of the box extends beyond the front and ends, and is moulded at these edges, as shown in Fig. 2. On a line with the ends of the box, brackets are to be screwed, or otherwise fastened, to the lower side of the bottom, to which the box may be fastened from above with blocks of wood glued into the angles. The top may then be nailed on. If the appearance of the nail-heads be objected to, dowels may be used instead, and, by being inserted in the ends first, need not come through. An alternative plan is to make the part I have called the box without back, and then to fasten the top on with blocks, as suggested for the bottom.

Fig. 3 represents the construction in section from back to front, and is so clear that comment is superfluous.

The bracket will look well finished in almost any way; but it may be interesting to state that the original is black, relieved with gilt lines on the parts marked × in Fig. 3. The front of the box also has gilt lines instead of a panel, as indicated in Fig. 1.

Another bracket (there are several of them of the same design, but varying in size) has the front of the box part decorated with gilded lines, as shown in Fig. 4, which at once suggests that a piece of overlaid fret of the same pattern may be used, the corners being mitred for the sake of neatness. A small inlay of bold design, and surrounded by a neat moulding, would also look well, and it is needless to say that if the front is carved, as it easily may be, in a suitable style, the value of the bracket will be increased.

As suggestions for what may be considered appropriate, without entailing much or difficult work, Figs. 5 and 6 are given for inlay and carving respectively.

Alterations and variations from the

original might be suggested at almost indefinite length, till by the process of evolution something totally different in style and design results. It would be interesting to illustrate this; but as there are other subjects besides wood-working which require the space which would be occupied in doing so, and enough has probably been said to enable those who wish to contrive for themselves, I must—at any rate, for the present—take leave of the unpretending little South Kensington bracket.

## TO PREPARE FRESH-BURNED CHARCOAL IN SMALL QUANTITIES.

BY E. W.

General Observations—How to Make—The Wood to Use—Culinary Uses.

*General Observations.*—Although charcoal is cheap, and everybody that has frequent need to use it may avoid a complete exhaustion of their stock by a timely renewal, yet it will not unfrequently happen that many, especially amateurs, who only occasionally have any use for such, cannot so conveniently get it in the time of need as could be desired. Perhaps only a small quantity is wanted for some special purpose; it may be for a small job at brazing, or perhaps a supply of fresh-prepared carbon for chemical purposes. In cases like these it will often be far better to make than to buy.

*How to Make.*—If there is clay at hand, and a thin coating placed around a piece of wood, a small puncture hole being left for the escape of steam and gases, and the whole placed in a good fire, the wood will quickly become charred, but not consumed, and when taken from the fire separates readily from the burnt clay. It is desirable, however, when time permits, to let the clay dry slowly before burning.

A better arrangement is to place the wood inside a tin box or canister that is provided with a lid. With a bradawl or nail, punch a hole as vent, and burn. These tins are now lumber in every household, and a few usually find their way into every workshop and amateur's laboratory. Mustard, coffee, cocoa, paints, and innumerable other articles of every-day use, are now sold in such tins, and I apprehend that no one within touch of civilisation would have the slightest difficulty, if occasion required, in collecting a cartload of such discarded tins in a very short space of time. The paths trod by the pioneers of civilisation across the vast prairie lands of America are distinctly marked by the presence of such, and far in the depths of the Australian bush have I seen the camping grounds of carriers and travellers strewn with the rejected empties. For our purpose, those tins that are connected at the side and bottom by welt-seam joints are preferable to those that are soldered.

*The Wood to Use.*—A non-resinous wood is best, and oak is as good as any. It is advisable to have the wood as small as the purpose for which it is required will permit; and a close fire, as that of a kitchener, is better than an open one, as the heat is more intense.

*Culinary Uses.*—Housewives and cooks, who know the value of charcoal for culinary purposes, are also likely to find this useful in connection with the preparations of the kitchen.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Hitches and Bends.

Two Half Hitches—Builder's Knot—Double Builder's Knot—Timber Hitch—Killick Hitch—Magnus Hitch—Fisherman's Bend—Rolling Hitch—Topsail Halliard Bend—Racking Hitch—Slippery Hitch—Carrick Bend—Sheet Bends—Blackwall Hitch—Midshipman's Hitch—Marlinespike Hitch—Regulating Lashing—Stationers' Knot.

We now come to a somewhat different class of fastenings, though it is very difficult to discover where knots end and bends and hitches begin; indeed, a tie that, under certain circumstances and made a particular way, is called a "knot," differently constructed, and under dissimilar conditions, is called a "bend" or "hitch," though the result is the same in both cases. As an illustration of what I have been saying, we may take two half hitches (Fig. 25), which, if made in another way round a pole, is called a "Builder's Knot." If my readers will analyse the knots I shall set before them, they will find several other similar instances occurring amongst them. A, Fig. 25, is a single hitch: it is merely a loop formed in a rope. This is readily done by holding the rope in the left hand, and giving it a twist with the right; the loop then forms itself, as it were. When a tightly laid piece of cordage is twisted, these loops are apt to arise of their own accord; they are then called "kinks." They are very objectionable, as the cord is sure to part at the kink when a strain is put on it. It is still worse in the case of wire, which breaks readily when once kinked. Tight, hard cordage should always be well stretched before it is used, to avoid kinking. Two half hitches (Fig. 25) form a very useful knot for a great variety of purposes, as they are very quickly made, and will not slip, no matter what strain is put upon them—indeed, the more they are hauled upon the faster they hold. There is no better or easier way of making a rope fast to a hook. First one hitch is slipped on, and then the other on the top of it, and the rope is fast in less than a couple of seconds. This knot is used by surgeons in reducing a dislocation of the thumb joint. Fig. 26 is the builder's knot, which, as said before, is merely two half hitches, but as it is used in places where it is impossible to pass the hitches over the ends of the timber, it is made by holding one end in the left hand, passing the rope round the pole, under the end, round the pole again, above the first part, and under its own part; from its non-liability to slip laterally this knot is always used to fasten one pole to another in fitting up scaffolding, from which circumstance it has acquired its name. If, instead of making the commencement of the knot as shown in Fig. 26, we pass the end, after it has gone round the pole, two or three times round the other part, as in Fig. 2 (page 65), the remainder of the knot is rather more readily made, as it holds itself taut, and will not slip while the end is put round to complete the fastening.

A "Double Builder's Knot" is made the same way exactly as the builder's knot, but the end goes round again, as before, and underneath its own part. This makes it much stronger. When a builder's knot is made on a rope for the purpose of securing a small line to a stout rope, it is called a "clove hitch."

The "Timber Hitch," Fig. 27, is a rough and ready way of securing a piece of timber or any similar thing, and comes in handy on a great many occasions. It is made by bringing the end of a rope round the timber, then round the standing part, and then, taking two or more turns, round its own part. The pressure of the coils one over the other holds the timber very securely, and the more it is hauled on, the tighter it holds. It can also be cast off very readily.

Fig. 28 is a modification of the timber hitch, called the "Killick Hitch." It is much used to fasten a stone to the end of a rope. After making a timber hitch and hauling it taut, a single hitch is made, and slipped over the end of the stone alongside of it. Some of the best fishing grounds are on rocky coasts where an anchor would not hold; and if it did, there might be considerable risk of losing it altogether, from its jamming in the crevices of a rock. In these places a killick, or large stone, slung as shown in Fig. 28, is used, which holds the boat by its own weight, without any risk of getting fast to the ground.

Fig. 29 is a "Magnus Hitch," a good strong method of securing a rope to a spar, as there is little tendency to slip endways along the spar. In making it, take the end of the rope twice round the spar, in front of the standing part, round the spar again, and then through the last bight.

The "Fisherman's Bend," Fig. 30, consists of two round turns round a spar, and a half hitch round the standing part, and through the turns on the spar, and another half hitch above it, round the standing part. It is used for bending studdingsail halyards to the yard, and, in yachts, for bending on the gaff topsail halliards.

A "Rolling Hitch," Fig. 31, is made by taking three round turns round a spar, and then making two half hitches round the standing part of the rope, and hauling taut.

The "Topsail Halliard Bend," Fig. 32, is another bend, used chiefly on board yachts. It is made by bringing the rope twice round the spar, then bringing it back round the standing part, under all the turns, over two turns, and under the last. This hitch is shown open for the sake of clearness, but in practice we jam the coils close together, and haul them all taut.

Fig. 33 is a "Racking Hitch," for hitching a rope on to the hook of a block. Make two bights in a rope, and turn the bights over from you two or three times, and put the two loops on to the hook. This is sometimes called a "cat's paw."

Fig. 34 is a "Slippery Hitch," the value of which consists in the readiness with which it can be cast off in case of emergency; at the same time, it holds securely while there is a strain on the rope A. If the mainsheet of small boats is made fast at all, which is always a more or less risky thing to do, a slippery hitch should always be used as a start. A sharp pull at the end of the rope lets the sheet go at once.

Fig. 35 is the "Carrick Bend." Lay the end of a rope over the standing part, thus forming a loop; then take the end of another rope, and put it under the bight over the standing part at A, under the end at B, over the rope again at C, under its own part, and over the rope B, and haul taut. The parts A and B form the first loop made. This is generally used for binding hawsers together, to increase their length to warp or tow with. This method of binding ropes together has the great advantage of being readily undone without the aid of a pricker or marlinespike, which would have to be used for many knots, after they had been in the

water. As in the sailor's knot, we have but to grasp the ropes just outside the knot, and push the loops inwards, and the knot comes adrift at once.

Fig. 36 shows the clew of a sail, and the round the back of it, under its own part, and over the clew again. The end is generally stopped to the standing part with rope yarn or other small stuff. The knot thus formed is exactly the same as the weaver's knot, Fig. 10 cated method of bending a rope on to a loop; B is the standing part, and A the end of the rope to be bent on a loop already formed. Pass the end down through the loop, round over its own part, and through the loop,

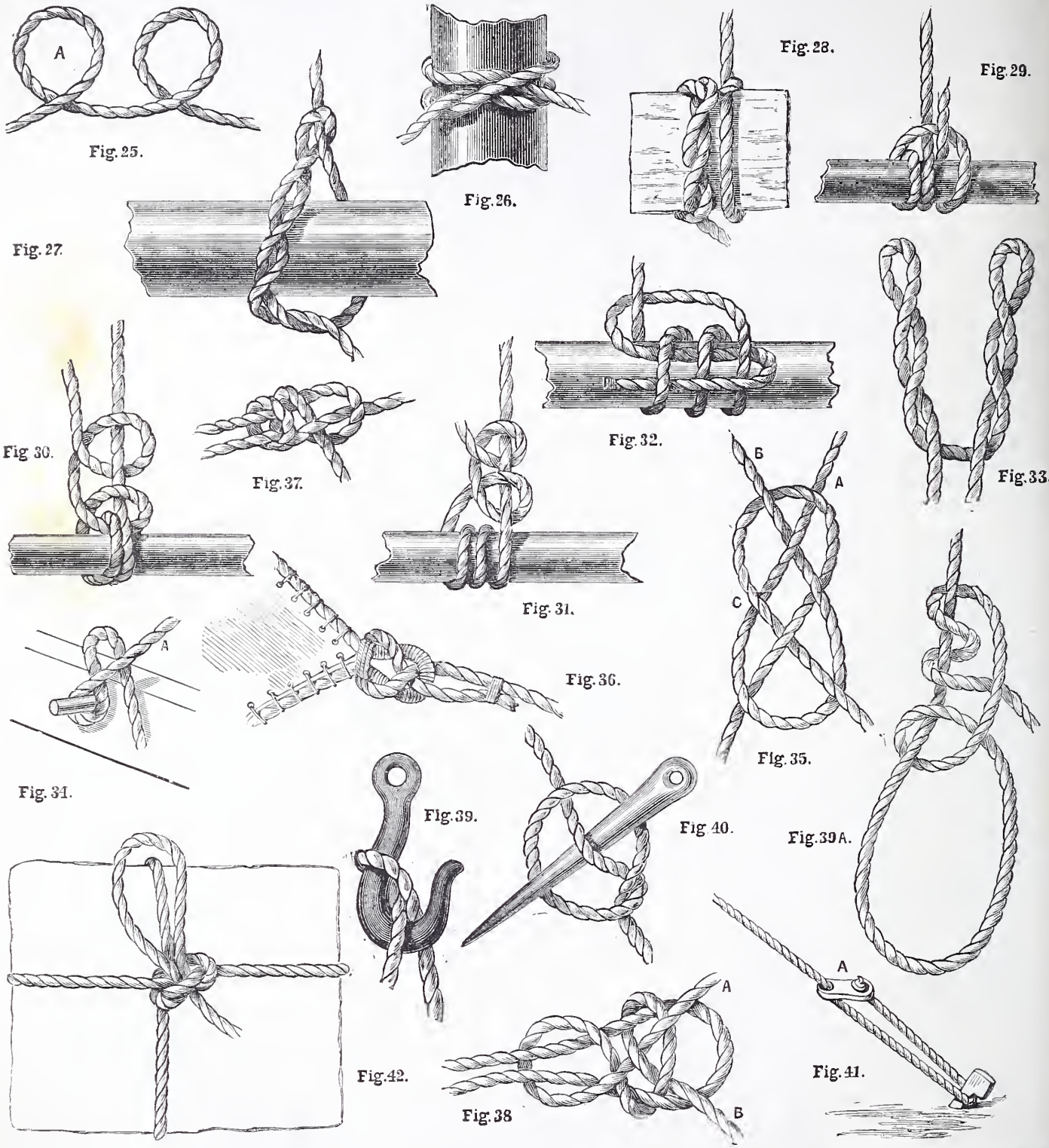



Fig. 25.—Two Half Hitches. Fig. 26.—Builder's Knot and Double Ditto. Fig. 27.—Timber Hitch. Fig. 28.—Killick Hitch. Fig. 29.—Magnus Hitch. Fig. 30.—Fisherman's Bend. Fig. 31.—Rolling Hitch. Fig. 32.—Topsail Halliard Bend. Fig. 33.—Racking Hitch. Fig. 34.—Slippery Hitch. Fig. 35.—Carrick Bend. Figs. 36, 37, 38.—Sheet Bends. Fig. 39.—Blackwall Hitch. Fig. 39 A.—Midshipman's Hitch. Fig. 40.—Marlinespike Hitch. Fig. 41.—Regulating Lashing. Fig. 42.—Stationer's Knot.

method of bending the sheet on to it. This is termed a "Sheet Bend." The sheet is not, as some of my readers might fancy, a part of the sail, but is a rope used in setting a sail, to keep the clew or lower corner of the sail down to its place. In making a sheet bend, the end is passed up through the clew, (page 65). Fig. 37 shows a method of giving additional security to this knot. This is done by passing the end twice round the back of the loop before putting it under its own part. This knot is very much used by fishermen in bending a line on to a loop of gut. Fig. 38 gives another and somewhat more compli- round the back of it, and through its own bight. When hauled taut, this holds more securely than either of the other methods, but, on the other hand, takes longer to make.

The "Blackwall Hitch," Fig. 39, is a ready way of temporarily securing a rope to a

hook. The way of making it is evident from the illustration. As the standing part when hauled upon jams the end against the back of the hook, it holds much more firmly than would be supposed at first sight.

The "Midshipman's Hitch" is an old-fashioned hitch, used for attaching a tail-block to a rope. A round turn is first made over the standing part, and the end is brought up, passed twice round above the first hitch, and then passed out underneath its own part.

The "Marlinespike Hitch," Fig. 40, is used for getting a purchase on the seizing stuff when serving a rope, so as to leave the turns taut. Make a bight in the seizing stuff, and bring it back over the standing part; pass the marlinespike under the standing part, and over the sides of the bight. This is practically identical with the running knot, Fig. 15 (page 137).

Fig. 41 is a "Regulating Lashing," used when the tension of a rope requires altering from time to time. Tent ropes are secured this way, as they require easing in wet weather, and tightening in dry. This is readily effected by slipping the piece of wood A upwards or downwards along the cord, the friction of the cord against the sides of the hole fixing it sufficiently.

The "Stationers' Knot," Fig. 42, is very handy for tieing up a parcel, as it can be made very rapidly, and undone with great ease. Make a running noose at the end of a piece of twine, and bring it to the centre of the parcel; take the twine round the parcel again at right angles, round the noose, and making a bight, slip it under, as shown in the figure. A pull at the end releases the knot instantly, as will be found on making the experiment.

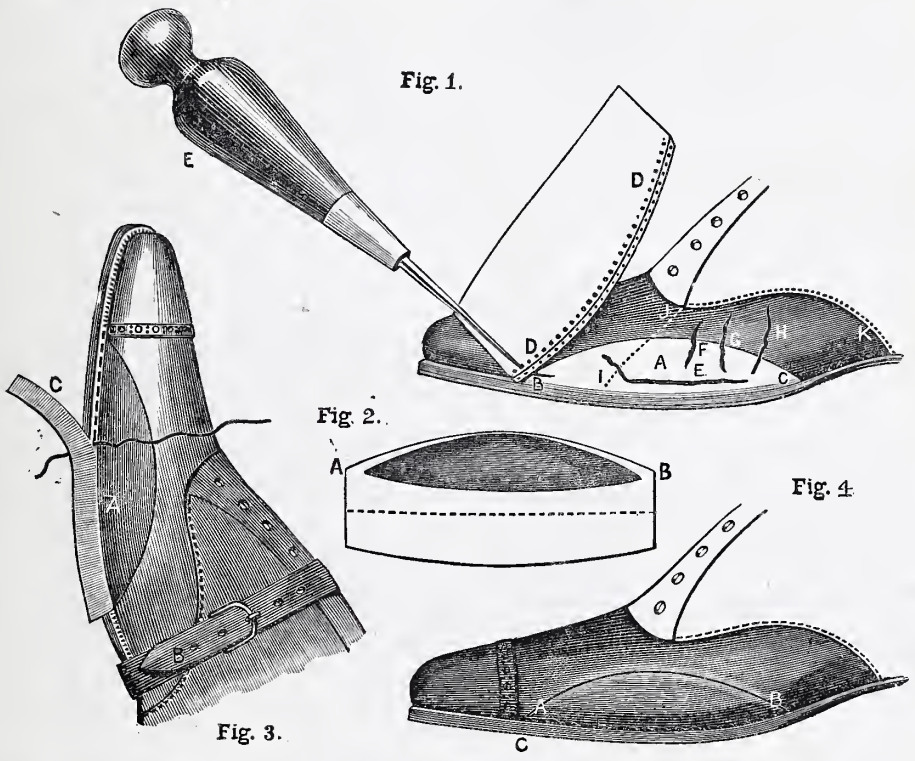



Fig. 1. Fig. 2. Fig. 4. Fig. 3.

**Fig. 1.—Repairing Worn or Cracked Leather with Patch. Fig. 2.—New Piece of Leather. Fig. 3.—Mode of tucking Patch into Crevice. Fig. 4.—Mode of sewing of Patch.**

## BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

### PATCHING.

HOW TO CLOSE IN A PATCH, WITH THE SEAM INSIDE, AND THE WAY TO FASTEN IT DOWN TO THE SOLE.

Now it often happens that when a pair of boots or shoes want soling and heeling (and sometimes before), the uppers want some repairing, such as stitching or patching. I shall, therefore, in this and the following paper give some of the principal methods of repairing such defects, with the way also of fastening such patches as need it down to the sole.

If the boot wants a patch, and does not need soling, it can be fastened down to the sole by sewing, as I shall soon describe; but if the boot has to be soled (and it is not hand-sewn), the sole (or welt, as the underneath sole is termed in machine-sewn) can be prised from the upper as far as the patch is coming to, and the patch tucked under, as the original leather is; and when it is smooth, with no foulness, the under sole can be tacked down with a few small tacks, to secure it till the sole is put on, when a few longer rivets (say, every other one at this part) than those you are using to nail the sole on with will make it as solid as it was at first.

One of the neatest and solidest ways to put in a patch is to close it in. This is done by cutting away the whole of the worn or cracked part of the old leather, as shown at A, Fig. 1. The cut should not have more curve than is possible, for the straighter the cut (that is, from B to C), the easier the piece will be to sew in. In cutting out the piece, be careful not to cut the lining (for by doing so, you put an unnecessary strain on the piece, as then it has no protection from the weight of the body in wear), and at the bottom cut it away right close to the sole. Now take the piece you cut out, and lay it on a piece of new leather of good quality (if the old leather is calf, use calf again, or if it is horse, krup, or porpoise, use calf, but as near the substance as possible; for any other leather it should match, such as kid, patent, etc.), and cut the new piece full large to it, as shown by Fig. 2, of which it will need to be the full size, if it is to be tucked under; but if it is to be sewn down, it will only want to be as large as the dotted line. It will be noticed here that the new piece has not quite so much curve as the old. This is done to give a fulness to the piece equal to what the foot has made in the old leather. The cut from A to B must be even and smooth, and, on the wrong side, holes must be made, as D, D (Fig. 1). This is done by placing it face side down on a board, and about $\frac{1}{16}$th from the edge, make a hole with a closing awl, E (Fig. 1), letting the point come out in the edge of the piece, about four-fifths of the way through, or really as near the face as possible without going through. This you continue the whole way across, putting about fourteen stitches to the inch.

It can now be closed to the boot, first slightly wetting the edge of the old leather. Do not start to sew at quite the end of the new piece, or, when turned over, it will be deficient at the corner. The old leather must not be split, but the awl put right through, and near the edge, so as not to make a hard seam.

For calf or any stout leather, the thread (wax-end) will have to be made with three cords of fine flax, and have bristles on each end. The way to make threads I shall explain in due course. For kid, or any light leather, twist, or stoutish black-thread, will do; a tapered end to either of these is easily made by untwisting them for about an inch and a half, scraping them gently between the thumb and a blunt knife. Then wet or wax them, and twist them back, holding each one separately in the left hand about four inches down, and twist the end on the right knee with the right hand, not too hard, as you may twist off the fine taper that is wanted on to receive the bristle.

In stitching the patch (in fact, all stitching or sewing), each stitch should have the same tension put upon it, being, at the same time, very careful not to pull too hard on the stitch that is to lie on the old leather.

When you have sewn the patch right across, wet the edge again, and scrape off the rough edge, rub it down, and turn the patch down to its right side. Put a last inside, and rub the seam down lightly, but well, on the right side. This can be done with the handle of a table knife, or anything hard and smooth.

Should the vamp be cracked in several places, as E, F, G, and H (Fig. 1), then it will be best to put in a new wing. It can be closed in as described above, from I to J, and blind-stabbed from J to K. In a case like this, it is well to have the top edge a little larger all round, to hide the old holes, and it must be skived a little thinner at this part, about a $\frac{1}{4}$ in. wide, on the wrong side. After you have rubbed this kind of seam down (if it is not a leather that has the grain side out), it will make the seam much neater if it is lightly buffed, or scraped, across from A to B (Fig. 4), and then rubbed down again. In fact, if this sort of patch is put in well, it can scarcely be seen after it has been blacked with blacking.

Previous to sewing the patch down to the sole, the crevice under where the old piece was cut off must be slightly opened with

a chisel, or piece of tapered wood or bone, and the patch tucked in, as shown at A (Fig. 3). This is to enable you, in sewing the patch down, to get the stitches as far back and as much out of sight as possible.

For sewing it to the sole, a sewing awl must be used: it is similar to the closing awl, only a stouter and wider blade.

The thread for ordinary work will need to be about ten cord of No. 9 Patent (price, 2d. per ball), and the awl, although it has to carry the two ends, should only be the substance of one.

The boot will need to be put on the knees, patch side up, and if the piece is on the side shown in either of the above figures, it must lay on the lap, toe from you, as Fig. 3. It must be held very firm on the knees, by means of a strap or stout piece of cord being placed round it, as B (Fig. 3), and passing under the ball of your foot. By this means, it can be held as tight as you please by simply pressing down your toe.

The stitching must be started from A (Fig. 4), the point of the awl being put in on the welt side A, and pushed through to the bottom of the sole, wriggling it a little, that it may find (or make) its own way through at C.

The bristle on the left side is put in first (in all sewing, stitching, or stabbing), and the one on the right side put in underneath it, so that when the stitch is set, it shall be between the thread (on right side) and the patch. This will not only help to lay the stitch back, but, if borne in mind each time, will make the stitches look even and lay flat.

The stitching must, of course, be continued right across to B (Fig. 4), setting about five stitches to the inch, and well tucking the patch under before each stitch is taken.

This done, and the ends cut off, the stitches on the patch side must be rubbed down with the bone, and hammered down lightly with a hammer on the sole side. The surplus of the patch can now be cut off level to the edge of the sole, as shown at C (Fig. 3). The edge can be blacked with ink or blacking, and then rubbed down. A little weak paste on the patch will, if let dry, make it smooth to receive the blacking; and when the whole is blacked and polished, will not only be a neat, but a very solid seam.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 30.—Smith's Tables and Memoranda for Mechanics, Engineers, etc.

This useful little waistcoat-pocket *vade mecum* for all who are engaged in engineering and the building trades has reached its fifth edition. Its nature and contents may be easily inferred from its title, which, when given in full, runs thus: "Tables, Memoranda, and Calculated Results, for Mechanics, Engineers, Architects, Builders, Surveyors, etc." The matter that it contains was first selected and arranged by Mr. Francis Smith, to meet the daily requirements of men engaged in various mechanical trades some ten years ago; but, in order to keep pace with the advances of science in every direction, the original matter has been carefully revised and enlarged; and a new section has been added, comprising numerous electrical tables, formulæ, etc., which renders the book of special value to electrical engineers. Its price is 1s. 6d., and it is published by Messrs. Crosby Lockwood & Co., 7, Stationers' Hall Court, Ludgate Hill, London, E.C.

### 31.—Hartley & Co.'s "Kristaline" and New Cold Lacquers.

I have much pleasure in calling the attention of metal workers, photographers, and others to whom such specialities may be useful, to the excellent lacquers prepared and supplied by Messrs. J. E. Hartley & Co., Electricians and Electro-Metallurgists, St. Paul's Square, Birmingham. I received samples of these lacquers, and specimens of metals and photographs treated with them, some time ago; but I have purposely withheld my notice until lapse of time should bear its testimony to their endurance, and, therefore, to their commercial value and utility. The samples of lacquers to which I refer were one of a pyroxilin dip lacquer, called "Kristaline," by Messrs. Hartley & Co., and two others of "Improved Hard Cold Lacquers"—a transparent lacquer and a gold-colour lacquer, for application to metals when cold—small articles, when brushed with these preparations, being placed on a stove to dry, but larger things, too large, in fact, to be placed on a stove, being left to dry cold. The specimens sent were: (1) a piece of steel, part lacquered with cold *transparent* lacquer; (2) a piece of brass lacquered, part with cold *gold*, and part with cold *green bronze* lacquer; (3) a piece of brass, silver-plated, then lacquered with Kristaline on one half of it, and afterwards hung over sulphur fumes to show that they have no tarnishing effect on the lacquered part; and (4) a photograph on opal, coated with Kristaline, which protects the gelatine film, and allows of dust or dirt being wiped off with a damp cloth without injury to the photo. In reference to these, I may say that what is said of the photo. is correct in every particular, while the lacquered metals are as bright and untarnished as they were on the day they reached me, though the *unlacquered* portion of the steel shows specks and spots of rust, and that of the brass is dull and clouded.

With regard to the method of applying the lacquers, it is necessary to point out that, although the cold lacquers may be, and I may say should be, applied with the brush, the Kristaline cannot be brushed on work owing to the pyroxilin it contains. Articles to be treated with it must be *dipped* in it; and if the articles be too large to be dipped, the lacquer must be poured or ladled over them, as in this way a small quantity is sufficient for a very large article.

Messrs. Hartley & Co. claim for the pyroxilin lacquer Kristaline: (1) that it is practically indestructible, as neither gases, acid fumes, nor sea air affect it; (2) that it is waterproof; (3) that it is perfectly transparent; and (4) that it is absolutely colourless. For the cold lacquers they claim: (1) that they can be brushed on cold metal, and on the largest articles, with as much facility as on the smallest; (2) that they have more body than ordinary lacquers; (3) that they leave no brush-marks nor treacly appearance; (4) that they can be applied by others than skilled lacquerers; (5) that as there is no loss from evaporation, one gallon goes as far as two gallons applied with heat: and, as skilled lacquerers are unnecessary, they are far more economical than other lacquers; and (6) that they resist atmospheric action longer than other lacquers. Messrs. Hartley & Co. have submitted the names of leading firms by whom Kristaline is used for lacquering silver and gilt ware, gilt and silvered navy buttons, brass foundry and opal photos.; but these, for obvious reasons, I cannot insert, as the names are mentioned for my own information only. The cold lacquers are used generally by brass founders, chandelier makers, engineers, electricians, bicycle and tricycle makers, steel workers, range makers, and for large work, where lacquers applied with heat are wholly inapplicable. I feel sure that Messrs. Hartley's specialities in lacquers will be appreciated by those to whom they are as yet unknown, and who may be led by this notice to become practically acquainted with them—as fully appreciated, indeed, as they seem to be by all who already use them. Messrs. Hartley & Co. will, I am sure, readily forward to any applicant their price list, which will supply all information with reference to prices, and which contains a few remarks on the pyroxilin lacquer, and describes the method of application at greater length than I can do here.

### 32—"Geometric Turning Simplified."

Many readers of WORK are, I am inclined to think, enthusiasts in turning, and especially in the higher branches of the art. To such as these, if they are not already acquainted with it, I venture to recommend a thin octavo volume of sixty-two pages, entitled "Geometric Turning Simplified," written by Mr. W. H. Northcott, C.E., the well-known author of "Lathes and Turning," and published by Messrs. E. & F. N. Spon, 125, Strand, W.C. The price of the book I do not know, but information on this point may be easily obtained by application to the publishers, or to the London Lathe and Tool Company, 37, Pomeroy Street, New Cross, London, S.E., by whom all the apparatus to which reference is made in the volume is made. The object of the writer is to show how geometric and ornamental turning may be practised without the need of the expensive lathes and apparatus hitherto thought necessary; and, in fact, the work described is done by the aid of a simple instrument devised by the author, which permits the operator to practise geometric turning of several sorts in any light lathe, however simple its construction, and in any light milling machine. The work is profusely illustrated with engravings of the apparatus employed, and the patterns that may be produced, each pattern, from those of simple form to others most complex and intricate in appearance, being accompanied by a description of the position of the tool, and the manipulation required in order to produce it.

### 33.—Colours for Marbling Purposes.

The following is taken from "Instructions for the Use of Colours for Marbling Purposes," to produce colours for extra shades and tints, issued for their customers by Messrs. George Royle & Son, Bookbinders' Tool Cutters and Material Dealers, Manufacturers of Marbling Colours, etc., 6, Lovell's Court, Paternoster Row, London, E.C. To produce a single colour from an assortment—yellow and carmine or dark red produce *scarlet* or *vermilion;* carmine and blue, *deep lilac, violet*, and *purple;* carmine, yellow, and black, *rich brown;* yellow and black, *bronze green;* carmine and white, *pinks of any shade;* azure blue, white, and carmine, *deep tones of lilac;* violet and white, *pale lilac* or *lavender;* Chinese blue and white, *pale blue;* Chinese blue, indigo, and yellow orange, *any tone of emerald green;* pale yellow, chrome, and carmine, *amber;* burnt umber and scarlet lake, *red brown;* burnt sienna, shaded with lake, *light brown;* burnt sienna and orange, shaded with white, *salmon*. The following are combinations of colours which harmonise well—scarlet, red, and deep green; light blue and deep red; orange and violet; yellow and blue; black and light green; dark and light blue; carmine and emerald; red, yellow, and blue; orange, black, and light blue; light salmon, dark green, and scarlet; brown, light orange, and purple; dark brown, orange, yellow, and blue; crimson lake, green, yellow, and black; black, green, dark red, and sienna; scarlet, dark green, lavender, and black; azure blue, vermilion, light green, and lilac; sienna, blue, red, and black. In order to give the desired effect for marbling purposes, the finest colours are required. Messrs. Royle & Son supply in 1 lb. tins, at prices ranging from 2s. to 26s. per lb., the following assortment of colours: finest drop carmine lake, second carmine, common lake—light or dark, indigo, yellow, orange, Chinese blue, drop ivory black, indigo black, burnt umber, azure blue, sienna, dark and light green, ultramarine. These will be found quite sufficient for all purposes, the instructions given above being such as will enable any marbler to mix his own shades. THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

* *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Instruction Classes.**—Rev. W. Wade (*St. Peter's Vicarage, Fulham, S.W.*) writes:—"Will you allow me to appeal to one or two of your readers who have a few hours' leisure at their disposal in the week? I am most anxious to start industrial classes for the boys of the children's guild connected with this parish. Unfortunately, the ordinary clerical training does not include instruction in any form of mechanical art, and my own fingers can do little else beyond wielding a pen. However, I hope this poor skill will stand me in good stead now if you will allow these lines to appear in your Journal. I should be most grateful if any gentleman, who could devote an hour or two in the week to the instruction of about a dozen boys (by way of a beginning) in one of the minor arts and crafts—such as wood carving, or the bent iron work now so popular—would communicate with me."

**Dry Battery.**—J. A. M. (*London, N.W.*) writes to H. E. (*London, N.W.*):—"In reference to your note in Work (No. 111, page 110) on how to make a dry battery, I have correctly and closely followed your instructions, and found them to be a failure. Thinking perhaps the quantities were not sufficient, I afterwards tried double quantities, and, after letting them stand for three or four days, I did not find the slightest result. If you will kindly furnish me with further instructions on this, or tell me of any other method of how to make a dry battery, through Work, you will oblige."

**Decoration in Applied Art.**—The Secretary of the City and Guilds of London Institute for the Advancement of Technical Education (*Technical College, Finsbury*) writes:—"An important meeting of representative men in the painting trade met recently at the above College, to consider what means could be taken to improve the quality of the workmanship in their trade. The chair was taken by J. D. Crace, Esq. A paper was read by Mr. Wm. Fourniss, Instructor in Decoration in the Applied Art Department of the College. A discussion followed, which resulted in the following resolutions being carried unanimously:—1st, That it is expedient that trade classes for painters should be established for the benefit of the trade. 2nd, That the Guilds of London should be respectfully requested to establish trade classes for painters at the Finsbury Technical College. Some discussion occurred in reference to the question whether or not certificates should be offered and given for proficiency in the painting trade, in which Mr. J. Shaw took part. No resolution, however, was come to in respect to this. Dr. Silvanus P. Thompson, Principal of the College, and J. D. Crace, Esq., chairman of the meeting, gave their entire concurrence with the objects of the meeting."

**Mail-Cart Springs.**—The Victor Cycle Company write:—"Several of your readers have written us, at various times, respecting springs for mail carts. We have now arranged to supply these as well as wheels."

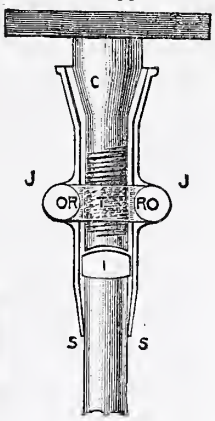
**Small Tin Boxes.**—A. G. (*Sheffield*) writes:—Mr. A. Truelove's address (see No. 112, page 126) is 111, Carver Street, *not* 14, as stated."

**Cold Water on Saws.**—A. R. (*Scorrier*) writes:—"In No. 113 of Work, page 139, W. H. R. (*London, N.W.*) writes in reference to trueing circular saws when buckled. A saw may run wild, as W. H. R. terms it, through undue heating, and by freeing the timber from the saw, and letting it run a little while, even if there is no water thrown on it, the saw being properly packed, it will run true again. A saw may run wild through unfair usage, and consequently become buckled; but if the plate is once buckled, throwing cold water on it will not take out the buckle. I have had to do with saws a number of years, but never threw as much as a pint of water on a saw to get it to run true. When I see men throwing water on a saw to try to get it to do its work, I am quite satisfied that there is something wrong. I know it is an old practice, but men in these days should get beyond such a system of working. In Vols. I. and II. of Work, there are several reasons given why saws run as stated by W. H. R.; and I would advise all readers of Work, who have not the above numbers, to get them. I think the price of each Vol., ready bound, is 7s. 6d."

**Patents.**—A. B. L. (*Newbury*) writes:—"I wish some one of your readers, conversant with the Patent Office, Patent Agents, and Patent Law, would consider the subject of a concise treatise to throw the fullest light upon all appertaining to Patents."

### II.—Questions Answered by Editor and Staff.

**Billiard-Cue Tips.**—T. R. (*Belford*).—The tips of billiard cues are pressed in by a screw working in a socket which holds on to the cue the tighter the screw is applied. I send a rough sketch, useful



Billiard-Cue Tip.

to cue-makers; but most of these workmen have their own devices to ensure a close-down fit of rubber to the wood. The diagram is a sectional elevation sketch. A cross-bandled key or screw-pin with a coned shoulder (C) fits into an expanding double-jawed gripper (J, J), which is formed of two blades of iron or brass slightly segmental, to fit the screw-pin and end of cue. These blades are jointed to a solid ring by lugs hinged to projections from the ring. The middle hole in the ring is threaded to take a screw on the pin (T). The extremities of the blades (S, S) further from the cores grip the cue by the action of the cone shoulder forcing open the opposite ends of the blades, acting as a vice on the cue, holding tighter the more the rubber is pressed down by screwing the pin on to it at I.—J. C. K.

**Flower-Box for Bay Window.**—R. G. (*Streatham Hill*).—A very handsome-looking flower-box may be made for your bay window in the manner I am about to describe, and which I hope you will understand by the rough sketches given. Instead of making your flower-box in one piece as you suggest, and putting the tiles in the front of it, you will do much better to have the tiles in a separate front; it can then be lifted away from the sill when required, or the boxes can be removed for gardening operations if necessary. In Fig. 1 you have a sketch of the arrangement when in position. The front board containing the tiles should be about 2 in. back from the edge of the window-sill, and three boxes made to fit the spaces between it and the front and side windows. Fig. 2 shows a section through the front and the box. To get at the exact

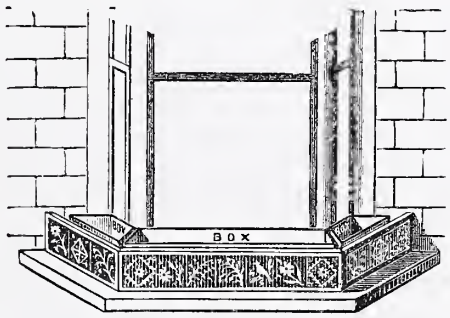


Fig. 1.

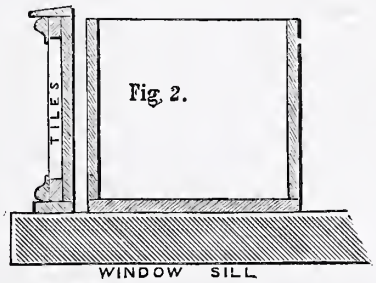


Fig. 2.

Fig. 3.

Flower-Box.

sizes of the wood, you must first purchase your tiles and then make the fittings to suit them; but, for the sake of example, I will suppose that they are 6 in. square: the backboard on which they are laid would thus be 8 in. wide, and would have a batten 1 in. wide, and just the thickness of your tiles, nailed along the top and bottom edges and down the ends of each of the three pieces of the front; the tiles are then laid in their place, and a 1½ in. moulding, of whichever pattern pleases you best, mitred round them. The ends of these front panels are now bevelled to fit each other, and held together by a pair of backfold engines at each joint; these hinges admit of the ends being folded flat to the front when the panelling is removed from its position, as, if rigid, it would be awkward to handle. To steady it when in its place, a hook and eye at each end may be used, the hook being on the inner side, and the eye either in the wall or on the woodwork of the window, whichever answers best. A piece of ⅝ in. wood runs along the bottom of the panelling, and a similar piece on the top, which is bevelled towards the front to throw off the water. Yellow deal should be used both for the front and for the boxes; the moulding you can buy ready for use at almost any timber yard. I think a few minutes' study of Fig. 2 will make the foregoing instructions clear to you, and Fig. 3 will show how the ends are meant to be hinged. The boxes should be made of ¾ in. wood, and may be lined with zinc if preferred; they will, however, last a good many years without lining, and a pipe should be run from near the bottom of each out over the window-sill to carry off the drainage. Another plan is to dispense with boxes altogether. Make your front panels as described, and when in position put your flowers in pots behind them; this is a very good arrangement, as it lessens the labour involved in carpentering, and also admits of changing the plants whenever required, thus enabling you always to have a good show of flowers at your window. A number of minor details and modifications may suggest themselves to you as you proceed with the work, and if you find any difficulty write again. That drawing attached to your letter was of the utmost service in giving me an idea of exactly what you wanted, and I wish all querists would adopt a similar method (where possible) when writing to Work for information; it would so simplify the task of answering, and tend to their getting the requisite replies. I may just add that if you still think of making three boxes, and not using a front as described, the details given for the panelling of the front will equally apply to the panelling of the boxes.—G. le B.

**Electric Belt.**—W. W. J. (*Great Broughton*).—Any size of wire may be used to connect the discs on the belt described on page 827, Vol. II. You may use brass wire uncovered if you cannot get silk-covered copper wire, or you may use uncovered copper wire. Fine wire braid is best, because more flexible than any other. By watching the replies to others in "Shop," you may learn much more about these belts.—G. E. B.

**French Polishing.**—V. S. (*Sheffield*).—By the time this appears in print you will no doubt have noticed that a series of articles on French Polishing has commenced in the present volume of Work—the first in No. 105, the second in No. 108—to be followed by others. These will, I feel certain, suit your purpose better than any book I can recommend. As regards your failures to obtain a level body of polish, perhaps you work your rubber too straight (this will get the work into ridges), instead of circular, as shown on p. 54, No. 108, Vol. III. of Work. A good saying of an old master of mine was, "Keep round the outside edges and well into the corners; the middle will take care of itself." This rule applies well in the case of narrow slips and panels; on a larger surface it will be necessary not to trust too much to the middle taking care of itself. Again, the shape and pliability of the polish rubber have much to do with success. You cannot get into sharp corners and close to the edges of sunk panels, etc., with a round or badly shaped hard rubber. The best shape is one resembling a pear cut in half. It will assist you in keeping the surface level if, when bodying up, you give the work a few slight taps occasionally with a little fine pumice powder tied up in a piece of rag. Use this with caution at first; many amateurs court failure by a too liberal use, thereby breaking up instead of levelling the surface.—Lifeboat.

**Stain for Cabinet.**—J. W. (*Tranmere*).—Fretwork is at all times difficult; it requires tact that can only be got by practice. This difficulty is rendered doubly so by attempting to do it with new rubbers. If you practised first on some flat surfaces, it would place you in possession of rubbers which would save you a lot of trouble, besides giving you such an insight into the *modus operandi* that will enable you to do your cabinet more satisfactorily to yourself. If it is light oak and you wish it simply darkened, this can be best accomplished by shutting it up in an air-tight box or cupboard, on the bottom of which has been placed an open dish of liquid ammonia; or if required darker, or walnut colour, it may be wiped over with a stain made as follows: One pennyworth of nut galls, ½ lb. American potash, 1 pennyworth of vandyke brown; 1 gallon of water; or a little vandyke brown and brown umber, and just a dash of black, made into a thin paste with liquid ammonia, and then thinned down with water till you have the required shade. But do not apply any liquid stain swimmingly; the less they are used on fretwork the better, owing to their tendency to cause it to twist. It is best to use a small sash tool to enable you to get into the interstices, which must not be omitted. Particulars of "How to French Polish" and "The Rubber in French Polishing" have appeared in Nos. 105 and 108, which please read.—Lifeboat.

**Horse-Power.**—F. C. B. (*Lambeth*).—One horse-power is the unit employed for expressing the rate of working a machine, and is equal to 33,000 foot-pounds per minute. This may be explained thus: If I lift a weight of 10 lbs. to a height of 3 ft., I do a certain amount of work; if I lift 20 lbs. through 3 ft., or 10 lbs. through 6 ft., I do twice that amount of

work, and so on. To measure this work, we take the amount of work done in raising 1 lb. to a height of 1 ft. as unit, and call this a "foot-pound." Thus, if I lift 15 lbs. to a height of 4 ft., I do 15 × 4—*i.e.*, 60 —foot-pounds of work; if a carpenter urges his plane forward through 3 ft. with a force of 11 lbs., he does 33 foot-pounds of work: or if a weight of 360 lbs. be raised through a height of 150 ft., the work done is 54,000 foot-pounds. But when we wish to measure the work done by powerful engines, etc., the figures beeome so large as to be confusing, and so another unit is adopted in the same way that a pound is used as the unit for weight, and we say an article weighs so many "pounds"; but when thousands of pounds are to be used, another unit, a ton, is adopted, and we speak of so many "tons." Watt estimated that an average horse eould, in one minute, do an amount of work equivalent to raising 33,000 lbs. through 1 ft., and this amount of work—viz, 33,000 foot-pounds—has been adopted as the unit of work for engines, machines, etc., and is ealled a "horse-power" (H.P.). A 4 H.P. engine, therefore, is one that ean do four times this amount of work, or, in other words, can do 132,000 (*i.e.*, 33,000 × 4) foot-pounds of work per minute. The rate at which a man does work per minute is taken at 3,300 foot-pounds, or one-tenth that of a horse.—F. B. C.

**Electric Belt.**—J. L. D. (*Downham Market*).—In making the belt as advised to G. F. R. (page 827, Vol. II. of WORK), have a metal elasp at the ends, such as that on boys' and cricketers' belts. Solder a fine insulated wire to, say, the left-hand half of the clasp, and to the first disc of copper or of zinc on the belt; if to the eopper, then connect the opposite dise of zinc to the next disc of copper, and so on throughout the belt. This will leave a disc of zine unconnected at the right-hand end of belt; connect this to the other half of the clasp. When the belt is off there will not be any aetion, but when it is fastened around the body by the metal elasp the circuit will be completed through the clasp, and the battery will be in action.—G. E. B.

**Manchester Motor.**—W. J. S. (*Glasgow*).—As you got the eastings for this motor and the instructions for winding it from Mr. Bottone, I think you ought to have made complaint direct to him at first, instead of writing to us. You must have misunderstood Mr. Bottone's instructions altogether. I do not think he eould have ever led you to expect a ¼ horse-power from your motor when worked with current from twelve quart eells. You could not reasonably expect more than ⅓ horse-power from the motor with such small battery power. It ought to move, however, with the current from this number of eells; and I suspect the cause of its failure to lie with your own workmanship. You have either wound it badly and caused the coils to leak, or connected the coils wrongly to the terminals, or got the brushes in a bad position. Try a different angle for the brushes until you get the best effects. Alter the connections. You may try the coils in parallel, but I do not think you will get over the difficulty in this way. Test the winding for insulation, as directed on page 676, Vol. II. of WORK. If you find this imperfect, you will have to unwind the wire, find out the faults, insulate the bare spots afresh, and re-wind the machine. When you have thoroughly overhauled the machine and tested every part, connect up three of your quart eells to the terminals with two short lengths of No. 16 wire: see that all connections are clean. Then move around the rocker until your brushes are at the proper angle, and I will warrant you will get the armature to move, if *you* have properly done your part. I suspect that you ean find somewhere among your instruetions from Mr. Bottone a letter telling you to use a battery of thirty-five quart eells to fully develop ¼ horse-power with the motor he instructed you to make, since it will take quite this number of eells to send 5 ampères of current through the machine; and this will be needed to develop ¼ horse-power after providing for waste in the machine.—G. E. B.

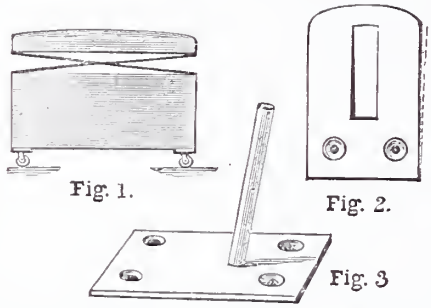
**Photo Frames.**—H. H. (*Basingstoke*).—Frames are sometimes fitted with glass and sometimes not. Those of small size, say up to 8½ in. by 6½ in., are frequently without; larger sizes are usually provided with glass. The only purpose it serves is to lessen the risk of breaking the negatives, which increases with the size of the plate. Stout plate glass is eommonly used.—D.

**Photographing.**—A. S. W. (*No Address*).—Carefully read any elementary handbook on the subject. One by Capt. Abney is very reliable. The chemieals may be purehased at any photographie material dealer's. Chemists and druggists can generally supply all that are required.—D.

**Camera Bellows.**—G. P. (*Elgin*).—The buckram, as sample, will do, but rather thinner would be better, as the paste and Amerieau cloth add considerably to the substanee. Set off the size at eaeh end, and draw lines from the corners at the broad end to those of the narrow end, and fold aeeordingly; if this is properly done the result will be straight. Make a pattern in brown paper by folding a sheet in a conically shaped tube of the right dimensions, and joined at the eorners; you will then at onee see how to shape the material to the best advantage. If the folds are equal the result cannot fail to be right.—D.

**Lantern Slides.**—J. A. (*Leeds*).—The enclosed specimen seems to be all that the introducer claims for it. With regard to non-liability to breakage, there is no doubt it is much less fragile than glass. The specimen sent was, however, broken, with a clear, sharp fraeture; but anything that will stand the test of postage; without protection is of necessity particularly tough. The ordinary exigencies of lantern exhibitions would probably be insuffieient to cause damage. The very thinness would be apt to give rise to diffieultics in passing them through the lantern, unless mounted in some way to add to their substance, but the cardboard mounts may supply this.—D.

**Ottoman Couch Lid.**—J. (*Portsmouth*).—*Re* the hanging of eouch lid, so that it opens either way. It might easily be effected by webbing it on the underside of the lid in the same manner that a elothes-horse is webbed. Of course, a better class of webbing should be used: about the same as is used on Butler's tray stands. It should be tacked firmly on the edge of the box, and then earried aeross the box to the other edge, and tacked firmly to the underside of the lid; now taek another piece on the opposite edge of the box (and in sueh a position that it will come close to the side of the first piece), and carry it across the box to the underside of lid; the other end of the lid must be done the same, and if done properly the box will open from either side. Of eourse, the webbing must be strong, and firmly fastened to box and lid with at least ¾ in. tacks, put in neatly, so as not to split or be unsightly. Perhaps Fig. 1 will explain itself. Another way would be to get four brass plates made with slots in them, and four plates with pins fixed in them: these should take the form of Figs. 2 and 3. Supposing the box




Ottoman Couch Lid. Fig. 1.—End of Ottoman Couch with Lid raised (out of Position), to show Method of attaching Webbing. Fig. 2.—Brass Plate. Fig. 3.—Plate and Pin.

to be made of ⅜ in. stuff, the illustrations are full size. The plates (Fig. 2) should be screwed down to the edge of the box, allowing the slot to project to the inside, about 3 in. from eaeh end; the pins (Fig. 3) on the lid should be screwed down in such a position that the lid will eome level all round. The best way to get the right place to put them would be to place a tack, point upward, on the slot plates, exactly where we want the pin to come, and then placing the lid on earefully. A little pressure will cause the taeks to stick, and we shall know where to put the plates; however careful we may be, we may expect to have to move them before we get them exactly right; for this reason, only one screw should be put in each plate, till we are sure the plates are in the right position. If a tape is securely fixed to keep the lid from going right back (in tho centre), it will be all right. Choose which way the lid is opened.—H. H.

**Electric Belt.**—T. P. J. (*Manchester*).—When I penned tbe reply to G. F. R. (*Woolwich*), which is printed on page 827, Vol. II. of WORK, I thought I had rendered all things as clear as could be desired in the small compass of a reply in "Shop," and I think G. F. R. must have been satisfied, for he has not eomplained. One cannot go into all the details in a reply, or it would take up too much spaee. In your letter you have shown that you fully understood the instructions, as you yourself supply the details omitted. I hope others will do the same. Yes, the silk-covered wire to connect the dises are "to be cut into several lengths aceording to tbe number of dises, and eonnected by soldering from one disc to another, and so finish off at the extreme end ones, where it is then complete as an eleetrie belt." The soldering ean be easily done with an ordinary soldering iron or soldering bolt when the discs are on the belt. Or you may solder the connections, and work them in as you proceed in sewing the discs to the belt. Take a zine dise, for instance, to form the extreme disc at the left-hand end of the belt. Clean it bright with emery-eloth, drop a mere trace of spirits of salts on the centre of the inside; bare and clean one end of a length of silk-covered wire; dip this into killed spirits, then solder it to the prepared spot on the zinc. Sew on the zine dise, pass the insulated wire out through a small hole made in the belt, and solder its other end to the inside of the copper disc to form one of the next pair; then sew this on the belt. The two dises to form one pair (outside and inside the belt, exactly opposite to each other) will not be thus eonneeted, as the eurrent will pass from one to the other through the thin flannel to whieh they are sewn when this is moistened with the sour sweat eoming from the body, or moistened with vinegar. I may mention here that the copper dises will be more effective and lasting if they are thickly electro-plated with silver. Now, when the whole number of discs have been eonnected as above directed, you will find one zine left out at one end of the belt, and one copper at the other. Connect the eopper to one part of a metal clasp sewn on the belt at one end, and the zine to the other part of a metal elasp sewn on the belt at the other end. The elasp may be made of any metal you may choose, and the two parts may be eonnected by a short piece of ehain if you wish to let out or take in the belt; but they must be thus eonnected by a metal conneetor of some sort to complete the circuit around the body. When the discs are all sewn on, you may cover the whole with thin flannel, and thus form a belt of triple thickness. The belt should be worn next the skin. Whether a current of electricity thus eontinuously passing around a person's loins has any beneficial effect on the liver and kidneys, or not, is more than I can say. A belt made as I have directed in No. 103, page 827, Vol. II. of WORK, will generate a current of electricity when the belt is moistened between the discs with sour sweat or with vinegar. This is all I can undertake to prove.—G. E. B.

**French Medieal Coil.**—F. G. B. (*No Address*).—The coil of which you send a sketch is a compact form of medieal eoil, enclosed in a box together with a Marié Davy battery of two eells, a receptacle for bottles, and another for the various electrodes employed with medical eoils. The battery cells are fitted with carbon plates at the bottoms; over these is spread a layer of sulphate of mercury. The cells are filled with water, and the zine plates lie in a horizontal position just beneath the surface of the water. At the right-hand side of the cell, next the letter N, the zinc plate rests on a platinum lug; and this is eonnected with the bushed hole marked N. This is the positive plate of the battery and its negative pole. The carbon plate at the bottom of this cell is connected to a platinum lug in the next cell, on which one end of the next zinc plate rests. The carbon of this cell is connected to the bushed hole marked P; and this is the positive pole of the battery. To connect this with the coil, make some brass plugs to fit in the bushed holes, and attaeh flexible connecting cords or lengths of insulated wire to the plugs. This done, connect the battery by means of the plugs and wires to the terminals of the primary coil (one going to the break pillar), and the coil should then work. The intensity of the eurrent is regulated by sliding on or off the two outside coils; when these are on, and the wires are attached to the bushed holes in the eoil ends, the maximum effeets are experienced. In this way you may get the powers from either one or two coils. The handles are made of wood to insulate the medical practitioner from the current whilst employing the selected electrode on his patient.—G. E. B.

**Hot-Air Engine.**—R. S. H. (*Calne*).—A friend of mine has a hot-air engine of two man-power at the brake; it indicates five man-power, so it uses up three man-power to work itself. It has a piston 9½ in. in diameter, stroke 7½ in; its fly-wheel is about 3 ft. diameter, and the centre of shaft about 5 ft. high. This will show you what a bulky affair it is; also it requires water to cool the eylinder. You must have a tank, or a continuous current through the casing, to keep it cool. A hot-air engine advertised as two man-power would very likely have a 7 in. piston, and give out one man. They are very easy to manage, very convenient, except that they take so much room, soon started, say, in fifteen minutes, but they are expensive. Messrs. Bailey, of Salford; Hayward, Tyler & Co., Queen Victoria Street, London; and Messrs. A. E. and H. Robinson, of Albert Square, Manchester, make hot-air engines. —F. A. M.

**Repairing Accumulators.**—W. J. D. (*Manchester*).—If the plates are all in good condition, and the cells are tolerably free from patches of paste from the plates, you may remove the old acid, and re-eharge the cells in the following manner: First eharge the plates up to tbeir full eapaeity, to prevent injury to the paste by air aetion. Then draw off all the acid by means of a syphon made out of 3 ft. or more of ⅝ in. or ¾ in. vulcanised indiarubber tube. Fill tbe tube with dilute acid, stop both ends with the thumbs of each hand, lower one hand below the surfaee of the liquid in the eell, and hold the end of the pipe there whilst both thumbs are withdrawn at the same instant. When the syphon has started drawing the aeid, lower the inner end to near the bottom of the cell, so as to draw off all the old acid. This done, fill it up at once with the new acid, and thus finish eaeh cell before emptying another. If the plates need repair, the whole set must be lifted out of the acid for the purpose, and replaced when repaired in the fresh acid. We eannot oblige by answering letters "next week," as next week's paper is made up and in the press when letters arrive.—G. E. B.

**Medical Batteries.**—DERNAX.—The following are makers of electro-medieal apparatus. From them you may seleet one to suit your requirements. Messrs. Woodhouse & Rawson, 88, Queen Victoria Street, London, E.C.; Messrs. O. Berend & Co., 61, Fore Street, London, E.C.; Messrs. Eidsforth & Mudford, Jackson Road, Holloway, London, N.; Messrs. G. Cohen & Co., 60A, Market Street, Manchester; Messrs. Salt & Sons, 21, Bull Street, Birmingham. Batteries are made and sold by Messrs. Cathcart & Peto, 57B, Hatton Garden, London, E.C.; F. C. Allsop & Co., 165, Queen Victoria Street, London, E.C.; and Messrs. T. Gent & Co., Faraday Works, Leicester.—G. E. B.

**Rolling Curtain for Optical Lantern.**—OVICE wishes to know how the wooden frame for ic rolling curtain is attached to the stage plate. will generally be found sufficient if the frames mply slide stiffly on to the supporting pillars of e slide stage, as it will then be an easy matter to move them if necessary at any time. If you articularly wish them to be a fixture, you can drill couple of holes through the stage plates in such a osition that a short screw can be driven into the de of each frame from the back, as shown at A in ie accompanying diagram. Care must, however, e taken to see that the screws do not interfere with the sliding of the curtain shutter along the grooves in the frame. In order to attach your portrait combination to the draw-tube of the lantern front, you will require to braze

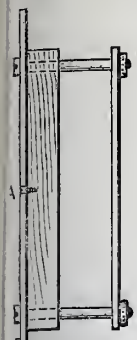


Fig. 1.

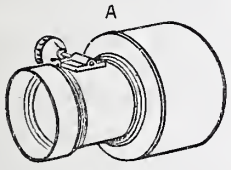
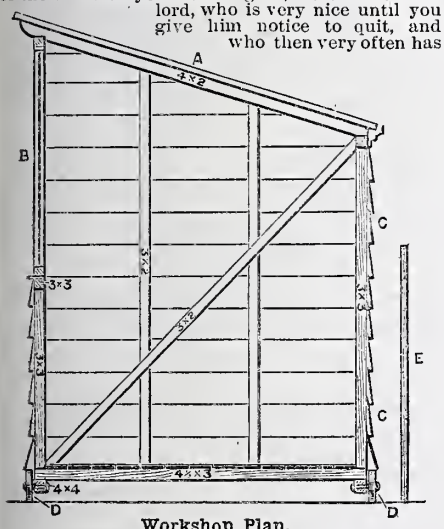



Fig. 2.

Rolling Curtain for Optical Lantern.

an ordinary O. G. brass flange (to be obtained from any lantern manufacturer) on to the end of the draw-tube, as shown at A in Fig. 2. The opening in the flange must, of course, be furnished with a suitable thread to take the thread of the lens mount; or, better still, the thread can possibly be removed from the present flange of the lens, and then soldered into the flange of the lantern front. If you do not possess a lathe, you could possibly get a job like this executed by Mr. Platt, Birkbeck Works, Kingsland, N.E.; or Messrs. O. Noakes, of Nelson Street, Greenwich.—C. A. P.

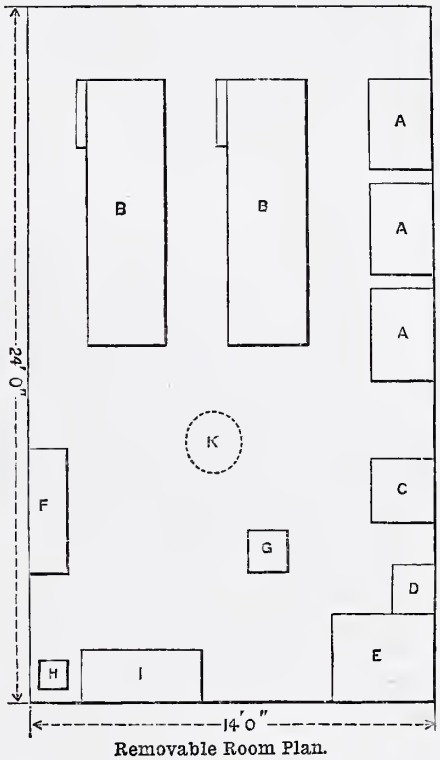
**Workshop Plan.**—N. M. (*Norwich*).—If, as you state, you wish to be able to remove your workshop in the event of moving, I certainly should not utilise the garden palings for part of the height, and most decidedly not let uprights into the ground. There are several things to be considered in matters of this kind; the first and most important for the time being is that very nice person "the next-door neighbour," who has a knack of determining for his own satisfaction the proper angle of light he is entitled to. Not but what he would have a very just cause for complaint if you did as your sketch shows you are inclined to do—viz., make his garden the receptacle for the water off your roof. Again, there is the landlord, who is very nice until you give him notice to quit, and who then very often has




Workshop Plan.

the same propensity for considering his own interests, and for keeping on his property anything to which he has the least claim, or may be beneficial to him, and causing to be taken away anything that may be the reverse. Below you will find a section based on the same lines as your own, showing what I should advise. I think this will at once explain itself. The two most important points are:—Firstly, the gutter, which you should lead down with a down-pipe to deliver on to your own property, and let it empty itself if possible into a gully, or else form a tank let into the ground; you will notice that I put the structure upon wheels, much after the style of a contractor's office. If you build it up a few feet away from its intended position, and then wheel it into its place, it would then, I think, take a very long stretch of imagination to call it a fixture. When you have it in its place, I should advise you to lever it up one corner at a time, and block it, keeping the wheel off the ground, having previously thoroughly greased with tallow the wheels and bolts, so that should you wish to demonstrate to anyone at any time that the structure is not a fixture, it would be an easy matter. This will give you a good air space underneath, and prevent your floor from rotting. You would find having tongue-flooring a great boon, as it would keep out the draught; and I should recommend some coarse wire netting between the sleepers and ground, to prevent cats from getting under. As to the cheapest material, the most suitable thing is sound yellow deal. If you frame the carcase together, and secure the tenons in the mortises with coarse screws, I do not think anyone will be able to prevent you from taking it away, and you will likewise be thoroughly independent. Should there be anything you do not understand, do not hesitate to ask again. I am very pleased to hear you have made a lathe out of an old machine stand, as not only does it show great ingenuity, but I am sure you must find it very useful.—E. D.

**Removable Room.**—J. C. (*Scarborough*).—Below you will find sketch plan of what you wish. You will notice that I have not given any more space between the lathes, benches, etc., than is absolutely necessary, and have allowed no room for materials, plant, or vice (which latter I think you would find almost indispensable), and yet your room has attained quite formidable proportions—viz., 24 ft. by 14 ft. In fact, there are some people who would call it a factory. I should advise your




Removable Room Plan.

making inquiries as to insurance, etc.; and if after this you still adhere to your original intention, kindly send rough plan of house and grounds, showing site upon which you propose to erect room. State likewise the stipulations laid down by insurance and surveyor—that is, if it comes within the jurisdiction of the latter. I shall then have much pleasure in going into details. Casually I may say that on the face of it it seems to me that brick or concrete and iron, not match-lining and iron, should form the foundation, etc., of the structure. I think you will agree with me that these particulars are a primary consideration.—E. D.

**Bamboo Canes.**—INQUIRER.—Bamboos may be bought in London from F. Westbury, 183, Gt. Dover Street, S.E.; from Benjamin & Co., 168, Great Dover Street, S.E.; from W. and T. Elmore & Sons, 16, City Road, E.C. London is the chief market for this material, and perhaps INQUIRER will do as well by sending his order there, though a Manchester or Liverpool directory would doubtless give him the name of a nearer dealer. In Vol. II., page 177, No. 63, he will find full details as to varieties, sizes, prices, etc.—M. M.

**Sable Writing Pencils.**—SOUTH AFRICA.—A reliable maker is J. B. Smith, 117, Hampstead Road, London, N.W. But makers are not always so expert at selecting as experienced users of pencils, who can tell their fitness with such critical accuracy. As you may want only a few selected ones of a sort—sable for writing, camel for lining, ox-hair, fitch, ichneumon, for other uses—you might try a selecting factor: in London, C. Witham, 22, Grove Street, Lisson Grove, N.W.; in Paris, Walter Lodia, 21, Avenue de l'Opera.—J. C. K.

**Cartridges.**—R. E. A. (*Sheerness*).—You do not say if ball or blank cartridge. If blank, the Martini cartridges answer. A Sheerness gunsmith will get what you require, if in small quantities; if large, Adams & Co., New Oxford Street, W.; Eley Brothers, London; or Kynoch & Co., Witton, near Birmingham. Prices vary for large or small quantities.—J. C. K.

**Arches.**—G. S. W. (*Walford Heath*).—If you refer to page 361, No. 75, and page 428, No. 79, of WORK, you will see the methods of drawing five different forms of arches, from which you will see how the radius is found. The centres are formed of ribs made of 1 in. boards, as shown in Fig. 1; the ribs are fixed 2 ft. or 3 ft. apart, and laths 1 in. or 1¼ in. thick nailed upon them, on

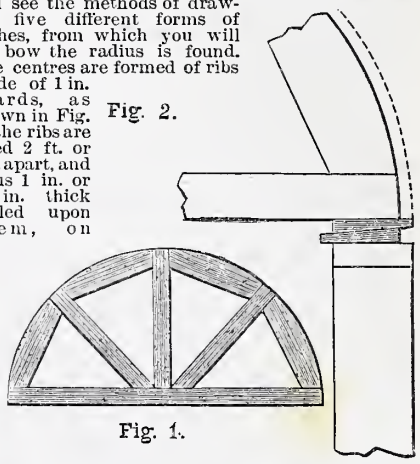


Fig. 2.



Fig. 1.

Arches. Fig. 1.—Rib for Centre. Fig. 2.—Method of fixing Centre.

which the arch is turned. They must be fixed on strong supports with double wedges under each rib, as shown in Fig. 2. These are for arches up to 8 ft. or 10 ft. span. If wider than this, the centres must be made correspondingly stronger, and bolted together.—M.

**Buckled or Bent Hand Saw.**—W. C. (*Stone*).—You should have stated how and in what place his saw was bent. As you have not done so, I give a rough sketch or two, showing, by hammer marks, how and where the saw should be struck, should it be as represented in either of the annexed sketches. W. C. must be very careful, and not deliver heavy blows. The plate of a hand saw being thin, requires a much lighter blow than saws of stout

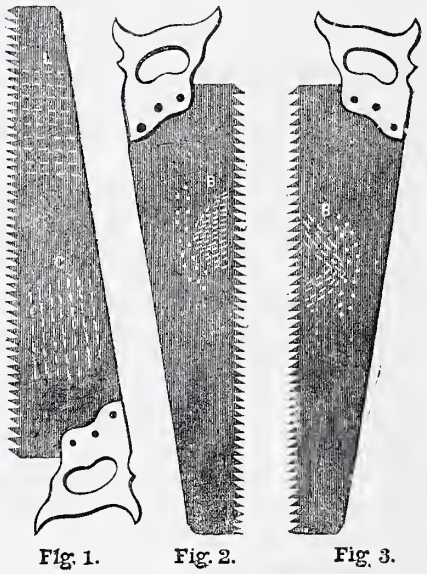



Fig. 1. Fig. 2. Fig. 3.

Buckled Saw Repairs.

gauge. If the blows are given too heavy, they will indent the plate, and at the same time stretch it more than is needful, and in consequence, a bad matter will be made worse. Fig. 1 represents a saw undulating, or wavy, lengthways of the plate at L, and bent or seamy across the plate at C. It will be seen that at L the blows are delivered across the plate, and at C lengthways of plate. The hammer to be used should be a cross-faced hammer. Figs. 2 and 3 represent a saw that has a bend at the edge; in this case the cross-faced hammer should be used on the convex side, as at B, Fig. 2, and on the concave side, as at B, Fig. 3; after which, it should be struck very lightly with the dog-head hammer, as indicated by round marks on both sides. In place of the dog-head hammer, the ordinary carpenter's hammer will answer the purpose by grinding the head a little convex.—A. R.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Electric Gas-Lighter.**—ELECTRIC SPARK writes:—"Can any contributor to 'Shop' inform me how to make the above on most approved form?"

**Galvanometer.**—GALVANIC writes:—"Would anyone kindly give me full instructions how to make a cheap, but good, galvanometer for experimental purposes? The Tangent, recently described in WORK, is too complicated; one of simpler construction would interest many readers."

**Photography.**—BOY-SORTER would like to know "(1) where is the best place to buy a camera for about 10s. 6d.; (2) also the simplest book for beginners; (3) which are the best dry plates to use?"

**Battery Troughs.**—M. H. M. (*Hull*) writes:—"Can any reader inform me if a small hole, sufficient to allow one cell in a trough battery to fill from another, would short-circuit the cells to the weakening of the current?"

**Autographic Ink.**—ON-TIME writes:—"How is an autographic ink made for draughtsman's drawings, from which reproductions can be made at letter-press machine?"

**Spring Mattress.**—APEX writes:—"Some time since, very good instructions for making a spring mattress were given. Will someone kindly inform me where I can obtain the springs, fibre, etc?"

**Soldering Pewter.**—APEX writes:—"Will some practical hand let me into the secret of soldering this metal? With all others I have been fairly successful, but have utterly failed in this."

**Wax.**—CARVER writes:—"I am at a loss to know where to get wax suitable for modelling a panel previous to carving in wood. I shall be glad if any reader could inform me through 'Shop.'"

**Treadle Knife.**—CUTTER writes:—"Would any reader kindly furnish me with particulars of a contrivance for attaching to a treadle grindstone (stone 25 in. in diameter) for the purpose of grinding a guillotine knife 20 in. long? Drawing would oblige."

**Braces.**—W. B. (*Preston*) will thank any reader to inform him where he can purchase wholesale quantities of indiarubber web, rivets, and rings for brace-making.

**Sewing Machines.**—SEWING MACHINE asks where he could get a book entitled, "The History of the Sewing Machine," by N. Salaman, who is also the writer of "Elias Howe's Biography" (London, 1863). Also Green's translation of Dr. Herzberg's work (1864) on the sewing machine.

**Draught Table.**—M. P. (*Manchester*) will be obliged for design, with size and working drawing, for draught table, suitable for two gentlemen.

**Sealing-Wax.**—J. C. (*Chelsea*) writes:—"Will any reader inform me the way to make white sealing-wax? Also, is there any white stain that will sink into hard wood and bone, and where I can get it?"

**Quartz and Grindstone.**—SINE CERA writes:—"Will any reader of WORK kindly inform me where I can obtain crushed quartz? It is required for covering buffing hands for buffing up spokes, etc. Also could you inform me the proper speed at periphery of grindstones?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Clay Mixture.**—M. (*Bishop Auckland*) writes, in reply to HEATHFIELDS (see page 110, Vol. III.):—"These are called cob walls, and are built of a mixture of clay, loam, and chopped straw. The walls are made about 2 ft. thick, and are built on stone or brick foundations 2 ft. above the ground level. The material is kneaded into a stiff mass, and is built in layers, one layer being allowed to stiffen before another is laid on. The face of the wall is pared level with a sharp spade or parer, and is coated with plaster. The top of the wall must be well protected from rain. In some places it is built in frames similar to concrete walls (see page 60), small gravel being mixed with the clay, and is called Pisé work."

**Gas Engine.**—M. (*Bishop Auckland*) writes, in reply to H. R. P. (*Nottingham*) (see page 112, Vol. III.):—"You can obtain working drawings of these from Mr. A. Holmes, 127, Clowes Street, Hyde Road, Manchester. I do not know whether he supplies the castings, but if you write him he will tell you."

**Teasing Hair.**—E. W. C. (*Leicester*) writes, in answer to A. A. (*Edinburgh*) (see page 142, Vol. III.):—"There is, I believe, no machine that will tease horse-hair at the rate mentioned. There is a machine made by a Manchester firm called a 'devil,' which is made with a large wooden drum studded with steel points, but it is useless for hair. As everybody knows, the beauty of horse-hair is its length and curl. The machine I have mentioned breaks it into short bits, but is very useful for wool and flocks. The only way to open new hair is by hand, which is the best way for all kinds of hair; but for old hair there is what are called 'cards,' which consist of two boards covered with a kind of leather, and studded with a sort of square wire staple, with the points bent to an angle of about 45°. The bottom board is fixed, and the top one is worked with the two hands, by the aid of which from twenty to thirty lbs. of hair per hour can be accomplished. These 'cards' can be obtained from any upholsterer's warehouse in Old Street or Curtain Road, London. If A. A. thinks it will pay him to make one—which I douht—I will send more particulars."

**Scrap Leather.**—G. P. (*Fulham*) writes:—"If A. F. W. (*Oldham*) (see page 829, Vol. II.) will offer his scrap leather to Geo. Ives, Wakefield, Yorks., I think he will get a much hetter price than from the two firms mentioned on page 46, Vol. III., by J. M. (*Manchester*)."

**Fish Stuffing.**—F. H. (*Streatham*) writes, in answer to F. M. (*London, N.W.*) (see page 110, Vol. III.):—"I would advise F. M. to practise upon a tough-skinned fish, such as the perch or a pike. First note all the peculiarities of shape and colour; it is a good plan to make a water-colour drawing of the subject. Select the hest side of the fish, and cover it with tissue-paper or muslin; this keeps the scales fast in their seats during the skinning. You must he sure to keep the fish damp during the operation. Lay the fish the worst side uppermost on a board, then cut the skin from head to tail in a straight line; cut through the large bone heneath the gills with a strong pair of scissors. With a broad knife in one hand, and holding the skin lightly with the other, with a scraping motion of the knife carefully separate the skin from the flesh. Be careful at the fins; cut them deep, leaving a part of the flesh on. Work towards the tail, and remove the skin round the tail with the fingers; cut the bone and flesh completely through with the scissors about 1 in. from the last joint of the vertebra. Now work the skin off round the head, and with a knife sever the bone near the head. The skin now being free from the hody, scrape away all the small pieces of flesh that are still adhering to the inside of the skin, and around the fins and tail. Now turn your attention to the head. Make a cut along the side of the under jaw, cut away the gills, clear the head of all remaining flesh, take out the eyes, and he careful not to eut your fingers with the small bones. To stuff the fish, procure a thick piece of wire somewhat longer than the hody, bending one end to form a large oval-shaped loop, to be placed into the head, the other end to be pointed to push into and support the tail. This wire is to form an artificial back-hone, and must he such a length as to allow one end to go through the centre of the bone in the tail; form two loops on the wire to support the hody on the hack of the case when finished. Now wrap round the wire some paper, tied with string, until it is a little less than the hody that is taken out, and make it somewhat the shape of the fish without head or tail. When this is done, cover it with tow tied on with hemp. Lay this down, and thoroughly anoint all parts of the fish. Stuff out the now hollow sides of the face, gums, and the underneath of the throat with putty, of which push some thick pads underneath the root of the tail. Next lay a thin skin of putty over the whole of the skin on the inside. The next thing to he done is to insert the hody. Pushing the sharpened end of the tail wire through the hone of the tail, fix the loop in the head, and commence to sew the edges of the skin with needle and thread, shaping the fish as you go along. A little gentle tapping with a small piece of wood will bring it into shape. Bore two holes in a board for the supporting wires, and carefully turn your fish over, to examine the show side. Gently press the skin with the hands; now go over the whole of the outside of the skin with a carbolie wash:—Glacial carholic aeid, 2 oz.; hurnt alum or pure tannin, 1 oz.; water, one pint. Keep in stoppered bottle lahelled 'Poison,' and shake up heforc using. Place all the fins in their position; the head will require a great deal of attention. It is now flat, and, perhaps, drops down upon the board. To obviate this, prop the nose from the underneath by a piece of cork. The mouth may he kept open as much as desired hy wire. The fins must be 'braced out' on flat pieces of cork with pins. Let the fish be now put hy in a moderately warm situation to thoroughly dry. When it is thoroughly dry, the skin will be like leather, with no colour in it at all, and must, of course, be subsequently coloured up according to nature—the eyes put in with wax. The fish should now he varnished with spirit varnish, and mounted in a case with appropriate water-weed. The fish should be coloured with oil-colours, such as are used by artists, thinned with turpentine."

**Mandrel Head.**—TURNER writes, in reply to H. M. (*Maiden Newton*) (see page 142, Vol. III.):—"Whatever you do, do not on any accouut run your mandrel in east iron. I worked a lathe for three days running, in hot June weather, which had cast-iron hearings all over, and I might just as well have heen on a tread-mill. The cast iron gets hot with the friction, and, consequently, the mandrel 'binds.' Brass hearings would do, hut hardened steel is the proper thing, though troublesome to true up. I am now myself engaged on a new lathe spindle of my own design, hard steel wearing parts so arranged that you may take all play out, and yet have it run freely. I hope to have it finished a fortnight hence." [TURNER may send in his drawing and description on approval.—ED.]

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—A FRETWORKER; W. H. W. (*Great Yarmouth*); QUÆSITOR; J. B. (*Manchester*); T. A. (*St. Helens*); F. D. B. (*Newcastle-on-Tyne*); O. M. (*Barrow-in-Furness*); A CARTWRIGHT; G. H. (*Camberwell*); LEGHORN; H. R. (*Clapham*); R. W. (*Bow, E.*); H. J. (*Rochdale*); TEVIOT; H. E. B. (*Cheshire*); BICYCLE BUILDER; A. T. B.; A. W. (*Paisley*); J. H. (*York*); F. P. (*Swansea*); C. D. (*Glasgow*); INCUBATOR; H. R. M. (*London*); J. S. (*York*); A. M. (*Putney, S.W.*); ARTIST NOVICE; B. F. E. (*Carlisle*); ANXIOUS; RAYNOR; P. P. (*Harrow*); TOXTETHIAN; R. H. M. (*York.*); H. MCG. (*Kilmarnock*); T. B. B. (*Manchester*).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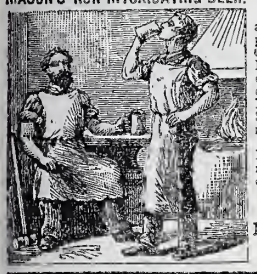

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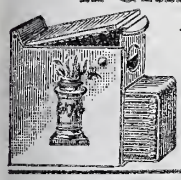

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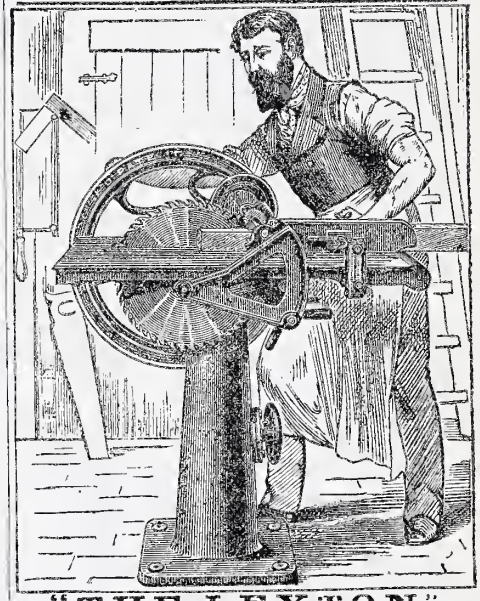

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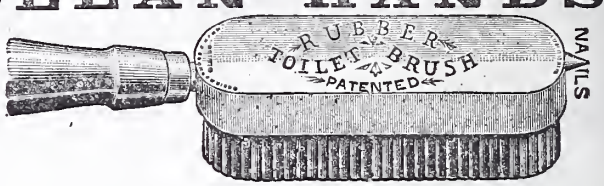


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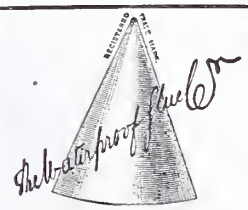


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# WORK

## An Illustrated Magazine of Practice and Theory

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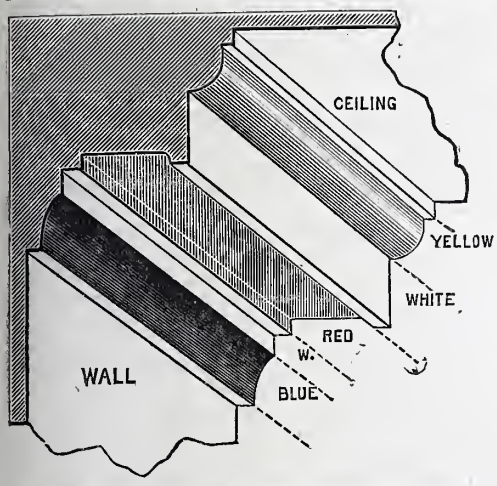



Fig. 1.—Primaries applied to Form on Owen Jones's Principle.

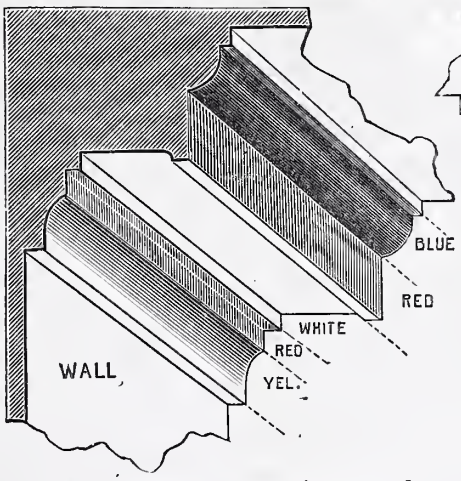



Fig. 2.—Positions of Primaries reversed.

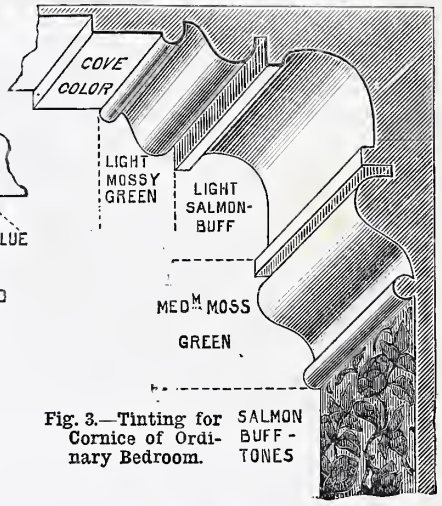



Fig. 3.—Tinting for Cornice of Ordinary Bedroom.

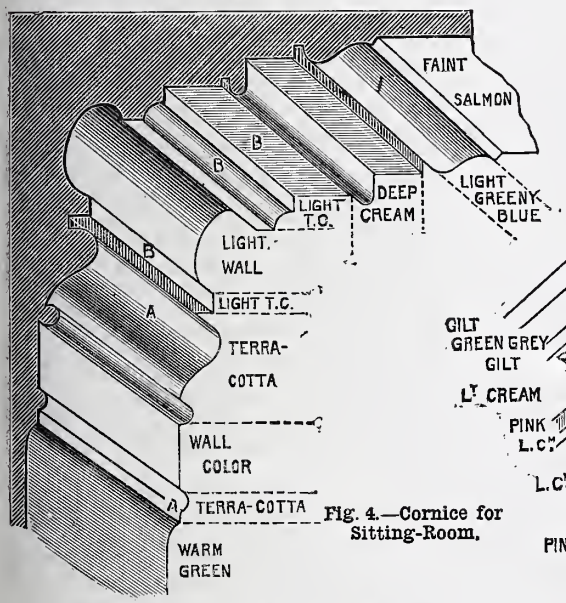



Fig. 4.—Cornice for Sitting-Room.

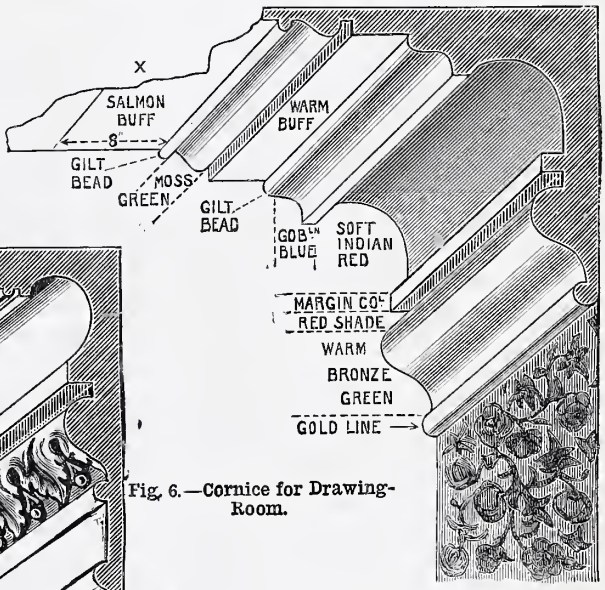



Fig. 5.—Cornice for Dining-Room.

Fig. 6.—Cornice for Drawing-Room.

## ON COLOUR APPLIED TO FORM.

BY FREDERICK PARSONS, F.S.Sc.

INTRODUCTION—TINTING THE CORNICE—ELASTICITY OF TERM—INDIVIDUAL TASTE—COLOUR, A SCIENTIFIC AND ARTISTIC SUBJECT—OWEN JONES ON COLOUR—RUSKIN ON COLOUR—CHROMATIC EQUIVALENTS OF CHEVREUIL AND FIELD—EXPRESSIONS OF PRIMARY COLOURS—CORNICES ON OWEN JONES'S THEORY—SUGGESTED TREATMENT OF BEDROOM CORNICES—CORNICE FOR DINING-ROOM—CORNICE FOR DRAWING-ROOM—GENERAL RULES FOR TREATMENT OF CORNICES.

LET not the intelligent reader start, nor his countenance grow troubled, on seeing my head-line, since the purpose of this paper is of both a simple and practical nature. No mystical theories of "luminiferous ether" or "wave-lengths" are about to be considered; nor am I desirous to "trot out" those items of interminable discussion—the ancient polychromatic treatment of classic statuary, or the truth and beauty of mediæval applications of colour to stone mouldings, tracery, and panel-work. Those who want a strong dish of "scientific colour" must turn to the recent works of Professors Ogden Rood or A. H. Church; whilst it would ill become one to consider in WORK the latter aspect of colour applied to form—"the form divine"—when all the skilled and learned Fellows of the "R.I.B.A." are fervently enthusiastic in their divided opinions.

"The cornice to be tinted to match." This is a harmless-looking sentence that appears on nearly every specification of modern house and decorative painting. There are many readers of this paper who, doubtless, "could a tale unfold" concerning that apparently simple operation which, if not so harrowing as that related by the ghost in *Hamlet*, would so reek of worry, nervousness, and mortification of spirit that they here greet with gladness any attempt to explain the practical aims and methods by which this tinting of cornices is successfully governed.

It is a remarkable fact that, whereas even

ten years back tinting to plaster cornices was seldom undertaken beyond the reception-rooms, nowadays it is common, in all the chief centres of trade, to every decent bedroom of a house of any pretensions. The great expansion of our notions of home and industrial art has chiefly accounted for this; but a greater stimulus has been directly derived from the "fashion"—educated demand—for the beautiful effects of *colour* that is now current. Instead of the old orthodox "grey-satin" wall-papers, with their white-washed or "water-wave" papered ceilings, we have "blue bedrooms," "red," "old gold," or all these primary tones combined in one design of wall-paper; whilst the ceilings have ornamental designs to correspond in paper-hangings, or are distempered in a decided tint of pink, cream, or blue. To leave the cornice white, or even the same as the tint of ceiling, looks altogether weak and poor; and here it is that the worker, unless he has both colour ability and experience to guide him, often finds his peace of mind forsake him.

This "tinting," as applied to plaster cornices, is a somewhat elastic term. It may mean the application to the whole of its members of one general "tint" of colour with white, or the addition to this of a few beads and lines of positive colour; or it may be further interpreted as colouring the cornice with various and many colours and tones, to harmonise with or contrast the wall or ceiling decoration.

Now, when a woman—or the average woman—chooses a coloured ribbon or dress material, she is usually guided in that choice by her own individual "taste." This selection by "taste" is in many respects a very curious phenomenon. "I know what I like!" is usually the sole justification of colour choice. If one were to inquire the why or wherefore of the decision, the only resource that avails is "Taste—my taste!" Should the object of discussion be a carpet, curtains, or wall-paper, we usually find the same operative power in force. So long as one person's colour "taste" has but to please the author of it, this kind of irrational and irresponsible selection may work very well; but if the *decorator* desires to conceive a scheme of colour that shall stand criticism and merit general approval, he must work on totally different lines.

*Colour* is, in itself, both a scientific and an artistic subject—scientific, for instance, in its dependence on and relation to the sense of vision; and *artistic* in that its effects are capable of "individualism" in manipulation, and of conveying definite sensations and emotions of truth and beauty from the mind of the colourist to that of the beholder. We may fairly class the art of the colourist upon the same level as the art of the musician. What, therefore, should we think of any person's "taste" in pianoforte playing which simply consisted of strumming haphazard certain strings, without any regard for or knowledge of the laws of harmony and concord? And yet this is, if anything, a less questionable matter, since that instrument gives us *fixed* tones, while with colour we have no similar permanent scale to work upon. One would further imagine, judging from every-day experience, and an occasional dip into the "Home Art" column of a Society paper, that "colour taste" is inherent in nearly all human nature. If that is to be seriously accepted as a correct standard of selection, we can only rejoin by pointing to the interesting inhabitant of the Cannibal Islands, whose physical palate, according to this argument, is equally a natural and "good taste," since it is "his taste."

Notwithstanding forty summers have come and gone since John Ruskin, and that eminent architect and decorator the late Owen Jones, boldly controverted each other's teachings on the relation of colour to form, the force and application of their "old-time" contentions are still to-day of much interest and value. We will, therefore, briefly consider those conflicting arguments, and endeavour to see how far they supply a basis for practical work, such as tinting cornices and other simple decorative arrangements of colour.

The Marlborough House lectures of Owen Jones, given in the year 1852, contain this dogma or proposition:—*Colour is used to assist in the development of form, and to distinguish objects, or parts of objects, one from another.* In general support of this, the lecturer referred to Nature, and pointed out the difference in colour between flower and stalk, the appearance of earth and sky, and of the hair, eyes, etc., of the human figure.

Mr. Ruskin's theory, which he also deduces from the observance of natural colour, is that colour never follows form, but is arranged on a totally different system. He argues—"What mysterious connection is there between the shape of the spots on an animal's skin and its anatomical system? The stripes of a zebra do not follow the lines of its body or limbs, still less the spots of a leopard;" and in sequence to these and other natural examples he concludes—*that the first great principle of architectural colour is this: let it be visibly independent of form.*

Although even a bare statement of these two diverse conclusions should be valuable to all young students in architectural or decorative colour, I do not intend here to further explain or analyse them. The period of time that has elapsed since the above lectures and that wherein we record our own humble experiences has shown much progress in decorative art and colouring, so that modern conclusions concerning the relationship of colour to form are now on this wise:—*That the two systems, whilst being quite distinctive and separate, may be so combined as to materially enhance the beauty and effect of both.*

Now, let us assume, for the purpose of practical illustration, that the early chromatic equivalents of M. Chevreuil and George Field are correct—viz., that the *primary*, or first, colours are pure red, pure blue, and pure yellow; that each primary is contrasted harmoniously with, or neutralised by, a mixture of the two other primaries in certain proportions, which mixture is named a *secondary;* and further, that each secondary is balanced by a certain mixture of the two remaining secondaries, termed a *tertiary* colour. The total purport of this is, therefore: *primaries*—red, blue, yellow; *secondaries*—purple (red and blue), green (blue and yellow), and orange (yellow and red); *tertiaries*—olive (green and purple), russet (orange and purple), and citrine (orange and green).

The *expressions* of the primary colours—that is to say, the main impressions they convey to the mind through the vision—are, briefly, as follows. Red gives richness and warmth of sentiment, and appears stationary of position when applied to form. Blue speaks of space and coolness, and will give a retiring effect to form. Yellow conveys several sensations, and is most difficult to successfully manipulate: we consider it chiefly an exciting power, which may verge from high brilliancy and lustre to very gairish and irritating effects. Beyond this, in its application to form, yellow has a prominent or advancing appearance.

Here let us turn to Fig. 1, representing the section of a cornice used by Owen Jones to explain his theory. Red is placed in the shade to soften its brightness; yellow is put on the most prominent form to assist its shape; blue in the concave moulding. White intervenes between them on the vertical planes, to prevent one primary impinging on the other. This, it must be pointed out, is really but applying to mouldings the colours best adapted to displaying their shape; it does not secure colour harmony of the cornice in itself, much less of cornice with the supporting wall. We get an idea from Fig. 2 how far colour (represented there by shade) does assist form. At Fig. 1 we have them as above-mentioned; at Fig. 2, the colours reversed. *Colour harmony* is still independent of either arrangement.

At Figs. 3 and 4 we consider the tinting of ordinary bedroom and sitting-room cornices, respectively. The first of these assumes a bedroom of cold aspect, the walls hung with a paper in "self-tones" of light salmon-buff, the ceiling-flat being distempered a warm cream—white with *raw terra-di-sienna*. The mouldings next to the paper I put a warm, "mossy" green, made from ochre, umber, a little *ultramarine green* (a blue of very green hue), and a little white. The green hue must be very subordinate, since the warm walls will bring it out fully. In the cove I put a light tint of warm colour, which, by reason of the shade, will look a little deeper; this also is used on the flat A, next cornice. The mouldings between cove and flat are a lighter tint of the moss-green made with the latter, and the ceiling cream-colour. If handled with care and judgment, the result will be harmonious and effective with simply three tints of colour. The other example (Fig. 4) provides a neutral, or "warm," green, flatted wall-colour. Next to this we put a soft terra-cotta, or reddish-brown, a few shades darker than the wall; above this a band of wall-colour, and this framed by the previous terra-cotta at A and a lighter shade at B. The cove we put in a lighter and more yellow tint of the walls, bounded also on top by the lighter terra-cotta tint. A deep-cream flat comes next, then the ogee in a light tint of greeny-blue, which is separated by a small cream flat from a light and soft salmon-tint on ceiling.

Fig. 5 represents colour applied in a dining-room over a rich and glowing wall-paper of semi-natural floral design, the colours being warm greens and browns, with flowers in mixtures of soft, rich red, old gold, and a little "gobelin" or greenish-blue. We give the ceiling a soft but decided pink tint, made with Venetian red and ochre, and put an 8 in. margin, next to cornice, in a deeper shade of ceiling colour. The base of cornice is a medium bronze-green, the cove Indian red and a little white—deeper than the base in tone. The margin colour of ceiling is put on the flat above at X; a medium tint of soft gobelin blue at the flat and hollow next to the cove, and the remaining members warm buff and a greenish-yellow or light mossy green. The lines and ornament may be in terra-cotta, moss-green, and light gobelin blue upon the light pinky-buff of ceiling. In this section the place for a little gilding is indicated.

Fig. 6 is a treatment for a drawing-room having straw-cream ceiling and old gold

walls in self-tones (or monotones) of that colour. The blue cove tint, though appearing blue against a faint yellow and cream, is, when viewed alone, quite a green tint. The very faint pink reed-colour is a tint of Indian red. The creams are made with chromes and umber, and must not be at all irritating.

I do not wish to imply by this lesson that any worker who attempts to follow my directions will be sure to get the best results. He must have a mind that is sensitive to harsh or crude sensations, and that can avoid them. Beyond this, when dealing with the individual client, we may have to consider his or her colour-idiosyncrasy, which often exists in a natural dislike of one particular colour. In all cases, let the cornice *in its entirety* frame the ceiling. Let the darkest colour be at the base, and lighten up to the ceiling; but always get the deepest tones darker than the general wall-colour. In mixing distemper tints, accustom the mind to judging the effect of a colour when dry. Avoid all plain tints of white with pure red, blue, yellow, green, etc. Make up the various tones of colour in the pots; then put a little red into green, green into red, etc., until they are sufficiently soft and neutralised to give a restful and harmonious combined effect. Do not fritter time away in putting twenty colours and shades into one cornice; the client cannot appreciate it, and it is lost to ordinary view, besides destroying the breadth of the cornice. Never put gilding save on advanced portions, and always finish it off with a coating of clear size.

## THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

NECK AND SCROLL—BLOCK FOR NECK—MARKING OUT—CUTTING OUT—TRACING SCROLL OUTLINES—CARVING SCROLL—FINGER-BOARD—CUTTING PEG-HOLES, ETC.—GLUING ON FINGER-BOARD, NUT, ETC.—CUTTING SHOULDER—FITTING NECK TO BOX—ROUNDING AND GLUING UP NECK—VARNISHING AND VARNISHES—FINISHING—SETTING SOUND-POST, STRINGING, AND SCREWING UP.

**Neck and Scroll.**—The neck is next wanted, and I will try to tell you how it should be made; but as regards the scroll, I fear you will have to depend more on your eyes and the patterns than on any description which I can possibly give. By all means have a good neck and scroll near you for reference and guidance.

*Block for Neck.*—The block from which the neck is made is a piece of sycamore $10\frac{1}{2}$ in. long, 2 in. broad, and $2\frac{1}{2}$ in. deep. The 2 in. side should be that nearest the bark of the tree. Plane this side true, and it shall be called the "face." Next plane both $2\frac{1}{2}$ in. sides true and with the same bevel from the "face," and saw one end square off. The block, when ready for use, should be $10\frac{1}{2}$ in. long, $2\frac{1}{2}$ in. deep, and $1\frac{7}{8}$ in. on the face side, with an end section like Fig. 17. It will be convenient at this time to make a centre line along the face, square it down each end, and continue with a straight-edge along the under side. If you are fortunate enough to get a piece 2 in. wide both top and bottom, your labour will be considerably reduced, as it will be much easier to make true or square cuts.

*Marking Out.*—I have assumed that Fig. 18 will be cut out, as well as preceding patterns, in zinc or thin wood. Your neck block being now ready, lay the pattern Fig. 18 on the block, and trace round it with the marker, pencilling afterwards; next square the line A $A^2$ across, and, $\frac{25}{32}$ in. from the top of this line, square from the end of the block the line B $B^2$; the intersection of these lines gives the proper position, or centre, from which to describe the eye of the scroll, which is done with the compasses opened to $\frac{5}{32}$ in., and making a circle from this centre. Three-quarters of an inch from A the line E E should be squared across. From a point midway between $A^2$ and B and crossing the centre draw line C $C^2$, and from midway between $A^2$ and $B^2$ draw line D $D^2$; now prick through the dots on the lines in the following order: A, C, $B^2$, D, $A^2$, $C^2$, B, $D^2$, and then through the second or outer dot on A. When a proper curve is drawn between each of these dots, the outline of the spiral is complete. Now square lines across the face at F H, and $5\frac{5}{8}$ in. from F the line I.

*Cutting Out.*—The outline may be cut out by a narrow band saw; for a few pence a sawyer will do this, and it is much safer than the bow saw. If the neck is being made from a piece like Fig. 17, a piece of deal, sufficiently thick to make the unmarked side lay square on the saw table, had better be glued on. After being sawed out, remove the remnants of the strip, and mark this side in a corresponding way to the other side. The centre marks will have been partially taken out by the saw, and the line must now be continued all round the head from F to G. Now square a line across the back at G. With the compasses open $\frac{3}{4}$ in., set out that distance each side of the centre line at I; close the compasses to $\frac{7}{16}$ in., and mark so much off each side of centre line at F, and with a pencil and straight-edge make a line over the marks on each side, but extend them to E. The sides thus marked out should be sawn down, and then cut square off at E.

*Tracing Scroll Outlines.*—Trace the scroll outlines, Figs. 19 and 20, in their places, as marked on the patterns. Open the compasses to $\frac{3}{16}$ in., and draw them down each side of the head from the end of line C to F; one point of the compasses will be at the side, and the other will mark out the cheeks of the peg-box, which, being thus described or marked, should at once be cut out with gouges and chisels. When this has been done, file the cheeks clean and square. Now fasten the neck edgeways in the vice, and with a dovetail or fine tenon saw cut down just outside the lines K K, L L, M M, N N, but not so deep as to cut into the lines marked from Figs. 19 and 20. Next saw at right angles with these cuts, and along the marks made from Figs. 19 and 20.

*Carving Scroll.*—The rough wood is now taken off, and with gouges of various shapes you should now be able, constantly referring to your model, to make a respectable scroll for an amateur. Accurate manipulation of the carving tools is not the only requirement before a good scroll can be made; a cultured eye is essential. When the scroll is carved, the head should be scraped and sand-papered, and thoroughly sponged over with cold water; this will throw up the defects. When it is quite dry, gauge, with the compasses opened $\frac{1}{16}$ in., lines all round the head and scroll. Between the gauge mark and the centre line, from G round to C, the hollows should next be carved. With a fine file bevel off the edges all round the head and scroll as far as the compass lines; now carefully sand-paper all over, leaving the edges of the bevels quite sharp.

*Finger-Board.*—The ebony finger-board—which, of course, you will buy ready made—should next, with the veneer plane, be planed true on the flat side, and have a centre line marked along it. The "face" of the neck should also be toothed over with the same plane, and the centre line be freshened up.

*Cutting Peg-Holes, etc.*—Place the neck pattern (Fig. 21) flush with the neck and to the marks F and I, and trace firmly the lines O O, P P P, and also make the four dots where the peg-holes will have to be bored. Repeat the process in corresponding position on the other side of the neck, and with tenon saw cut down O O, keeping square across centre mark at I. Now square the centre line down the face thus cut.

*Gluing on Finger-Board, Nut, etc.*—The finger-board should now be glued on (use only two or three drops of glue, as it must come off again before the fiddle is varnished), with the centre line coinciding with that on the neck, and the narrow end of the board touching the line H. The board being cramped fast with hand-screws, the nut should be glued on. It is a piece of ebony $\frac{1}{16}$ in. deeper than the thickest part of the narrow end of finger-board, $\frac{5}{16}$ in. wide and $\frac{15}{16}$ in. long. Both nut and board being quite set, which they will do much more rapidly if made hot before they are glued, put the neck, board downwards, in the vice, and cut just outside line P P P with the bow saw. This done, file down to the line, using a small straight-edge to try the evenness of the neck, between the curves.

*Cutting Shoulder, etc.*—Remove the neck from the vice, and place the shoulder pattern (Fig. 22) with the top side close under, and even with the edges of the finger-board, and mark down both sides and across the bottom of pattern. With a gouge, followed by broad chisel, cut to the lines last made, and also across the bottom at T (Fig. 21); along this face the centre line should next be squared. Fasten the neck in the vice, and cut off the parts which project over the finger-board, and with files make both the neck and nut even with the finger-board.

*Fitting Neck to Box.*—If the instrument has been made true to the lines, there will not be much difficulty in fitting the neck. Place the neck with its back centre mark on the joint of the "tab" and the centre line of shoulder, coinciding with the joint of the belly. With a sharp knife make cuts *slightly narrower than the shoulder* in the end of the belly, and remove the neck. Extend the cuts to the inner edge of the purfling; lay a small straight-edge along the purfling, and cut out the rectangular piece of the belly between the shoulder-marks. Again put the neck in position, and with a very fine point trace the sides of the shoulder on the ribs, and cut through these lines into the block. With a $\frac{5}{8}$ in. chisel cut the block down to the belly, proceeding very carefully, frequently trying the neck until the true position is obtained. This must be tested by looking along the sides of the finger-board and between the sound-holes, up the back joint and along the centre line of the head, and along the edges of the back, with which the eye of the scroll should be in line. Now mark the shape of the tab on the back of the shoulder.

*Rounding and Gluing up Neck.*—The neck should next, with gouges, rasp, and files, be rounded to a rather oval shape

(for which I never use patterns), and thoroughly sand-papered. When this is done, it is the best time to bore the peg-holes, with a $\frac{3}{16}$ in. bit, from outside each cheek, with a wedge or block inside the peg-box to make it solid. Now run the taper bit through the holes as a finish. The holes nearest the finger-board should taper from left to right, the next two from right to left, and so on. Now "size" the shoulder, and glue the neck in its place. In a few hours wash the fiddle over to remove all glue and dirt, and when dry, finish the "tab" and give a final course of sand-paper, and the violin will be finished in the "white." It is hard to resist the temptation to string the fiddle up in this state, but to do so would cause a great deal of labour, so you had better remove the finger-board and get ready for varnishing the instrument.

**Varnishing and Varnishes.**—It is not my intention to enter into a disquisition on varnishing. Should the reader wish to study the question for himself, he has any amount of opportunity offered for doing so; and, in experimenting, he has a good chance of disposing of his surplus capital and spare time. Amongst the works offered for his assistance are those of Davidson, Otto, Hart, Savart, and others, as well as in Mr. Fleming's very readable book, "Old Violins." But I confess that nobody has impressed me so much as the late Charles Reade did in his letter which went the round of the newspapers some years ago. Whenever I have varnished a fiddle in the way named below, it has always been most satisfactory. It would be an impossibility for anyone to begin to varnish a fiddle without being compelled afterwards to make some experiment or other.

Placing a small quantity of Howard's essential oil of turpentine in a cup, I put the latter in a water bath on the gas stove, and, at a very gentle heat, dissolved as much gamboge as the oil would take up, and then laid a coat on the violin. In three hours, the first coat being dry, another coat was given of the same varnish. Two days afterwards the varnish was quite hard—a beautiful yellow; the grain had not risen, and was quite bright. Having a good foundation, I put coat after coat of varnish, composed of the saturated alcoholic solutions of dragon's blood, sandarach, and benzoin (rubbing each coat down with a piece of oiled felt), until the varnish was quite solid and brilliant.

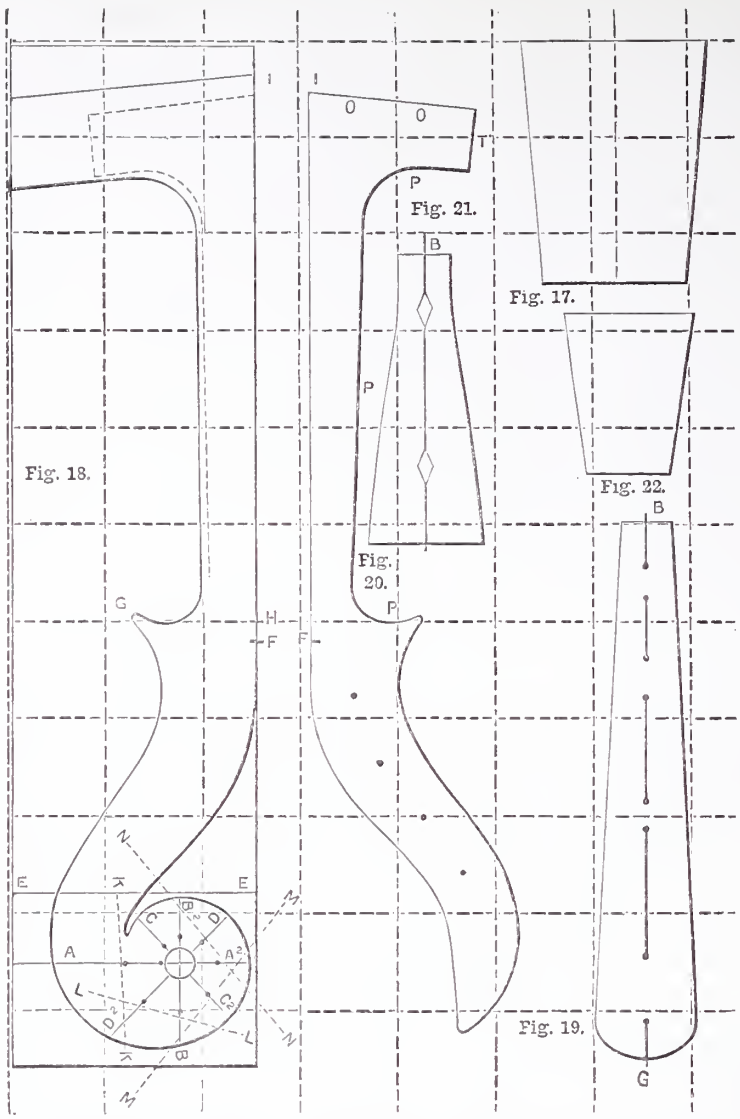



Fig. 17.—Section of Block for making Neck and Scroll. Fig. 18.—Pattern for making Neck and Scroll. Fig. 19.—Outline of Head (Back). Fig. 20.—Outline of Head (Front). Fig. 21.—Pattern of Neck. Fig. 22.—Pattern for cutting Bevel for Shoulder. All the above Figs. are half size, and divided into Squares for Enlargement to full size.

There are on the shelves in my work-room the saturated solutions of mastic, dammar, elemi, sandarach, benzoin, myrrh, dragon's blood, Socotrine aloes, Barbadoes aloes, gamboge, annato, seed lac, sandal-wood, saffron, Venice turpentine, etc. Appended are a few recipes for making varnish, which have been gathered from various sources.

(1) Dissolve in oil of rosemary as much clear copal as the oil will absorb. If too thick, use spirits of wine to dilute.

(2) Essential oil of turpentine, 8 ozs.; drying linseed oil, 4 ozs.; fused amber, 4 ozs.; gum lac, 1 oz. Dissolve by heat.

(3) Dissolve by heat 8 ozs. of copal in 1 pint of drying oil, and use oil of turpentine as a dilnent.

(4) Make a strong alcoholic solution of sandal-wood or other colour desired, and concentrate this solution by evaporating it to half the bulk. Mix the solution with essential oil of turpentine, and evaporate all the spirit by boiling in a water bath. To each gill of coloured essential oil add in turn, as dissolved, $1\frac{3}{4}$ ozs. of mastic, 1 oz. of dammar, and lastly, 1 oz. of linseed oil. This varnish should not be used until three or four months old.

(5) *Spirit Varnishes:* Gum elemi and mastic, $\frac{1}{2}$ oz. each; sandarach, 2 ozs.; Venice turpentine, 1 oz.; seed lac, 1 oz. Dissolve in 12 ozs. of methylated spirits which has been coloured to suit.

(6) Colour 1 pint of methylated spirit or wood naphtha to suit, and add the following: 2 ozs. of mastic, 1 oz. of seed lac, $2\frac{1}{2}$ ozs. of juniper, and 1 oz. of Venice turpentine.

(7) Three ozs. of shellac or seed lac, 3 ozs. of sandarach, 1 oz. of mastic, 1 oz. of benzoin, to each pint of coloured spirit.

**Finishing.**—The fiddle should be varnished, with the exception of the "handle" part of the neck, and when it is perfectly hard—not before—it will be ready to have the neck cleaned; which done, glue the finger-board on the neck again—this time quite fast. When it is set, wash all dirt and glue from the neck, and polish it up with the finest sand-paper and linseed oil; but mind that the varnish be not injured in doing this. With a fine "rat-tailed" file cut in the nut the four grooves in which the strings are to lay. Mark the positions of the outer grooves $\frac{1}{4}$ of an inch from each end of the nut, and, with the spring dividers, divide the intervening space into three portions. Make all the grooves free from sharp edges, as these would cut the strings. Free the peg-holes from varnish, and file a set of pegs to fit. The bridge should be fitted to its position: between the V's of the sound-holes. No. 1 gouge will be about right for cutting the feet. The top of the bridge should have nearly the same curve as the finger-board, but should be about $\frac{3}{16}$ in. higher than the place at which a line along the top of the finger-board would terminate if extended to the bridge. The bridge will also need to be made a trifle thinner towards the top. Make four very shallow grooves with the file: these are for the strings to lay in. Fasten a piece of

Fig. 23.—Violin finished and strung.

strong gut into the tail-piece, of such length that when the loop is placed in the groove of the end pin the tail-piece is brought close to the bottom nut or rest.

*Setting Sound-Post, Stringing, and Screwing up.*—The sound-post should now be set in position; but, as remarked in the earlier part, there may be some difficulty in deciding which is the best place for it, and this can only be tested when the instrument is strung up. This can now be done. First, put the fourth or G string in the left-hand "slit" of the tail-piece, and through the peg nearest the finger-board; the first or E string is the next in order, then the third, and lastly the second string. Whilst the strings are quite slack, set the bridge in position, and screw the strings steadily up to pitch, alternately fourth and first, second and third, meanwhile observing that the bridge does not pull forward. Now, how do you like the tone? Of course everyone will remark, by way of encouragement, that "it is all right for a new fiddle," or "the tone is rather raw, but it will improve in two or three years." These observations are as certain as the stereotyped ones about the weather.

I do not know what other people may feel, but to me it was a moment of intense pleasure when I heard the first note from my first fiddle: exceeded, perhaps, when I heard the voice of double bass No. 1. This I was so anxious to do that it was strung up in the "white"—a mistake that will not occur again.

## SUBSTITUTE FOR HALL-STAND.

### EASILY AND CHEAPLY MADE.

BY B. R. CONDER.

AIM OF DESIGN—MATERIAL AND COST—HAT-STAND: DIMENSIONS AND CONSTRUCTION—DECORATION—MIRROR—DIMENSIONS AND CONSTRUCTION OF UMBRELLA-STAND AND CUPBOARD—TRAP-DOOR.

I PURPOSE describing briefly in the following paper two very easily and cheaply made, and yet thoroughly efficient, substitutes for a hall-stand. In planning them I aimed chiefly at economy of penee, and therefore of material, simplicity of construction, and consequent economy of time in making, and compactness. At the same time I was desirous to some extent that they should be ornamental, or, at least, not absolutely unsightly.

For the cheapness I ean answer, as the entire cost of material—wood, paint, brass hooks, and mirror—did not exceed 8s. They are made of deal, and painted with Aspinall's black enamel; as, however, so little wood is required, the cost would not be greatly inereased if, instead of deal, some ornamental wood, such as oak, mahogany, or walnut, were used.

The construction of the hat-stand, which we will consider first, is very simple, and a very short description of it will suffice.

Its dimensions are: extreme height, 2 ft. 6 in.; and width, 1 ft. 11½ in. It consists of an outer and an inner frame, which are mortised together. The four pieces forming the outer frame are 2½ in. wide and 1 in. thick, and their edges are stop-chamfered, as shown. The horizontal rails are mortised into the upright ones, 2½ in. from the ends of the latter, the tenons being carried about two-thirds of the way through. The parts of the inner frame

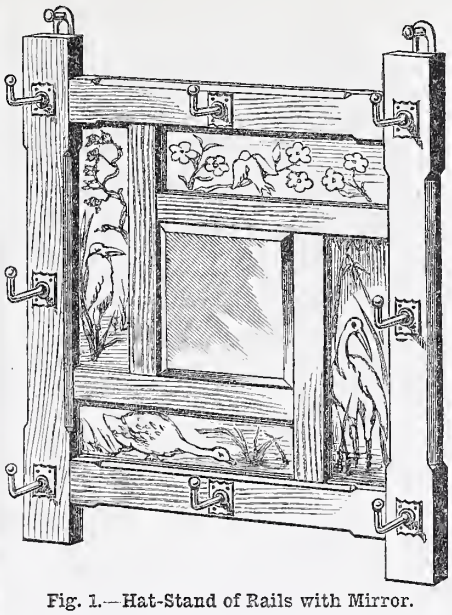


Fig. 1.—Hat-Stand of Rails with Mirror.

are 1½ in. wide, and only ¾ in. thick, so that, when fixed in place, their faces are flush with the inner chamfered edges of the outer frame, and both frames are flush at the back. They are mortised together and into the outer frame, in such a manner as to leave a space in the centre 9 in. high by 7½ in. broad for the glass, and oblong spaces 4 in. wide between each inner rail and the rail of the outer frame parallel with and nearest to it. A rebate of the required length is cut in each for the reception of the glass, which is secured at the back by a small beading. The whole framework is glued together, and if the tenons fit, as they should, so tightly into their respective mortises as to necessitate some little force being used to drive them home, nothing more is necessary. Care should be taken in joining up to keep it square. After this it is painted or otherwise decorated, the glass fixed in its place, and the hooks and plates by which to hang it to the wall screwed on, and it is complete. For purely decorative purposes I added a thin back, covered, where visible from the front, with Japanese gold leather paper, which improved its appearance wonderfully. The mirror might be dispensed with, and the centre space treated in the same manner. To those who intend using a mirror, I would suggest procuring it first, and making their framework, so to speak, to fit the glass; for the simple reason that one of stock size would cost considerably less than one made to order to a given measure.

The dimensions of the umbrella-stand are—length, 2 ft. 4½ in.; breadth, 9½ in.; and height to top of posts, 2 ft. 7½ in. Its construction is as follows: Four posts 1¼ in. square and 2 ft. 7½ in. long, whose edges are stop-chamfered, are connected by eight rails, which are mortised ¾ in. into them. These rails are ½ in. thick; the upper ones are 1½ in. wide, and are mortised into the posts 1½ in. below the tops of the latter; the lower ones are 3 in. wide, and their lower edges, which are rebated to take a thin bottom, are 1 in. above the floor. The front and back rails, top and bottom, are slightly notched at a distance of 7 in. from the posts, for the reception of the sides of the cupboard, which are let into them. These sides are of ½ in. stuff; they fall ¼ in. short of the under edges of the lower rails, to allow for the thickness of the bottom, and project the same distance above the top rails, in order to be let into the top of the cupboard, which is grooved to receive them. They are rebated to take a thin back, and grooved for the shelves, which are slid into their places from behind after the sides are fixed and before the back is screwed on. Their front edges are lined up to 1¼ in.

The various parts are glued together, with the exception of the bottom and the back of the cupboard, which are screwed on, the top being blocked inside for additional security.

Two large flower-pot saucers serve as receptacles for the drippings of wet umbrellas, though, doubtless, zinc trays would look better, and a small curtain answers the purpose of a cupboard door in screening from sight clothes-brushes, slippers, etc. Doubtless these little articles are more or less makeshifts; but they are extremely useful ones; and as their construction is so simple as to be within the ability of all who can use a saw, plane, and mortise-chisel with a very moderate degree of skill, and they can be made for about as many pence as a good hall-stand would cost shillings, they are by no means to be despised.

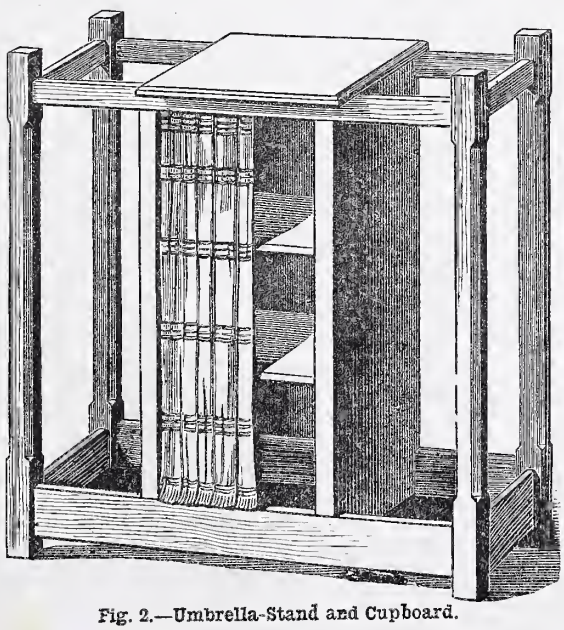


Fig. 2.—Umbrella-Stand and Cupboard.

## SOME WORDS TO WOULD-BE PATENTEES.

BY "AN INVENTOR."

WHERE TO FIND COPIES OF PATENTS—INDICES TO PATENTS—FORMS A AND A 2—POSTAGE—RULES FOR DRAWINGS—APPARATUS FOR COPYING DRAWINGS—COPYING MANUSCRIPT—CORRESPONDENCE WITH COMPTROLLER—REGISTRATION OF PATENT AGENTS—PROVISIONAL PROTECTION—WHEN ACTUAL PROTECTION COMMENCES—PROTECTION IN NEW ZEALAND.

"A CONSULTING ENGINEER" enforces the necessity of instituting "a most *careful* and *analytical* search through all the specifications *relating to the subject*," but omits to say where such search can be made, or how an inventor is to go about making the search; so I will supply the omission. In addition to the library at the Patent Office, full copies of every patent granted from March 11th, 1617, to the present time, with indices; reports of patent

trials, all carefully indexed, so as to enable anyone quickly to discover every question brought up in the Courts for decision; the official weekly journal, also carefully indexed, with abstracts, at the following places, which can be seen or copied by *anyone free of charge*:

Aberdeen, Public Library; Birmingham, Central Free Library; Bolton-le-Moors, Public Library, Exchange Buildings; Bradford (Yorks.), Free Library; Brighton, Free Library; Bristol, Free Library, King Street; Cardiff, Free Library and Museum, from 1871; Carlisle, Public Free Library, Police Office; Cork, Royal Cork Institution, Nelson Place; Derby, Free Library and Museum; Dublin, National Library of Ireland, Kildare Street; Glasgow, Stirling's Library, Millar Street; Halifax, Town Hall; Huddersfield, Corporation Offices; Hull, Mechanics' Institute, George Street; Ipswich, Museum Library, Museum Street; Keighley, Mechanics' Institute, North Street; Kidderminster, Free Library, Public Buildings, Vicar Street; Leeds, Public Library, Infirmary Buildings; Leicester, Free Library, Wellington Street; Liverpool, Free Library, William Brown Street; London, Patents Library, 25, Southampton Buildings, Chancery Lane, W.C.; ditto, British Museum; ditto, Free Library, London Street, Bethnal Green, from 1869; Manchester, Free Library, King Street; Newport (Mon.), Commercial Room. Town Hall; Nottingham, Free Public Libraries; Oldham, Free Library, Union Street; Plymouth, Free Library; Rochdale, Free Library, Town Hall; Salford, Free Library, Peel Park; Sheffield, Free Library, Surrey Street; Stockport, Central Free Library; Swansea, Free Library; Wolverhampton, Free Library.

If a private copy of any patent is desired, the price is marked on it in plain figures, and is sent free, plus the amount of postage (book rate), to any address in the country by the Comptroller of Patents, 25, Southampton Buildings, Chancery Lane, London, W.C. He will also send, post free, the Patents, etc., Act, 1883, for 1s. 9d.; ditto, 1885, 2d.; ditto, 1886, 2d.; ditto, 1888, 2d.; Patent Rules, 1883, 7d.; ditto, 1885, 3d.

The indices to the patents are chiefly of two kinds: viz., a *Name* Index and a *Subject Matter* Index; there are others also. This latter enables us to see at a glance the number of any patent for the year on the subject in hand, and the Patent Specification itself can be referred to at once on the shelves; and who so likely to recognise the same invention in another form as one who has invented or worked it out? Certainly he would be a very clever patent agent who could equal all-round, on every subject, every inventor; but if a visit is paid in the daytime, we shall find youths—merely lads—doing the searching for local patent agents. Everything is so nicely arranged, that as soon as the system is understood, the back patents on the subject can all be quickly examined: this *may* be done before applying for a patent, but I should never advise an inventor to employ a professional patent agent, as, if he is capable of inventing anything, he is quite qualified to "search." Reports of ALL patent cases tried in the Courts are also SUBJECT MATTER indexed, so that easy reference can be made to any subject tested; in fact, carefully reading and studying these reports will give inventors more insight into the requirements of the Patent Laws, and how to understand the various Acts of Parliament, than all the patent agents' circulars and barristers' law books—written for ignorant inventors—put together. When a man can be his own lawyer, he has an advocate that will do his utmost for his clients' interests, and such a one will not always keep an eye on future possible employment. The greatest crime a professional man can do, whether a patent agent or solicitor, is doing things "unprofessionally"—that is, depriving himself and his professional brethren of all chance of making a *future* "picking." This is no advantage to a patentee, therefore he should learn to do things himself, so as to be able to tell if they are done right, even if he does not do them himself.

This article should be read as a supplement to that of "C. C. C." in WORK, Vol. I., page 545, in which all statements may be considered as being fairly correct, with the exception of the following:—Form A is the Application Form when applying for a patent by an original inventor or a British invention; Form A 1 is used when the invention is an imported foreign one, taken out in the name of a resident in this country; Form A 2 is for use when a foreign inventor applies in his own name, but wants it dating back to correspond with the date of his home foreign patent.

There is no need to pay postage on any package sent to Patent Office, beyond the stamps on the forms; just write on, "O. H. M. S.," this is quite enough; so that if the inventor does the work himself, the cost out of pocket to get his patent is just £4—no less or more.

The rules for the drawings are not on the form for the "Complete" Specification; the requirements are, that it be *white drawing* paper—Windsor and Newton's keep it, and it can be had from their customers; most drawing papers have a "creamy" colour, which is objected to; the "white" is often difficult to get. The size to cut it is 13 in. by 8 in., or 13 in. by 16 in., and must have a margin drawn half an inch from the edge all round, within which all the writing and drawing is to be done. If the drawings are done to scale, the scale must also be shown on every sheet; on the top right-hand corner of each sheet, must be marked the number of sheets of drawings, and what number that sheet is; on the left-hand top corner is to be marked the number and year, and whose Specification it is; on the bottom right-hand corner the sheet has to be signed by the applicant or his agent, and every drawing must be in duplicate, one of which must be marked a "True Copy."

Now, to most people it is no joke to make a drawing on thick drawing paper in Indian ink, and then make a *true copy* of it, exact in every respect. It was a difficulty I was much puzzled over at first; but, however, I hit on a plan at once simple and efficient, which I think will be found of use to many more people besides what are likely to take out patents; for instance, I showed the plan to a lithographic printer, and he was delighted with it as a means of taking tracings on "transfer-paper," to lay down on the stone.

The whole apparatus is the most simple and inexpensive, and the materials may be found in every house, and fixed up in a few minutes—in fact, I had my first working in half an hour. Fig. 1 shows at A a common box—it does not matter whether it is square or oblong—with one side and the top removed; C is a sheet of common looking-glass; if one is not found in the house—which is very unlikely—it can be had of any small ware dealer for sixpence: this is fixed at an angle of 45 degrees, which is to reflect the light *upwards* from the gas or lamp, Fig. 2. No tools are required to do this correctly: just light the gas or lamp, and look *downwards* until you see the light fairly in the centre of the glass, then drive two tacks in the box, at the foot of the looking-glass, to keep it from slipping out of place; the looking-glass can thus be fixed into the box, and taken out any time. A plain level sheet of transparent glass is now fixed on the top to trace on, when the box is complete. Fig. 2 shows a gas burner, but I prefer to use a petroleum lamp, with another looking-glass on one side to reflect more light into the box, and an opaque shade fixed on the chimney to keep the light out of the eyes while working.

Fig. 3 is a spring clip, to clip the two sheets together while being copied; two of them will be required for opposite diagonal corners: these are made out of a piece of clock spring or other similar sheet steel. I make them by holding a piece in the gas till hot, and then bending the two ends close together. I first of all make a drawing on thin white paper, on a drawing-board, which is finished in ink as black as possible; this will perhaps have numerous compass holes in it. When I have got it right I fix it under a sheet of drawing paper by means of the clips, Fig. 3; and now lay it on the sheet of glass B, on top of A, when the reflected light from lamp, or gas, will show clear through, making the drawing quite distinct, which I can quickly trace in Indian ink; the two sheets being clipped together enables me to turn them about anyhow so as to fix it just right for drawing every line. I can thus make any number of exact copies on the thickest drawing paper.

I am not sure that this plan of making exact copies is new or not. I have never seen it described, and it is, as far as I am concerned, my own invention: which, though it may be largely used, is really one of those things that are not worth patenting, simply because everyone who wanted to use one would make his own, and there could be no means of detecting him, or getting in any royalties.

The Tracing Box will meet a great want, both amongst amateur and professional patent agents, as very few can copy their own drawings satisfactorily.

There is no limit to the number of sheets, either in Drawings or Specifications, that may be sent in, and here again I may give another useful wrinkle. All documents require to be in duplicate, and fifty or more sheets of foolscap manuscript is no joke to copy. I work it thus: the rules say "written or printed," so I write the Specification in strong copying ink; I then get some strong thin sheets of unruled white foolscap paper, and place a wet cotton cloth between two sheets until quite damp, and then copy on these in the press in the ordinary way, taking *two* copies, one to keep and one for the Patent Office, to go with the original; the ink strikes through, and shows well on the other side. These copied duplicate sheets are quite within the rules, and are really preferred at the Patent Office, as only one set need be examined.

Having said thus much, I will now tell the public what treatment they may expect from the officials at the Patent Office. This is it: if you want any information regarding taking out a patent, write a courteous and respectful letter to the Comptroller—no need to pay postage—and he will send you a courteous reply back, giving, if possible, the information you ask for *all for nothing*—in

fact, I need to say no more than "Write for particulars to the Comptroller." Patent Agents think he interferes with their business by doing this, though he is strictly doing his duty to the public, as one of their servants. I will try to make it clear why this is so. The Patent Laws and the Patent Office exist for the benefit of the *public*, not for Inventors, nor yet for Patent Agents. Every useful invention is a public gain, and the duty of the Comptroller is to collect, and make public, every invention he possibly can, so that the public may have the benefit of it; the offer of a patent for a term of years, on behalf of the Crown, is an inducement he is allowed by Parliament to offer to all inventors who disclose their inventions to him: he naturally wishes to induce as many inventors as possible to come forward, and he certainly would not be doing this by giving them *worthless* patents; he therefore, to inspire trust and confidence amongst inventors, carefully examines all Specifications sent in, and if he notes any fault or error, he sends it back to be rectified. I have seen Specifications sent back because a comma had been omitted. It certainly is not his fault, if a Specification is defectively drawn; what he does, and has done, and what I have heard patentees say in the Local Patent Library he has done for them, in the way of help, seems too absurd to relate. The Yankee tale about the railroad agent (station-master) who kept a train waiting until an old hen laid an egg, to oblige a woman who was one short of a dozen to send by it, quite pales before the stories I have heard.

If you go to a Tax Office, you may be treated with scant ceremony, because *you are obliged to go*. But not so at the Patent Office: there the whole British public employs the Comptroller and his staff, to get your invention out of you, for *their* benefit, not yours; so it is his duty to use every inducement the law allows him to get it. Professional Patent Agents may want to stand between the inventor and the Patent Office, but there is very little need for their services, and inventors should look out for themselves, or their rights will be seriously curtailed. Patent Agents got the thin end of the wedge in by the Act of 1888; they will not be long before they give another blow to the freedom of inventors. So far, there is nothing to prevent "C. C. C." or anyone else acting as an "unauthorised" Patent Agent, or offering his *services* or assistance to inventors by advertisement, as long as he does not call himself "Patent Agent," or sign the documents as "Agent." As long as everything is done in the *name of the Inventor*, and all the signing is done *by him*, it does not matter who draws the documents up. I see Patent Agents are advertising themselves as "Registered," implying that they are "duly qualified." The Act of 1888 says: no person shall represent himself as a "Patent Agent' unless he is registered; but on the other hand, any person who has acted as a Patent Agent previous to the passing of the Act *is entitled to be registered*, no matter how little his knowledge of Patent matters may be. In future, the principal condition on which Patent Agents may be registered, is that they have served for a certain time to one of these possibly incompetent registered agents; thus the public get no guarantee. In fact, the Act of 1888 is simply to keep down the supply of Patent Agents, because many were doing work, under trade-statement prices. I have no sympathy with anyone who wishes to dictate or regulate the price of anything. I hold that the Law of Supply and Demand should do this; nor do I hold that anyone has a right to dictate to another man how little or how much he shall demand for his skill or labour. If a man wants a good price for his work, let him excel everyone else in its *quality*, and sooner or later he will get all he asks, no matter how others may be cutting under him. Many Patent Agents quote "so much" for taking out a patent, which they do on the principle of "averages"—that is, taking one with another. If a man chooses to do his business in this manner, he has a perfect right to do so, and I am not going to blame him, nor hint that such a person's work is not to be depended on; on the contrary, some of the Patent Agents who do business in this way are the most competent, trustworthy, and reliable in the profession.

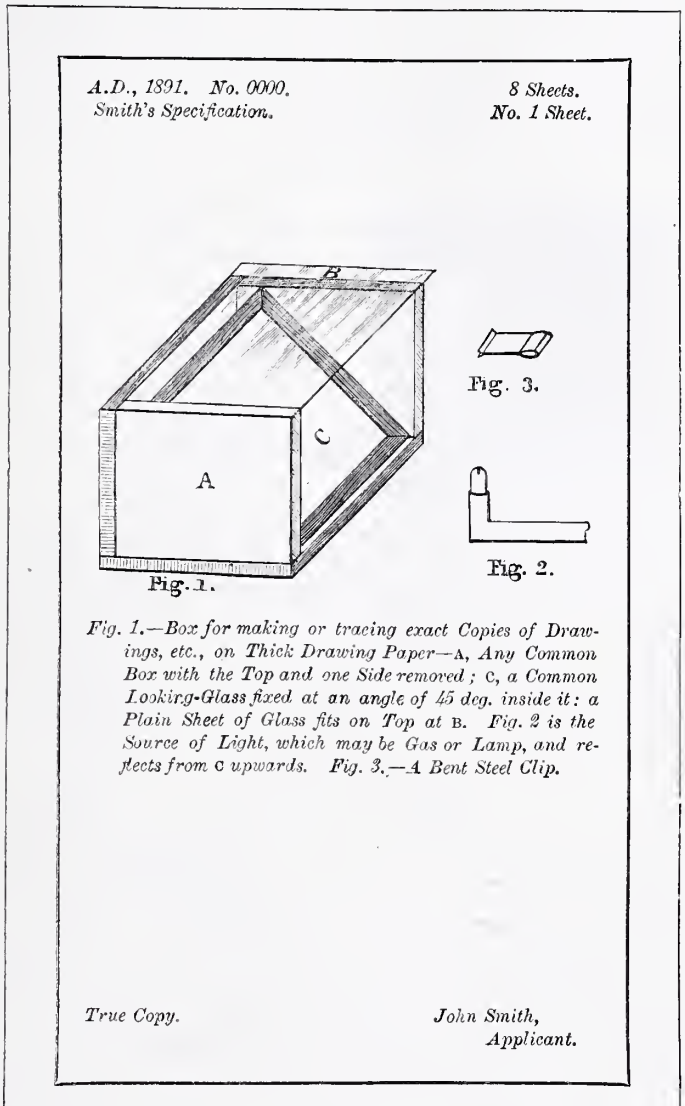



*Fig. 1.—Box for making or tracing exact Copies of Drawings, etc., on Thick Drawing Paper—*A, *Any Common Box with the Top and one Side removed;* C, *a Common Looking-Glass fixed at an angle of 45 deg. inside it: a Plain Sheet of Glass fits on Top at* B. *Fig. 2 is the Source of Light, which may be Gas or Lamp, and reflects from* C *upwards. Fig. 3.—A Bent Steel Clip.*

**Example of Sheet of Drawings for Patent Office.**

In No. 46, page 731, "C. C. C." does not draw quite safe deductions. I agree with him that "Provisional Protection" makes an inventor "as safe as if the patent had actually been granted"; but it gives him no protection against anyone who infringes *previous to the date of the acceptance of the Complete Specification*. If the infringer is a sharp, unscrupulous person, he might assert that he had been publicly making and selling the things *previous* to the date of the patent; and as such statement is not on oath, no charge of perjury can be made; no doubt he will have confederates to whom he will kindly refer you, who will show you invoices dated months previously, so a timid inventor may be frightened out of his rights; such a person, by lodging the proper form at the Patent Office (price 5s.), will be duly informed of every step taken; so that as soon as the Complete Specification is accepted, he can either back out scot free, or file opposition; if he does this, he may get a perpetual free licence to "square" him. This is no imaginary matter. In one patent I took out, I simply said that I had solved a problem that had been before the world ten years for anyone to solve. The matter was noised all through the trade; everyone was soon guessing, and numberless were the tricks resorted to, to learn how the thing was done; but kind friends told me to be cautious, because no matter what it was, it was decided to declare that it was "old."

One party professed to be my friend, and begged me to tell, just himself, as a particular favour, and he would be strictly "masonic" over it. I would not until after the date of acceptance of Complete Specification, though I made no secret of what the thing was like, and invited anyone to guess; one editor said if I could do that, it would be a novelty indeed. As soon as it was known what it was, up they all jumped to cry that it was *old*, my particular "masonic" friend heading the lot; and though they were twelve months after the date of my patent, and though I hold letters, in which it is declared such a thing is absolutely impossible, and hinting that I was surely taking them in, they actually presented me with a very formidable-looking list of names of people, who they said had made and used such, previous to the date of my patent. What inventors should do, is to always file a Provisional Specification, and delay filing the Complete one as long as possible, keeping their invention as secret as possible in the meantime; by this means, they get ten or twelve months' start of all such gentlemen.

"Patentee," page 574, No. 36, must read

Acts of Parliament differently if he is to teach Law. Patent Specifications are always interpreted according to what they *mean*; whilst Acts of Parliament are interpreted by what they *say*. Let him read section 14 again: he will see that it simply says that an invention for which a patent has been applied for, may be used and published, without prejudice to the *grant of a patent;* section 15 invests him with all the rights and privileges of a patentee from the date of the acceptance of the *Complete* Specification, though he does not get his patent for ten weeks after. If Parliament had intended a patentee to have the privileges of a patentee from the date of his patent, or the date of Provisional Specification, they would have said so; but instead, the Act says clearly and distinctly "the date of the acceptance of the *Complete* Specification." *Therefore it is, or should be, clearly evident to anyone of ordinary comprehension* —unless it is "Patentee"—that no action can be brought on anything done in infringement previous to the date of the acceptance of the Complete Specification, simply because Parliament says a patentee shall not go beyond that date in claiming anything in an action for infringement; while section 13 says, "Every patent shall be dated and sealed as of the day of the application, provided that no proceedings shall be taken in respect of an infringement committed before the publication of the Complete Specification."

On the 1st of January, 1890, a new Act came in force in New Zealand, entitled a "Patents, Designs, and Trade Marks Act"; it is almost word for word, the British Act of 1883, the forms being obtainable at any money-order office in the colony, and transmissible by post. The principal differences are as follows: 10s. is payable in filing application, which may be accompanied with a Provisional or Complete Specification; 10s. on filing a Complete Specification in nine months, and £2 on sealing the patent: total fees, £3. There is a further payment of £5 before the fourth year, and £10 the seventh year; but there is a new departure, that I think all inventors will be interested in, *viz.*, that British patentees have twelve months from the date of their British patents to apply in New Zealand for a patent, and when they do apply, the patent takes the same date as the British one, so that all British patentees get twelve months' Provisional protection in the colony.

There are quite a number of matters I have left untouched; but should any difficulty arise, they can be answered in "Shop." The present paper will, along with "C. C. C.'s" article, act as a good guide, and what is not mentioned will, I think, be readily found in the libraries I have given a list of. Thousands of inventors daily pass them in ignorance of their existence, or that they have a perfect right of access to everything in them *free of any charge whatever*, no matter where they live or come from. It is only right that information on this point should be placed within the knowledge of the readers of WORK, and this I have sought to supply to the best of my power in the foregoing remarks on this subject.

## A HANDY MEAT SAFE.

BY "AN AMATEUR CARPENTER."

INTRODUCTION—WOOD—CONSTRUCTION OF PARTS AND PUTTING TOGETHER—CONCLUSION.

*Introduction.*—Now that the hot weather is coming on—or, at least, summer is approaching—a meat safe will be a very useful article in which to store commodities of daily consumption in the household, and all things that are likely to suffer from the delicate attentions of the inquisitive housefly. It is especially hard in hot weather to keep articles from going bad, and, besides, a safe is a very simple article to make, so that the amateur may not shrink from attempting to construct such a useful thing, as anyone with a slight knowledge of carpentry and a few simple tools can do so.

I will now proceed and give some instructions to help in making one.

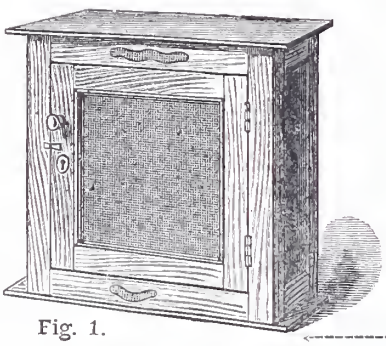


Fig. 1.

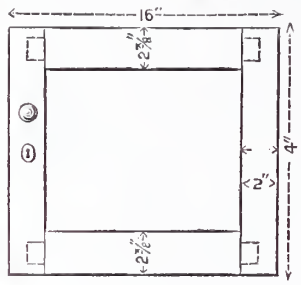



Fig. 2.

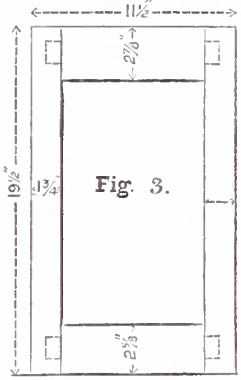



Fig. 3.

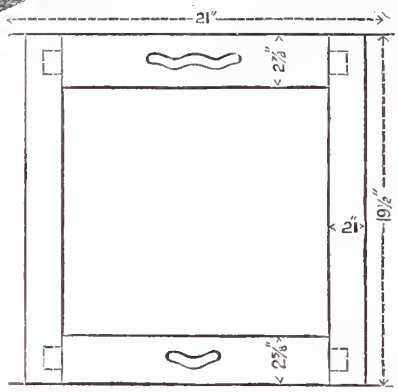



Fig. 4.

Fig. 1.—Safe complete, in perspective. Fig. 2.—Framing of Door. Fig. 3.—Side of Safe. Fig. 4.—Framing of Front in which Door (Fig. 2) is hung.

*Wood.*—The best wood will be yellow pine, and the sizes that are wanted can be seen by referring to the illustrations. It had better be about ½ in. or ⅝ in. thick.

*Construction of Parts.*—Fig. 1 shows the safe complete, in perspective. Fig. 2 is a view of the door. About 14 in. high by 16 in. wide would be a good size for the outside measurements. The width of the wood for the top and bottom pieces had better be about 2¾ in., and the uprights about 2 in. across. Fig. 3 shows the side piece, two of which must be made. The sizes and length of the wood are shown in the illustrations. In this figure, and also in Figs. 2 and 4, the joints had better be mortised and tenoned if the reader cares to. Fig. 4 shows the arrangement minus the door. The two holes cut in the top and bottom are for the zinc to be nailed at the back of each. Of course, it is understood that zinc will be wanted for the door and side pieces. In Fig. 3, it will be noticed that there is another line on one side of one of the uprights. This is to show how the front is joined, and that line represents the thickness of the wood of Fig. 4, and the way of putting together. For the top and bottom and back of the safe, some small planks of wood must be nailed on to the uprights. The interior had better be fitted with a shelf and a small hook, attached to the top of the safe, for hanging meat on. The shelf, for convenience, may be made so as to be removed in case it is wanted, as a large joint of meat would not be able to hang unless the shelf was very low, which would not do, as nothing could be placed underneath it.

*Conclusion.*—In concluding, I may say that I think the reader would find it very easy to put the parts together, and also to make them. The boards at the top and bottom had better be about ½ in. each way wider than the uprights; and if it be exposed to the damp or rain, some thick felt (which can be got at most ironmongers' at about 6d. per yard) had better be nailed on the top. The other fittings, viz., a pair of hinges, a lock and key, and a small handle, can be obtained at almost any local ironmonger's, as can also the zinc which will be wanted for the door and sides. Any inquiries on points not made quite clear I shall be happy to answer through the medium of "Shop."

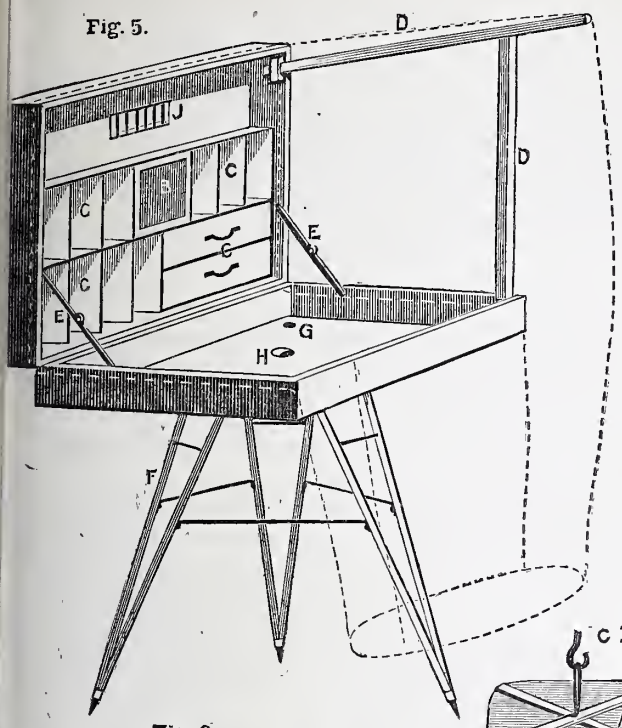
## PHOTOGRAPHIC TENTS.

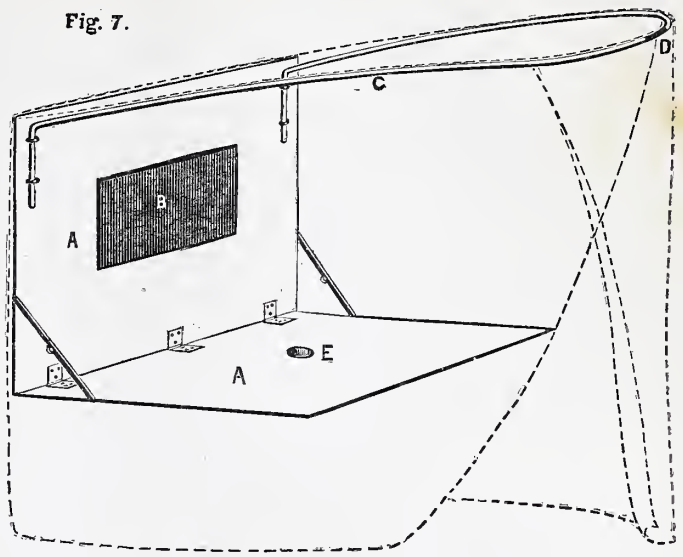
BY AN OLD HAND.

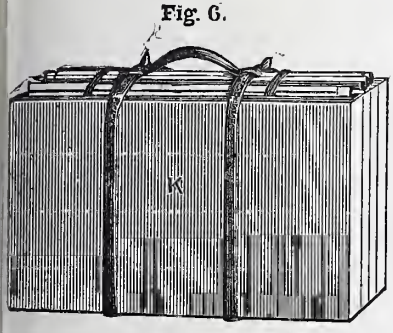
TRAVELLING TENT—FOLDING TENT—HOWARD TENT—PLATE CHANGING BOX—LIGHT CHANGING BOX—SACK TENT.

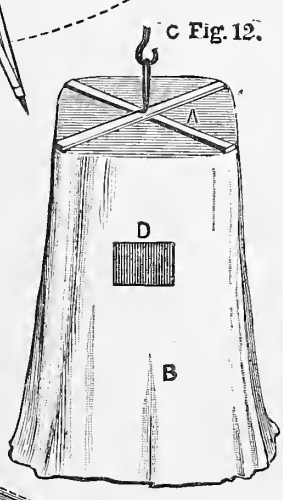
No. 2 is a lighter and more portable form of tent, useful when the smaller sizes of plate have to be developed; but as the room inside is somewhat limited, the face is necessarily much over the developer, and if ammonia is used, is somewhat disagreeable to work in, besides being close and hot. It is, however, a practicable tent enough for occasional use, for merely changing plates and ticketing them is all that is necessary. It consists of two shallow double boxes hinged together, each 24 in. by 16 in., and 2 in. deep. When open, the half that is raised up, and kept in place by a knee and strut on each side, is partitioned out for holding bottles, brushes, etc., with a small ruby glass window in the middle. The lower half is screwed on to a stout tripod, and acts as a receptacle for the frame and cover when packed, and which is not removable, as in No. 1, but carefully attached to the case in the manner shown in the diagram. It is intended that the operator shall stand to work in this tent. He slips the bag at the back over his head, and fastens it round his waist with a buckle and strap, the upper part of his body only being under cover. The fixing bath is arranged as in No. 1, the water supply being contained in an indiarubber bottle hanging outside the tent, and communicating by means of an indiarubber tube with the inside, where it terminates with a pinch tap. The ventilator is similar to No. 1.

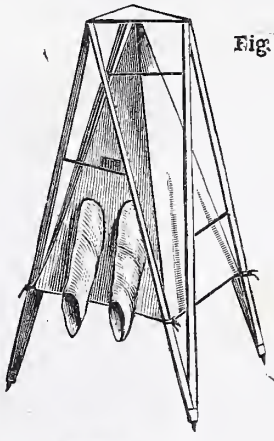
No. 3 is somewhat similar in design, but, instead of the double box, consists of two boards arranged in a similar fashion, and fixed in position with elbow struts, with a window in the upright one. The framework

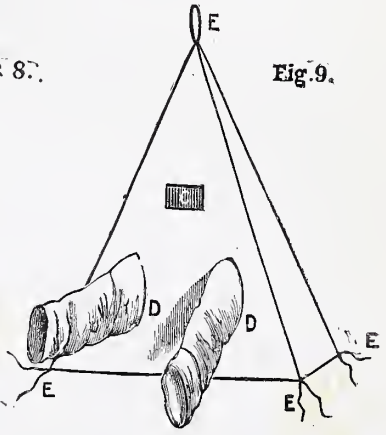


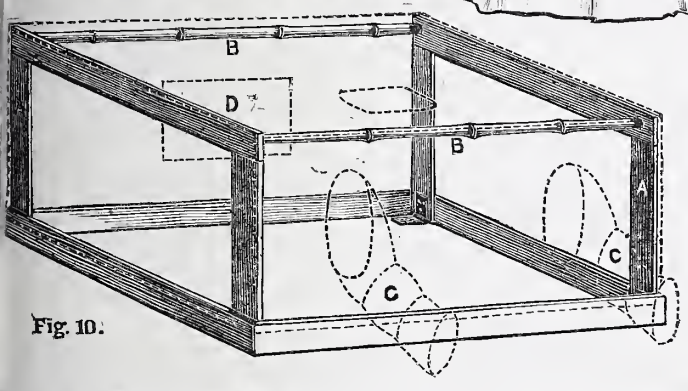



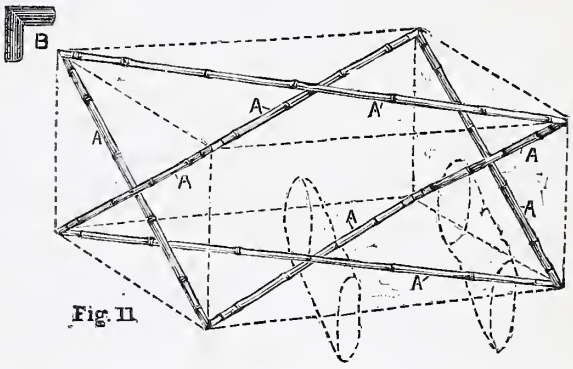




ENT No. 2. Fig. 5.—Tent Set up—B, Ruby Window; C, Partitions for Bottles; D, Framework of One Side; E, Strut; F, Tripod; G, Hole for Waste Pipe; H, Bolt to Tripod; J, Ventilator. Dotted Lines show where Covering is attached to Woodwork and Bag Entrance. Fig. 6.—Tent packed, with Tripod at top for transit. TENT No. 3. Fig. 7.—Bottom and Front of Tent—B, Window; C, Iron Wire to support Covering, hinged at D; E, Screw Hole to attach to Tripod. Dotted Lines indicate Cover. TENT No. 4.—THE HOWARD TENT. Fig. 8.—Triangular Bag suspended under Tripod Head. Fig. 9.—Bag detached—C, Ruby Window; D, Sleeves; E, Cords to attach to Tripod Head. TENT No. 5. Fig. 10.—Tent showing Details—A, Frames of quarter-inch Mahogany hinged to each End of Box and folding down when not in Use; B, Bamboo Rods sprung into Hollows in the Frames to stretch out the Covering and support the Ends; C, Sleeves; D, Window. Dotted Lines show where Cover is attached to Tray. To pack, remove Stretchers, and fold down the End Frames and Cover into Tray; put a Strap round to carry it with, and the whole is complete. TENT No. 6. Fig. 11.—A, Bamboo Rods, each Pair pivoted in Centre; B, L-Shaped Ferrule. TENT No. 7.—SACK TENT. Fig. 12.—Tent set up—A, Wood Cross-Pieces; B, Sack; C, Hook in Ceiling; D, Window.

onsists of two uprights screwed to the ack edge of the lower board, and folding arallel with it when out of use. To fix or use, they are placed upright, and a iece of iron wire jointed in the centre f the back overhead—the opposite ends eing bent at right angles—is fitted into yes attached to the front board. In his case the cover is detachable, and made of one thickness of ruby and one of black twill, similar in make to the cover of No. 1, an opening being cut in the front to admit light, and cross-folded at the back, folding a few inches under the bottom board, and retained in place by a cord. A band with hook and eye fastens round the operator's waist. This tent is only suitable for changing plates and marking them. Of course, it might be used for development in an emergency. The cover is removed, the wire frame doubled, the boards shut together, and the cover wrapped round them and strapped up for carriage.

No. 4 is called a Howard tent, from the name of its designer. It consists of a triangular bag of three thicknesses of material, and is suspended under the tripod

head, the window being made by removing the outer thickness, leaving the yellow and red. The lower corners of the triangle are tied by tapes to the legs of the tripod, which is opened a definite width, and kept so by struts. A small ruby glass window is let in on the one side, also two sleeves, one of them of sufficient width to admit the dark slides and plates, and about 8 in. long, with elastic bands a few inches apart to prevent the light entering when the hands are inserted. The operator looks through the ruby glass, and can easily change his plates. Of course, this tent is unsuitable for the development of gelatine plates, although, by having a folding board for the bottom and a rubber drainage pipe, small plates could be worked in it. The size of the tent is determined by its height from the ground and the width of the legs apart.

No 5 is a tent in which the hands of the operator only are inside; it is thus made. A tray of any desired area, with a frame hinged at each end, which, when not in use, folds on the bottom of the tray. To fix, turn the frames upright, and secure with struts. The cover is attached to the tray, and strained tightly by the upright frames. A window is left on one side, and a ruby glass eye-piece, so to say, on the other; two sleeves, with elastics, allow the manipulation of the plates. In packing, fold down frames and covering, and strap up.

No. 6 is, perhaps, the very lightest contrivance made for changing plates. It consists of eight bamboo rods, each long pair pivoted together in the centre, the shorter ones forming the ends, the longer ones the top and bottom. The end ones are provided with L-ferrules, and the whole covered with an oblong bag, made of a size that will be tightened out when the bamboo rods are opened and fixed. This is provided with two sleeves, as the others. The changing of the plates is entirely done by feel—an easy enough plan after a little practice. A small gummed label fixed on the back of the plates will facilitate matters. The bag may be made of one thickness of black velvet and one of ruby cloth. When packed, the whole makes but a small bundle, and cannot get out of order. Of course, in all these tent-coverings the sewing must be carefully done, and carefully examined afterwards to ascertain its perfectly light-tight condition; inside any wood or metal work blackened with black varnish, to minimise chance reflections.

No. 7 is called a sack tent. It consists of a cylinder of red and black twill, of any suitable diameter, the closed end supported by a cross-piece of wood, two strips pivoted in the centre, with a pin to keep them in place. These are placed at the closed end of the sack, which should be made square, and suspended to a hook in the ceiling of the room. The length of the bag is such that when the operator is inside there will be a few inches space above his head, and two or three inches in folds upon the floor. A window is left by cutting away a few inches of space in the black cover. This, of course, is only intended for changing plates of small size, which may be carried in a satchel hung over the shoulders. Three or four carpet pins will, by pinning the lower edges to the floor, prevent it being accidentally lifted during the exposure of the plates. All tents for photographic operations must be light-tight, with plenty of air-space and elbow-room, easily set up and taken down, and with as few loose pieces as possible.

## OUR GUIDE TO GOOD THINGS.

**** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 34.—The Patent Ball-Bearing Castor.

The Patent Ball-Bearing Castor Company, Highfield Works, Upper Kent Street, Leicester, send me the following letter:—"A gentleman so far away as Leith, N.B., has called our attention to your notice in issue of the 2nd inst. of a castor. He is of opinion that our castor is far superior, and we need hardly say that we think so too. However, we submit a set for your inspection, with one not closed up that you may judge; and we trust that it may so far meet with your approval as to deserve and receive a notice." The appearance of this castor is decidedly attractive, being on a central vertical bearing, as may be seen from Fig. 1, in which

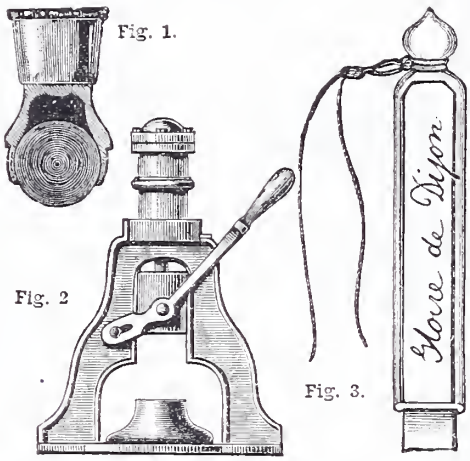



**Fig. 1.—Patent Ball-Bearing Castor. Fig. 2.—Doughty's Nut-Cracker. Fig. 3.—Gilles' Crystal Waterproof Garden Label.**

the cup that is closed on and over the ball that forms the castor is shown in section. The castor is made in two parts, an upper socket furnished with three or four screw-holes, as the case may be, which is fitted into and braced to the lower cup, which is inverted and closed over the ball on which the table or other article of furniture to which these castors may be attached is moved. Between the ball and top of the cup five small balls are placed, but these are not shown in Fig. 1. When all the balls are in position, the edge of the cup is closed in on the large ball sufficiently to prevent it from falling out, but not so tightly as to deprive it of free revolution in any direction. Now, in theory the castor seems everything that can be desired, and, as far as appearance goes, it is the most attractive form of castor that I have ever seen. I am, however, prevented from trying the effect on a heavy table, as there are only three in the set sent, whereas the table with which I should otherwise have tested them is a quadruped, having four legs. In working them with the hand, under both light and heavy pressure, I find, as I expected, that there is a tendency to jam, and then the large ball is drawn or dragged, without revolution, along the surface over which it is passing, and I am afraid that this tendency would become even more pronounced when the castors are attached to a heavy table or piece of furniture. The Company are right, I think, in describing them as "practically impossible to break or get out of order" (jamming excepted); and in saying that their "use imparts a certain finish and elegance, thus commending themselves to every lover of artistic effect, and entirely superseding the crank and wheel castor of the old type." These castors are made in brass, burnished, lacquered, and highly finished, fitted with metal or vitrified glazed spherical rollers and polished steel bearings, and are supplied in various sizes and patterns—namely, socket plain, socket scalloped; plate, with three screw-holes or central wood screw, or both combined: cabriole; with plate, special pattern, for pianos; and for iron and brass bedsteads, etc. They are also made in suitable forms for heavy window sashes, to facilitate opening or closing, sliding doors or partitions, portable baths, and heavy travelling trunks, etc. They are supplied in eleven sizes, ranging from ⅞ in. to 2½ in. inside measurement, and the price ranges from 2s. 6d. to 12s. per set of four. Further information will doubtless be accorded by the Company to anyone who may apply for it.

### 35.—Doughty's Nut-Cracker.

The form and construction of this nut-cracker, from the registered design of Mr. George Doughty, Allnutt Estate, Epping, Essex, will be readily understood from the illustration that is given of it in Fig. 2. As will be noted by those who are familiar with these machines, it is in the shape of a steam hammer. The main casting consists of a base-plate, from which spring the standards on each side, united at the top to support the central tube, whose top is closed over by a plate of the same diameter, secured by four screws, which pass through the plate and the flange encircling the top of the tube. The hammer or crusher is grooved on each side to permit it to work up and down the inner sides of the standards. It is actuated by a lever fastened to the hammer by a pin, about which it works freely, and to the left-hand standard by another pin, which passes through a slot in the fixed end sufficiently long to enable it to move along the pin, when the handle at the upper end is depressed. In the centre of the plate at the base is an "anvil," if I may call it so, attached by a screw, and grooved crosswise at the top to retain any nut that is placed on it in a proper position for cracking. To use the appliance, you place the nut on the anvil, place the *palm* of the right hand on the handle, and apply pressure, not as a blow, but as pressure. On removing the hand from the lever, the hammer moves up to its previous position, being raised by a spring hidden from view in the tube at the top, leaving the nut cracked on the anvil. It will crack nuts of any size, from a Spanish nut to a walnut or a Brazil nut. It is certainly safer and surer in its operation than the old-fashioned nut-cracker. Mr. Doughty tells me that he will send one to any address for 2s. 6d., post free. The iron casting is painted red, or rather vermilion, and it is gilt in the prominent parts, so that it presents an ornamental appearance.

### 36.—Gilles' Crystal Waterproof Garden Label.

In this I have something good for gardeners, who are often perplexed by the untoward condition to which their labels are reduced, when painted and written on with a pencil, by the combined influences of rain and dirt. In the Crystal Waterproof Garden Label, Mr. W. C. Gilles, 172, Portland Road, South Norwood, London, S.E., has provided a boon for all gardeners, professional and amateur, which, it is to be hoped, will be appreciated by them as it should be. The contrivance is illustrated in Fig. 3. It consists of a flattened tube of glass with a knob at the top, which renders it highly convenient for attaching it to trees, shrubs, plants, or garden sticks, by string in the manner shown in the illustration. At the lower end it is open to receive a slip of Willesden paper, doubled, on which the name of the tree, etc., to which it is attached, is written. The weight of the glass keeps the label in a pendant position, so that no rain can find its way into the inside of the tube to injure the label, and the writing on the paper must then remain

ible for any length of time. For labelling es it is most desirable, and, I believe, it has en taken into use by numerous firms who make se culture a speciality. When the durability d legibility of the inscription within are taken o account, the prices for the two sizes in hich the labels are made are most reasonable, e smaller size being supplied at 1s. 6d. per zen. Both sizes are sent post free for 2d. per zen extra. Visitors to the Crystal Palace, denham, may see them in use in the grounds.

THE EDITOR.

## SHOP:

### CORNER FOR THOSE WHO WANT TO TALK IT.

*In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTERS FROM CORRESPONDENTS.

**Photo-Lithography.**—A. J. A. (*Holborn, E.C.*) rites:—"In reference to PEN AND INK (see WORK, o. 113, page 142) requiring information regarding thography or zincography, I must presume he is n entire novice, and does not know anything about thography, or he would surely mention whether e requires information in the artistic or printing epartment, these being two distinct branches of ie same trade. So starting with this idea, and for eneral information, it may be interesting to note iat lithography is a means of bringing before the ublic in a cheap form copies of notable pictures, hich it would be otherwise impossible for them to btain, besides bringing the public taste to a higher vel as regarded from an artistic point of view. I o not speak about those wretched posters one sees n every hoarding, but to those charming pictures y well-known artists which one may see any day ecorating the home walls. Take, for example, the hristmas and summer numbers to nearly every aper, which are all now beautifully illustrated by ieans of this interesting art. Then, again, our Christ- ias cards, which I do not believe nine people out of n give a thought to *how* is it done, but which think one and all agree in saying 'How pretty!' But o turn to the practical part of the business. Suposing PEN AND INK wishes to become a lithoraphic printer, he would serve an apprenticeship or five or seven years, paying a premium which aries in different firms, when he would learn verything appertaining to the lithographic printer, xcept drawing on the stone. But should he wish o become a lithographic draughtsman or artist, he ould still have to serve his apprenticeship, though i another department. Should he have sufficient nergy and patience to study at home, I trust the ew hints given in Nos. 106, 109, and 112 of WORK, ith those to follow on this subject, will be of some ight assistance in enabling the noviee to overcome he difficulties of beginning a new study. With espect to zincography, the only difference between hat and lithography is that the latter is drawing n stone, and in the former one draws upon zinc lates, of which there are two kinds—the grey oned ones with which we are all familiar, and ately Messrs. Vincent, Brooks, Day & Sons have ntroduced into the trade a zinc plate with a litho oating, which certainly makes them more pleasant o work upon, being so mueh nearer stone colour; ut in both lithography and zincography the mode f proceeding is precisely similar, regarding it from he artist's point of view. But if PEN AND INK will sk definitely what it is he requires to know, I hall be pleased, with the Editor's approval, to nswer any questions, as I am afraid I have already neroached too much on his valuable space."

**"Work" Exhibition Testimonial.**—F. W. T. *Heathfield*) writes:—"I beg here to enclose my incere thanks for the splendid Book Prize and ertificate, which have arrived quite safely. I am orry I could not attend the Distribution of Prizes, s I should very much have liked to have been at he close of what has been, not only a great interest o me, but has evidently established me in the conidence of the public, which nothing else in my osition could have done. I have here to express my ratitude to Messrs. Cassell & Co., and our worthy ditor of WORK, who first established in me the reat object of bringing the mind into more studies han one. I therefore hope that such a valuable olume as WORK may still double its present xtensive circulation, and be of as much service to thers as it has been to me."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Optical Lantern Condensers and Objectives.**—F. J. D. (*Stoke Newington*) has constructed a agic lantern, and fitted the same with a single ondenser and objective, but is desirous of re-fitting it with better lenses, as the result is by no means satisfactory. The indistinctness of the single condenser is caused by the loss of light attendant upon the necessarily long focus of the lens. For example, a 4 in. condenser of, say, 6 in. focus will receive only about a fourth of the light it would if it were half this focus; but, on the other hand, shortening the focus of the lens would mean a considerable increase in its thickness, and consequently a greater liability to fracture, owing to the necessity of placing it nearer to the source of light; hence the advantage of using a compound condenser, in which a couple of lenses of, say, 6 in. focal length can be placed together, thus reducing the focus to 3 in., without any additional increase in the thickness of the glass. For the large flame of an oil lamp a couple of 4 in. plano-convex lenses of 6 in. equal focus mounted loosely in a brass cell, with the crowns almost touching (about $\frac{1}{8}$ in. apart), will give a lens of 3 in. focus, which will answer admirably for this class of work, but for limelight use, a meniscus or plano-convex back, and a bi-convex front of about 3 in. combined focus, will give much better results. With this combination some makers erroneously mount the lenses in such a manner that the meniscus side comes next to the picture, instead of which it should face the light in the lantern. The lenses should always be fitted loosely in the cells, in such a manner as to be capable of being readily revolved by means of the fingers; otherwise, the lenses (and especially the back one) may be apt to expand and crack upon the lantern being lighted up. One or two holes drilled in the brass cell will permit the escape of any moisture which might otherwise condense on the lenses. Compound condensers of 4 in. in diameter, and about $2\frac{1}{2}$ in. by 3 in. focus, are quite sufficient to cover the ordinary standard lantern slide, and this diameter should never be exceeded, except in the case of a condenser for a photographic enlarging apparatus, as a lens of larger diameter than the area of the plate to be covered means a corresponding loss of light. I had omitted to state that the lenses should be made of the best white flint glass, in order to get the best results, although a commoner variety is much in vogue by reason of its cheapness. Turning now to the objective, what you require is a short focus lens, which may consist of a couple of $1\frac{3}{4}$ in. lenses (a plano-convex and a meniscus) mounted close together, with the convex surfaces next to the source of light, and a stop in front of the meniscus (as shown in Fig. 1); this combination giving a lens of sufficiently short focus to allow of the lantern being placed at a distance from the screen about equal to the diameter of the latter. Such lenses, by reason of their necessarily short focus, will, however, give a slightly barrel-shaped distortion to square objects. A short focus photographic portrait lens will give a picture slightly fuzzy at the edges, which may be remedied by the use of a stop; but for lantern work this is inadmissible, as it means a considerable diminution in the light thrown upon the screen. The best method of overcoming this difficulty when space necessitates the use of a short focus objective is to employ one fitted with back lenses of large diameter. Short focus objectives are not, however, good to use at any time, as they disperse the light at an angle which interferes with the definition. Some good French portrait combinations—notably those made by Darlot—have large size back lenses and tolerably short focus, which render them eminently suitable for working in a confined situation. Although exhibitors are generally advised to employ an ordinary French quarter-plate combination for the objective of a lantern, they would find a considerable gain in the brilliancy of the picture by the use of lenses of larger diameter than the above, which seldom exceed a diameter of about $1\frac{1}{2}$ in., whereas an old-fashioned carte portrait lens of about 2 in. in diameter will pick up the rays of light much better, and give a more brilliantly illuminated disc. Fig. 2 is a section of the ordinary form of portrait combination, showing the disposition of the lenses. A serviceable objective can be constructed by an amateur by simply mounting together in a metal tube a couple of 2 in. plano-convex lenses of 14 in. focus, placing the crowns of the lenses close together, in a similar manner to a condenser. Longer focus lenses of this description should not be used. A still better objective can be made by making a couple of achromatic lenses, each of which is formed of a bi-convex lens of crown glass cemented by means of Canada balsam into a plano-concave lens of flint glass—the two lenses thus formed being afterwards mounted in a tube tolerably close together: plane sides of the lenses towards the screen. For objectives of, say, 6 in. focus, 2 in. lenses are best to use; and for 7 in., 8 in., or more, they may with advantage be $2\frac{1}{4}$ in. or $2\frac{3}{4}$ in. in diameter. Amateurs should bear in mind that good second-hand lenses can generally be purchased for considerably less than a novice could possibly hope to put one together for. As an example, Mr. Tyler, 48, Waterloo Road, S.E., a short time since offered some 4 in. condensers, the brass-work of which had got soiled, at 8s. each. Mr. Hughes, 82, Mortimer Road, Kingsland, publishes a second-hand list; so does Mr. Tyler; also Prof. Caplatzi, 1A, Chenies Street, Tottenham Court Road. A good selection of second-hand objectives, condensers, and miscellaneous lantern fittings can always be obtained from one or other of the above-named stores. —C. A. P.

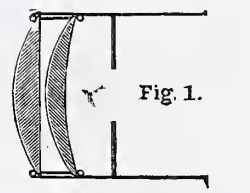


Fig. 1.

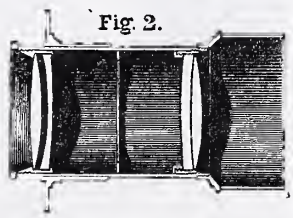


Fig. 2.

Fig. 1.—Simple Form of Lantern Objective. Fig. 2.—Section of Achromatic Portrait Lens.

**Moderator Lamp Key.**—J. L. (*Somerton*).—Glad to find that my description of the moderator lamp, and how to clean and put it in order, was of service to others besides the original querist on the subject. As to whether or no it is worth your while to have a key fitted to it in place of the one missing, that depends upon whether you mind paying the extra cost for oil that using it will entail, for I must tell you candidly that they are expensive lamps to burn. If you have an old-established ironmonger in your town, he will be almost certain to have some of these lamp fittings in stock, either new or taken off old worn-out lamps.—R. A.

**"Fur" in Kettle.**—M. J. J. (*Aston*).—To clean the corrosion, or "fur," out of a copper kettle, dry it out thoroughly till it ceases to give out any steam; make it as hot as you can, and rap it sharply all over with a small mallet; let the blows be about equal in force, and well distributed over the kettle, so as not to bruise it more than you can help; the fur will then drop off the sides with the concussion. To clean the spout out, I always melt it out, heat it, treat it in the same way, and re-solder it in.—R. A.

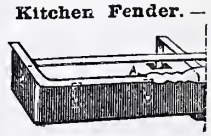
**E Puzzle.**—PUZZLED.—Your question is unsuited for WORK.

**Setting Quadrant of Slide-Rest for Turning Tapers.**—H. L. D. (*Strood*).—Suppose you have to turn the plug of a cock, and desire that it shall have a taper of 5 to 1, or that the diameter shall increase 1 in. for every 5 in. of length. You can proceed graphically thus: Take the diameter of your quadrant with callipers, and draw on paper a circle exactly the same size; from the centre of the circle draw a radius, and produce it beyond the circumference; draw a short line across the produced radius, at right-angles to it, and cutting it at a point exactly 5 in. from the centre; now measure from the point of intersection $\frac{1}{2}$ in. up the short line, and join this point with the centre of the circle by a straight line which cuts the circle at a point about $\frac{1}{2}$ in. above the first intersection; measure this distance very accurately with dividers, and it will give you the distance you must turn your quadrant from the zero mark to produce a taper of 1 in 5. Another way is by using a table of tangents. Suppose you wish to turn a taper of 1 in. per foot, or 1 in 12. Now, this is $\frac{1}{2}$ in. in 12, measuring on each side of the centre: $\frac{1}{2} \div 12 = \frac{1}{24} = \cdot 0416$, and this is the tangent of 2° 23′. If your quadrant is divided into 180 divisions, each division equals 2°, and you can set it to half a division for single degrees, but cannot estimate minutes or parts of a degree. If you want an accurate taper, there is nothing for it but measuring the taper itself.—F. A. M.

**Defects in Organ Pipes.**—F. H. (*Newington*).—Pipes may speak the octave above their proper note by reason of being over-blown, in which case stop off some of the wind by closing in the hole in the foot; or the upper lip may require cutting a trifle higher, or may require pressing in or drawing out in the case of a metal pipe; or the languid may require raising or depressing. Try the first recipe before tampering with the mouth of the pipe, and look to see that there is no dust or other obstruction in the windway. Weak tones are occasioned by similar defects, but remember that both dulciana and stopped diapason are intended to give a quiet tone; indeed, the latter would be ruined by trying to make it loud. Try giving a little more wind, and the upper lip of the dulciana may require cutting up a trifle. See that the stoppers of the stopped diapason fit truly, and are placed squarely in the pipe. If they lean over, or are not air-tight, the tone will suffer.—M. W.

**Wheel Cutting on "Go-Ahead" Lathe.**—(*No Address*).—I am sorry to find I have made a mistake in the drawing on page 61; the worm, W, could not be got in as drawn. INDEX will probably have noticed this, and seen that he must either make the worm solid and of no greater diameter than the hole for screw A, or else B must be bored out large enough to pass the spindle through it, and a sleeve fitted in afterwards as a journal.—F. A. M.

**Kitchen Fender.**—G. T. (*Castletown*).—The following sketch of kitchen fender will, I think, meet your requirements The front is made of sheet iron, the top of steel bars. The shaped piece from A is usually cut out in one piece, and then welded on to the bar.—T. W.



Kitchen Fender Plan.

**Paper Organ Pipes.**—F. W. (*Sheffield*).—Paper organ pipes can be obtained from Mr. W. J. Burton, Organ Builder, Winchester. I presume that the lengths given by you are the tone lengths of the largest pipes in the respective stops, as, doubtless,

you know that the smallest pipe may be only about ¾ in. long, whilst the 16 ft. tone can be obtained from a pipe 4 ft. long if it is a stopped pipe.—M. W.

**Bible.**—W. T. (*Bonnybridge*).—The leaves may be mended with tissue-paper and flour paste. Paste the edge of the tear and place a piece of tissue over it both sides, and when dry tear the tissue off again; this will leave a strip of tissue just where wanted. Let me know more definitely about the binding, and I will try and help you.—G. C.

**Phonograph.**—(*No Address*).—Your instrument seems to be all right so far as the construction is concerned, but your spring is too strong, and your needle certainly too blunt. Besides, I think that you screw the stylus, or needle, too far down, giving too much pressure upon the foil. Take note of these hints, and try again, and perhaps you may get better results.—W. D.

**Dividing Rules, etc.**—J. D. (*Poplar*).—A very fine graver is the proper tool to use, but you will require much practice before you can produce any satisfactory work, and can never approach the accuracy found in engine-divided scales.—F. C.

**Varnish for Screen.**—E. S. (*Liverpool*).—The rich dark polish and colour you have seen on writing desks, etc., can only be given satisfactorily to your screen by first darkening by means of stains, and finally French polishing. Varnish will not give so good a finish. You might try wiping over first with a weak walnut stain, and using just a tinge of red in your polish. An article, "How to French Polish," appeared in No. 105, March 21st; "The Rubber in French Polishing" in No. 108, April 11th. —Lifeboat.

**Stained Floor and Wax.**—Terpsichore.—To render your floor most suitable for dancing purposes, wax polishing is undoubtedly the best method extant, and if properly done, will not be "tacky," as you surmise, all tackiness being readily removed by finally wiping over with a piece of flannel, on the face of which has been sprinkled a little powdered French chalk; but for a large room it would be best to give the job to an experienced man, as it is laborious work in its first stages, though comparatively easy to keep in good condition afterwards. The fact that the floor is stained all over will make no difference if the present colour is suitable; otherwise, it must be done the right shade previous to polishing. Varnishing is often resorted to for the margins of floors, but cannot be recommended for the entire floor and the purpose you name. An article on Wax Polishing appeared in No. 52, page 826, from which you might glean many hints.—Lifeboat.

**French Polishing Fillers.**—S. S. (*Salford*).—The light oak may be oiled with clean linseed oil, and "filled in" by a mixture of finely-crushed whiting, just tinged with a little yellow-ochre, made the consistency of thick cream with turps or benzoline, rubbed well in crossways of the grain. For the satin-wood and maple you might omit the oiling first, also the ochre, using simply whiting mixed with equal parts of oil and turps; though for these light woods, including ash, some polishers use plaster of Paris and Russian tallow applied hot. This latter is a good filler, but its disagreeable smell prevents its general adoption; whilst others use plaster of Paris applied with a wet rag, and wiping off immediately: not left on all night, as I once saw done.—Lifeboat.

**Theatrical Limelight Apparatus.**—Stage Carpenter wishes to make a limelight apparatus for stage purposes. This may be said to consist of a wooden box of suitable size lined with metal, and mounted between a couple of standards attached to a base, something after the fashion of a toilet glass. A movable partition carrying a large size single condenser is made to slide into the box by means of grooves along each side, and a mixed limelight jet fitted to a tray moves along runners attached to the floor of the box immediately behind the condenser, connection between the gas bags and the jet being made by means of rubber tubing led through the back of the box, in a similar manner to an ordinary magic lantern. The coloured glasses (by means of which the varied tints are imparted to the light) slide into grooves immediately in front of the condenser. Some makers supply these coloured glasses mounted together on one circular disc or diaphragm, which is pivoted to the front end of the woodwork by means of a screw driven through a hole in the centre of the disc. This, of course, is very handy, as it does away with the chance of an accidental breakage. I will now describe a good useful form of limelight box, such as would be suitable for a 6 in. condenser. For the woodwork of the box (which should measure 10 in. by 10 in. by 12 in. when complete) obtain some *thoroughly dry* ½ in. or ¾ in. mahogany, preferably the leaf of a disused table, and proceed to carefully dress up three boards, each measuring 10 in. by 12 in.; and when ready, two of those which are to form the sides of the box should have a narrow groove run the way of the grain, at about 3 in. from one end, as shown in Fig. 2; after which, the three pieces are drawn for dovetailing, with the pins upon the floor or bottom piece. A narrow strip of the same wood, 10 in. by 3 in., which will also be required to form the top of the box, is merely intended for the purpose of binding the sides together, and should be placed across the top at 3 in. from the front end of the box, until just flush with the grooves, in which position it should be dovetailed to the sides. The framework can now be put together, with the grooves of the sides facing each other on the inside, using good glue for the purpose, and occasionally applying a square to the corners, in order that it may be got quite true. The base may now be prepared. For this, dress up a board to measure 11 in. by 14 in., and provide it with a couple of cross-ends, 11 in. by 2 in., which are screwed on in the manner shown in Fig. 3. A couple of standards, 9 in. long and 3 in. wide at the lower part, tapering to 2 in. at the top, are cut to the form of Fig. 4, and provided with dovetails, and next fitted into corresponding mortises prepared for their reception on opposite sides of the base; and before going further, it will be advisable to see if there is just sufficient room for the box to pass freely between the two standards. Returning to the box, a piece of ½ in. dry mahogany must be dressed up, and shaped and rebated on either side as shown in Fig. 5, until it slides smoothly along the grooves into the box; after which, a narrow slip of wood is nailed along the upper

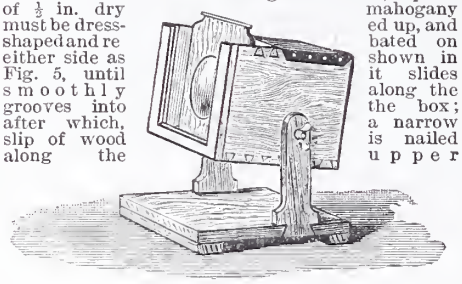


Fig. 1.

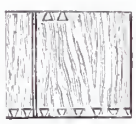


Fig. 2

Fig. 4.

Fig. 5.

Fig. 6.

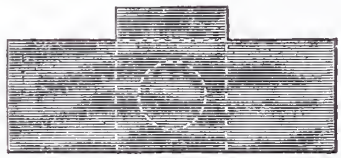


Fig. 7.

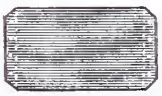


Fig. 8.

Fig. 3.

**Theatrical Limelight Apparatus.** Fig. 1.—Limelight Box. Figs. 2 to 8.—Component Parts of same.

edge of the shaped portion as a finish. A circular aperture is now cut in the middle of this board, in order to receive the condenser, being provided with a slight rebate, against which to rest the lens. When ready, the condenser is retained in the opening convex side outwards, by means of a ring of cane, which is sprung into the aperture against the glass, and then pinned to the wood. This arrangement is far preferable to having the lens fitted into a mount, as it will be less liable to crack. The woodwork is now completed by screwing a strip of rebated moulding round the front end of the box, thus forming the requisite grooves for the reception of the coloured glasses. The shutter, which is used for the purpose of obscuring the light when not required, may be made from a piece of thin ply fretwood (to be obtained at any fretwork emporium), cut to the form of Fig. 6, and made to slide in the same grooves as the coloured glasses. The box will now require to be lined with a piece of sheet iron or tin plate, 27 in. by 9 in., with a central flap, 3 in. by 9 in., cut to the shape of Fig. 7, and bent in such a manner that the central portion may come immediately behind the condenser, with the short strip above the central portion bent out to right angles, in order to cover the narrow strip of wood across the roof, the remaining portions of the metal being required to protect the two sides of the box. The lining is affixed to the woodwork by means of short nails driven through holes punched in the metal. We shall now require another strip of metal, 12 in. by 6 in., cut to the form of Fig. 8, for the roof of the box, which is also nailed to the woodwork through the two sides of the metal which lap over. The box may now be hung between the two standards by means of a couple of bolts and fly nuts, inserted from the inside through holes cut through the metal lining of the inside of the box. It will thus be seen that the box can be retained in any desired position by tightening these bolts sufficiently. The remaining fittings, together with the management of the light, will be precisely the same as for an ordinary magic lantern, requiring the use of a mixed jet, and a bag each of oxygen and hydrogen gases under pressure, unless the compressed gas in cylinders is used, in which case an automatic regulator should be fitted to each bottle. Mr. Hughes, of 62, Mortimer Road, Kingsland, London, N., can supply 6 in. unmounted condensers, specially made for light boxes, at 16s. 6d. each. Also a special mixed jet at 12s. 6d.; any form of mixed jet will, however, answer as well. When a suitable jet has been selected, it will be needful to fit it on to an upright metal rod, attached to a board or shallow metallic tray, which is made to slide between a couple of grooved runners screwed to the floor of the box. Messrs. Cox & Co., 11, Fetter Lane, London, who advertise in the *Stage*, supply all requisites for theatrical limelight apparatus at low rates. The above firm quote coloured gelatine at 6d. per sheet, 7 in. square. This can be had in a great variety of tints, and may readily be mounted between a couple of sheets of glass of sufficient size in a wooden frame. The same firm also supply stained glass, mounted in frames, at prices ranging from 1s. 6d. to 2s. 6d. each. Messrs. Perken, Son & Raymont, of Hatton Garden, London, publish a little booklet at 6d. on the magic lantern, which will give you all the information you require on the management of the light, as the subject is one which cannot be treated at length in these columns; any special point shall, however, receive due attention.—C. A. P.

**Thermometer.**—A. X. E. (*Nottingham*).—Thanks for pointing out my mistake in stating, at page 828, No. 103, Vol. II., that in the construction of a thermometer the boiling point of water should *first* be marked upon the tube, whereas the authorities you quote show that the freezing point should first be ascertained and recorded. Please observe that in my reply to E. N., in the number of Work alluded to, I wrote that I had never made a thermometer, and that I gave the substance of the best description I could lay hands on at the time. This was taken from a source which I have always found most reliable—viz., Spon's "Workshop Receipts," 1st series, page 432, being the last article in the volume. Upon referring to this now, I find that my abstract of the description was correct, as the words are: "Distilled water is made to boil, and the thermometer surrounded with the steam produced; the point to which the mercury rises is marked off with a file, *and the freezing point of water is also marked.*" As I said in my original reply, articles on "How to Make a Thermometer" will, without doubt, appear in Work in due course, in which our readers will be fully instructed with regard to both theory and practice in the construction of this invaluable instrument.—Opifex.

**Stain.**—J. P. J. (*West Hartlepool*).—As you have only one sideboard you wish to darken, it is a question whether it would be worth the expense of making a special air-tight box in which to fumigate, especially as you say you have no room you could use for the purpose. Could you find such a room, or see your way clear to use the box for the same or any other purpose in the near future, it might be worth your while, as fumigation is pre-eminently the best plan to adopt, on the score of cleanliness and evenness of tone that is gained. You say bichromate of potash gives too red an appearance; this would be obviated by the addition of some walnut stain; or try either of the following: 1 pint liquid ammonia, 2 oz. Vandyke brown, 1 oz. bichromate of potash; mix 2 ox. pearlash and 2 oz. American brown potash in a quart of hot water. It may be well to remind you that it is always advisable to try the effect of these stains on odd pieces of similar wood to your sideboard, and thin down till you meet the desired shade, bearing in mind that the afterwards oiling, filling in, and polishing will, in all probability, make it a little darker still.—Lifeboat.

**Rust from Japanned Iron.**—M. M. (*Liverpool*).—The old japan will have to be scraped off with a plane-iron or similar instrument, and the surface scoured with dry grit-stone till the rust is completely taken out. If any rust is left it will be sure to spread, and again "throw up" the japan. As M. M. will probably have no convenience for the "storing" which black japan varnish or cycle enamel (which is in all material respects the same) requires, he will, perhaps, do as well to make shift with Aspinall's Enamel for re-coating his box, as he suggests.—S. W.

**Compo. for "Scriptograph."**—Eastwood.—The basis of all these "graph" compos. is glycerine and glue. That in question is composed of glycerine ½ lb., Russian glue, or gelatine, ¼ lb., water, and sulphate of baryta. The water is added to moisten as required; the sulphate of baryta is of no other use than to render the almost transparent mixture sufficiently opaque to show whether the writing has properly touched in every part; French chalk has sometimes been used instead. To prepare: first soak the glue, then put it into a jar standing in a saucepan of hot water; add water and glycerine, and when the glue is dissolved add the colouring matter (sulphate of baryta), and stir the whole together. When thoroughly mixed, pour warm into the shallow tin tray of the apparatus, and let it set. If it prove too hard, melt again with more water; if too soft and sticky, add glue. It is more than probable that the first one or two attempts will not be satisfactory. Or the compo. may be bought ready prepared from Messrs. Baddeley Bros., Chapel Works, Moor Street, London, E.C., at 2s. 6d. per tin.—S. W.

**Staining and Book.**—G. J. W. (*No Address*).—There are several books published treating of the subject. I have not seen one yet that can be recommended to the amateur, though Messrs. Wyman & Sons, 74, Great Queen Street, London, W.C., issue one in their Technical Series, "French Polishing," price 2s. 6d., which is of more service to the professional than embryo polisher. Far and away the best to be recommended to the learner is the series of articles commencing in the present

lume of WORK, the first of which, "How to ench Polish," appeared in No. 105, March 21st, d "The Rubber in Freneh Polishing," in No. 108, ril 11th, to be followed by others besides. Had u read this paper closely, and the answers given "Shop," you could not fail to have gleaned many eful hints. Have you no bookseller in your neighurhood who would be glad to supply you with numbers of "Natural History" you require? If t, write Messrs. Cassell & Co., asking for a classid catalogue of books, and stating your requirents.—LIFEBOAT.

**Enamel Paint.**—H. A. K. (*Bedale*).—The nearest proach to be obtained by self-mixing is to use a hite enamel, or Bath, varnish, and add to it finelyound tube colours. Ordinary paste paints are not fficiently finely ground for the purpose; even the st white lead of ordinary paste form will dull and ake gritty the enamel or varnish. If white is anted, tube flake white can be used, from which nts of any colour can be made. See Index, Vol. I., r Picture-frame Compo.—F. P.

**Gold Bronze.**—J. D. (*London, E.C.*).—Gold ronze—viz., bronze powders—may be used in quid form by making a solution of white stick lac methylated spirit, and adding the bronze thereto. ufficient only of the lac must be used to bind the owder, or the brightness of the bronze will be ffected.—F. P.

**Banjo Fittings.**—P. Q. (*Denholme*).—Did you see dvertisement in advertising columns for fittings? ou can get ordinary fittings from Messrs. Dawkins, harterhouse Street, London. The portable music tands (folding iron) are patented, therefore you ould not make them. Even if you could buy the arts, they would very likely cost you as much as ou could buy the stands for finished. If you write o Messrs. Harrow & Co., 13 and 14, Portland Street, Vardour Street, London, W., they will, no doubt, ive you all particulars.—J. G. W.

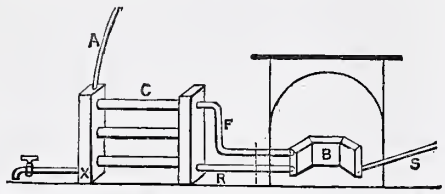
**Electric Light for Dark Corner of Room.**—N. B. E. (*Walsall*).—You will find full instructions n small electric lights in the articles published in Vol. II. on "Model Electric Lights" (see Nos. 76, 82, 9, 92, 94, 97, 99, 101, and 104). The little arrangenent for a photographic dark room described and llustrated in No. 89, page 593, will just suit the urpose of persons like yourself, who wish to have small light at the smallest possible cost.—G. E. B.

**Strength of Electric Current.**—LEARNER.—Your friend was quite right, but you have drawn a wrong inference from his statement, and have mixed up current strength with E.M.F., or current potential. The strength of an electric current is expressed in ampères, which represent the total volume of current obtainable through a given resistance when urged by a certain pressure or potential. We first of all take the potential, or electric pressure in the cells; this, in the battery you name, is 1½ volts each cell. To obtain 1 ampère of current from one of these cells, the total resistance of the whole circuit must not exceed 1½ ohms. If, then, the resistance of the motor is 1 ohm, and you get 1½ ampères of current through the motor, the resistance of the cell itself would be nothing. This course of reasoning is ridiculous, as the cell must have an internal resistance. Suppose it to be a large Leclanché cell, having an internal resistance of ¾ ohm: then the resistance of the cell will be ·75 ohm; the resistance of the motor 1 ohm: total, 1·75 ohms. Now, the E.M.F. of the cell is 1·50 volts. Divide the total E.M.F., 1·50, by the total resistance, 1·75, and we get ·85 ampère as the total strength of current. Now add another cell in series. The result will be $\frac{1{\cdot}50 \times 2 = 3{\cdot}00 \text{ volts}}{{\cdot}75 \times 2 + 1 = 2{\cdot}50 \text{ ohms}} = 1{\cdot}20$ ampères. If we take a smaller cell the internal resistance will be higher: say 1 ohm instead of ¾ ohm; then the result will be, $\frac{1{\cdot}50 \times 2 = 3{\cdot}00 \text{ volts}}{1{\cdot}00 \times 2 + 1 = 3{\cdot}00 \text{ ohms.}} = 1{\cdot}00$ ampère only. The consumption of zinc will be proportional to the ampères of current obtained, not the volts. The strength of current in ampères at the terminals of a secondary coil will be very small indeed, but the potential is enormously increased by the inductive effects of the coils of wire.—G. E. B.

**Slipping of Driving Belts.**—BELTING (*London*).—As I have not yet met with a good composition to prevent slipping of belts, I am sorry to say I cannot recommend one to you. All that I am acquainted with are injurious to leather belts, and more or less dirty in use. I am, therefore, an unbeliever in the efficacy of belting compositions. The supposed necessity for their use arises out of bad arrangements for driving the machines. If belts of the right width, made out of best raw hide leather, well oiled, are employed in the first instance, and the pulleys are properly proportioned, there will be no slipping of the belts, providing, of course, they are not too slack or too tight. If you will give me full particulars respecting the driving arrangements of your dynamos, I will endeavour to advise you how to prevent slipping of the belt.—G. E. B.

**Indiarubber Substitute.**—G. A. & Co. (*Stockport*).—We do not find any patent issued for the material mentioned under the name given. So far as we have learned, it was a failure, and did not fulfil what it was proposed to do. We are unable to give the address, not having been able to ascertain it, and from what we can learn, little benefit would be derived from it were we able to do so.—C. E.

**Portable Coil.**—W. A. T. (*No Address*).—If you mean an ordinary coil, such as is used to warm an entrance-hall, staircase, and so on, which is constructed of cast-iron or copper pipes, and is heated from a boiler in another part of the building, I say, "No, it is not practicable," as I presume you want to take it from one room to another; and there are various reasons why this could not very well be done. I do not say it is impossible. I send you a sketch showing how it *may* be done. B is the boiler, which is placed on the stove to form the




**Small Coil heated from Register Grate. B, Boiler, taking place of Fire-bricks. F, Flow-Pipe. R, Return-Pipe. C, Coil. A, Air-Pipe. S, Supply-Pipe. The dotted lines show where Valves would have to be put if Coil is to be removable.**

fireplace; C is the coil, which may be in the same room, a room adjoining, or a room beneath. The flow-pipe goes in at the top, and the return comes out at the bottom. If this coil is to be fixed so as to be removable at any time without disturbing the pipes, and so that it can easily be put back again, a screw-down stop-valve must be put in each pipe, with a connector in each pipe on the coil side of the taps. Some provision would have to be made to run the water out of the coil after the valves are turned off, before disconnecting—say a short piece of pipe with a tap at X. Water to supply the coil could either be taken to the boiler from a supply cistern, or the coil boxes could have loose covers, so that water could be poured into them occasionally, the waste from evaporation being small; in this case no air-pipe or tap would be required. Rippingilles—the oil-stove people—make several hot-water arrangements for use with their stoves; and probably one of them would answer your purpose better than the above, which, though movable, can scarcely be called portable.—R. A.

**A Doll's House.**—H. M. (*Hunsdon*).—Many family men are numbered among our readers, as is evidenced by the numerous applications received for designs of cots, bassinettes, etc., and, in the present instance, a doll's house. Overcrowded space prevents much from being said concerning constructive details, therefore, a great deal must be

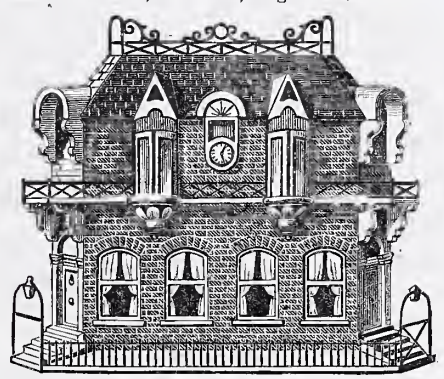


**Fig. 1**

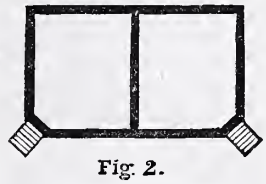


**Fig. 2.**
**Model Doll's House.**

left to the reader's judgment and opinion. In this design I have studied simplicity of construction; and sufficient opportunity exists for ornamental details to an unearrying limited extension. A ground plan is shown in Fig. 2, in which is indicated what I consider to be the best positions for doors. If these ends are fitted merely with windows, with the halcony also returned along them, such should suffice for effect. It will be preferable to make a rough cardboard model as a preliminary object of ascertaining the proper proportions and shapes of the various parts. The roof and its adjuncts will be found the most difficult part to construct. If a partially flat roof is adopted, the possessor of the house will value it the more. I would suggest that instead of carrying the ends entirely to the top as doors, the roof should open flap-wise, and the upper storey of the house be fitted as a work-box. You are going to make one 3 ft. high with four rooms; but, as will be understood, the design is not confined to one particular enlargement.—J. S.

**Flute Cases.**—S. G. F. (*Chiswick*).—The flute cases used by the bandsmen of the Guards' Drum and Fife Band are made of the best bleached buff, and are hand-sewn. They cost about 12s. 6d. each, but lower-priced ones are procurable. Apply to Messrs. Silvani, 45, Wilson Street, Finsbury.—G.

**Circular Rails.**—F. B. H. (*Wolverhampton*).—The smallness of diameter of the rail track will be limited by the amount of clearance you can give the flanges, and this will depend upon the width of the wheel treads, which you do not mention. If there were no play between the flange and rail a straight track would be necessary. Your simplest course is to make a short piece of track of stout tin plate, and so determine experimentally the shortest radius at which the flange of the leading wheel will not mount the rail. The outer rail should be raised slightly above the level of the inner rail, to counteract the tendency of the engine to fly off by centrifugal force. To find the necessary super-elevation of outer rail in inches above the inner rail, multiply the gauge of rails in inches by the square of the speed in miles per hour, and divide the product by the radius of track in feet and by seventy-two.—F. C.

**Beam Engine.**—J. B. (*Edenfield*).—Consult carefully the Indexes to Vols. I. and II. of WORK now published, and if there is no answer to your questions, kindly repeat them.

**Castings.**—CORINTHIAN.—Special tools must be made to suit special tasks. Generally speaking, those used by engravers, and also the metal shapes and burnishers used by fitters, are suitable. They are employed in similar fashion.—J.

**Engraving Drawing Instruments.**—DRAUGHTSMAN.—I recommend you to put them into the hands of an experienced engraver, who will do justice to them. Another way is to have them etched, for details of which please refer to No. 84, Vol. II., of WORK. You will find something about "Engraving on Metal" in Nos. 33 to 48, Vol. I. The special Exhibition Number is *not* intended to be bound in the case supplied by Messrs. Cassell & Co. for the ordinary volume of WORK.—N. M.

**Transfers for Coach-Work.**—(*No Address*).—The leading artist herald painter of the coach trade is Mr. John Sneath, Herald Painter, of Grantham, Lincs.; he is reliable for accurate delineation and work of the highest class in transfers. Leigh Anderton, Heraldic Artist, is also a first-class transfer artist; his address is 67, Vine Street, Manchester. For plain decorative work in transfers and heraldpainting transfers, Charles Witham, 22, Grove Street, Lisson Grove, N.W.—J. C. K.

**Setting a Razor.**—K. L. (*No Address*).—If K. L. will kindly hunt up No. 100, Vol. II., of WORK, and turn to "Shop," page 782, he will, I think, find all he wants to know on the above subject, though rather condensed. Two of the sketches might have been plainer, but I have no doubt it was owing to want of space. The razor is laid flat on the stone, and when holding the handle with the right hand, three or four fingers of the left should press the razor pretty strongly on the stone during the period when the sharp edge travels first—that is to say, just the opposite to the method of stropping. When returning for another stroke the pressure should cease entirely, or almost so.—P. B. H.

**Painting Mottoes on Carriages.**—H. W. (*Strabane*).—The fine work of heraldry is, like miniature painting, done with suitable brushes. The mottoes being simply conventionally imitative in execution, are not difficult with panels in good position for light and work. The subtle touches which shall give character to a face, or display a definite expression to animal form and aspect, is real art, and requires more careful selection of brushes than for motto writing. Sable brushes are used, being stiffer for touch than camel-hair, which serve best for surfaces or lines in the arms. Pens cannot be used with oil paints effectively. Major Middleton, a most successful artist for limning the character in the face of his study for a portrait, had a very small picture to execute, which required the high lights to be well marked, as in heraldry they are invariably done. He came for a day's shooting to the writer's land, "in search of his tools," he said; that was two fine and very small feathers, to be found only in the pinions of the woodcock. They are very fine pointed, with very slight flexibility, and just that imbrication of feather which will take up a pigment and release it easily, even to the smallest dot ever wanted in miniatures; they serve this purpose, and none other, in artists' work.

**Woodcock's Feather.**

**How to make a Greenhouse.**—WHEELBARROW.—In Nos. 12, 14, and 16 of WORK you will find the construction of a greenhouse thoroughly and practically dealt with.

**Grinding Scissors.**—W. B. (*Penna, U.S.A.*).—We have not the address of H. F., the reader to whom you wished us to send on your sharpener.

**Mathematics.**—F. K. (*Oldham*).—Write to Messrs. Cassell & Co., Publishers, London, E.C., for their list of school books.

**Bow-Hairing.**—J. B. (*Leicester*).—This subject requires a short paper, with illustrations.—B.

**Violoncello.**—NO NAME (*Glasgow*).—Send through the Editor, prepaid, a pencil outline of the instrument you intend to make, and I will give the thicknesses and measurements you ask for.—B.

**Electrical Measurements.**—E. G. (*London, N.*).—The volt is the recognised unit of electric current pressure, and is roughly represented by the difference in potential between the zinc and copper

elements in a Daniell cell. The ohm is the recognised unit of resistance to the electric current, and is roughly represented by 6 ft. of No. 36 pure copper wire. The ampère is the recognised unit of electric current volume, and is represented by the quantity of current forced through 1 ohm of resistance by 1 volt of current pressure. For exact measurements, there are measuring instruments constructed to measure the current pressure and the resistance. To find the resistance of a Leclanché battery, you will need a delicate galvanometer—*i.e.*, current indicator, a set of resistance coils, and a Wheatstone bridge. The bridge will correspond with the beam of a balance; the resistance coils will represent the weights; and the galvanometer the index pointer of the balance. The resistance of the battery is balanced against the known resistance of a number of the coils. A detailed account of the process would occupy too much space in "Shop." In answer to your other questions:—(1) Supposing each cell of a Leclanché battery gives a current pressure of 1½ volts, and each cell has an internal resistance of 1$\frac{2}{10}$ ohm, then the ampères of current obtainable from any number of cells placed in series will equal the total voltage as multiplied by the number of cells, *when divided* by the total resistance of all the cells and all the conducting wires. (2) The resistance is known by balancing it against a known resistance by means of the instruments mentioned above. (3) You will now see that resistance is a factor apart from current pressure and volume, as expressed by volts and ampères, therefore your third question means nothing at all. —G. E. B.

**Dressing Tarpaulin Sheets.**—A. W. T. (*Willesden New Junction*).—We apprehend A. W. T. wants to dress already made what he terms tarpaulin sheets which have been in use. Now, before we can give him any useful information on the subject he must let us know what kind of sheets he refers to, as although nearly all waterproof sheets or covers are, in common parlance, called tarpaulins, it is by no means a fact that one in a hundred is a "tarpaulin"; and unless we know exactly what kind of sheets he refers to, might give him quite wrong information, which we are by no means desirous of doing. In order that A. W. T. may see and understand what we mean, he must remember that in one class the waterproof qualities are obtained by means of a medium which is coated *on* the surface; in another class they are obtained by a material placed or included *between two* surfaces; and in the other by means of a material which *permeates* entirely through the whole of the material forming the sheet. A. W. T. must understand that what produces the desired effect in each particular case would cause entire failure and injury if applied to either of the others.—C. E.

**Taking out a Patent.**—F. S. S. (*Leicester*).—No invention patented in this country can be made abroad and imported by any foreigner or Englishman during the duration of the English patent. Of course, when the exclusive right has expired, it can be made by anybody anywhere, and imported or exported, as may be the case. It is perfectly free for a foreigner residing in any country where the invention has not obtained exclusive privileges to manufacture and sell the invention; but he cannot sell in or send them to any country where the inventor has obtained an exclusive privilege. There is no such thing as "protection," in the sense in which it exists in England, in any of the foreign countries. In these you have to apply for the grant of a patent, and deposit a complete specification, claims, and drawings, with the application; and when the patent is granted you have then got your rights and protection. The cost of all this entirely depends on the work to be done, the time it occupies, the cost of meeting the objections raised by examiners—most particularly in the case of the two latter countries named—and various other points connected with the work. We would advise F. S. S. to refer to, and read and study, the article on this subject in WORK, No. 44, Vol. I., p. 694; also the reply to R. W. S. (*Leeds*), in No. 109, Vol. III., p. 77.—C. E.

**Reproduction of Draughtsman's Drawings.**—ON TIME.—To reproduce drawings in the manner required by ON TIME, the drawings have to be traced on what is known as autographic transfer-paper with a peculiar ink, and then transferred to the plate, from which any number may be printed. We do not gather from the query whether it is desired to know the *modus operandi* of the process, or whether it is simply desired to know what is the best ink for the purpose. Lithographic or chemical ink may be used, which should be rubbed dry on a clean porcelain saucer until sufficient is rubbed off. Then add water, drop by drop, until sufficient is added to make it, when rubbed with the finger, of a deep black colour, and liquid enough to flow evenly from the drawing pen; but it will not do if it is at all "watery." Great care must be taken to keep it perfectly free from dust when in use, and if it is allowed to become dry it should be thrown away, and a fresh lot mixed, no satisfactory results being obtainable by re-mixing.—C. E.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Windmill Sails.**—TURNER writes:—"Can anyone tell me the length (from axle to end of whip) and breadth of windmill sails to develop at twenty revolutions per minute—1st, 5 h.-p.; 2nd, 10 h.-p.; 3rd, 15 h.-p.? Also I shall be glad of a sketch showing action of and method of coupling up of louvre-board rods. Average velocity of wind, twenty miles per hour. I give number of revolutions per minute and velocity per hour as two foundations to calculate horse-power on. I hope I am sufficiently clear."

**Oak Mouldings.**—T. J. J. (*Tottenham*) writes:—"Will any reader kindly inform me where I can obtain small oak mouldings and beadings, suitable for a small bookcase, about ½ in. or ⅝ in., anywhere round Shoreditch or the City?"

**Thin Lines in Fretwork.**—PUZZLE wants to know how to cut in fretwork very thin lines in the middle of a design. If he bores a hole, it makes the work look ugly at once.

**Glass Writing.**—E. E. D. (*Crewe*) writes:—"Can anyone inform me where to obtain a book on glass writing and embossing; also, how to mix isinglass and spirits of wine as used for size for gilding on glass?"

**Fan Blowers.**—W. H. (*Motherwell*) writes: "I shall feel obliged to any reader who will give me full particulars and dimensions of a useful set of fan blowers."

**Preservative for Outdoor Polished Brass.**—P. H. (*London*) writes:—"Can any reader tell me a simple recipe for preserving a brilliant polish on outdoor brass-work (handsome knockers and letter-box plates on front doors)? I have tried several kinds of enamel and lacquers, including 'Silicon,' but to no purpose, although it answers for indoor work. I have used a special preparation of vaseline, but it spoils the gloves and greases the hands of those who have to use the knockers, etc., and, besides collecting dust and dirt, it shows tarnish in a fortnight, and wherever the fingers have touched it it turns black in an hour. I have not time to spend a half-hour every day to clean them with polishing paste; besides, if then left two or three days, they get so black that it takes three hours or more to clean, only for them to go black again in two or three days."

**Fire Balloons.**—E. D. R. (*Brierley Hill*) writes:—"(1) Will any reader kindly inform me how to make coloured fire to illuminate the bottom of fire balloons? (2) How to fix same? (3) The probable cost?"

**Letter-Press Printing.**—W. A. D. (*New Brompton*) writes:—"Would anyone inform me where I could obtain (and the price of) a good practical work on Letter-Press Printing?"

**Air Pump.**—A. T. (*East Greenwich*) writes:—"Will any reader of WORK tell me how to make a pump for pumping air, and show diagrams in 'Shop?'"

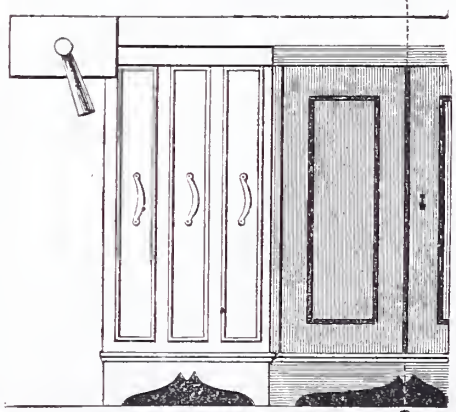
**Air Cushion.**—H. R. (*Clapham*) writes:—"I have an air cushion which has a slight leak. Can any reader inform me how I can find out where it is, so as to repair same?"

**Fret Clock Design.**—H. O. H. (*Bristol*) writes: "Will any reader of WORK tell me where I could obtain a good clock design for fretwork, either Italian or French preferred? Also where I could obtain a catalogue of French miniature designs?"

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Petroleum Motors.**—THE BRITANNIA COMPANY write:—"In reply to CONSTANT READER (see page 142, Vol. III.), petroleum motors cost more for fuel than gas or steam-engines, except in districts where petroleum is produced. In towns where gas is above 5s. per 1,000 the difference is not so important. There are two good petroleum engine makers who supply various sizes."

**Combined Bench and Tool Chest.**—F. A. (*No Address*) writes:—"In reply to T. R. B. (see page 142, Vol. III.), I send a design for a combined bench and tool chest. The drawing shows one half, the other half being exactly the same (of course, with the omission of the vice). All patterns of tool cabinets, as at present made—*i.e.*, with cupboards at the ends—require about 1 ft. 6 in. extra space at each end to allow for opening. This is obviated by having slides at A (which are really three drawers turned on end, and with racks for tools). Of course, these do not require any room at the end, which, as T. R. B. requires one end of bench to stand against wall, could not be spared. A B is a cupboard, set back about half the width of the bench, for large tools, glue-pot, etc. The lower portion should be made in three carcases, screwed to the top of bench and to each other, to allow of easy removal."



Combined Bench and Tool Chest.

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—ST. MUNGO; J. D. (*Glasgow*); I. R. C.; H. W. (*Bristol*); J. A. (*Perth*); GLEVUM; F. H. H. (*Wednesbury*); J. W. N. (*Gateshead*); A NEW READER; E. J. S. (*Leighton*); A. F. L. (*Manchester*); REDCLIFFE; H. H. (*Birmingham*); SAINT VALENTINE; A. B. (*Salford*); J. S. T. (*Southampton*); IN THE TIMBER; J. S. (*London*); A READER; F. W. B. (*Sunderland*); T. C. (*Belfast*); J. M. (*Wolverhampton*); J. G. (*Nottingham*); DYKEHOUSE; E. W. N. (*Leicester*); A. W. (*Paisley*); PAINTBRUSH; E. A. P. (*Tullow*); R. S. (*Gloucester*); T. J. (*Somerset*); J. F. (*Preston*); S. (*Westminster*); WORKONIAN; W. O. (*Skenningley*); WALLSEND; GREENHORN; G. H. B. (*Liverpool*); ANXIOUS; H. F. (*Wigan*); N. E. D.; H. E. (*Hampstead*); J. H. M. (*Manchester*); R. S. (*Oldham*); J. G. J. (*Glasgow*); A. M. (*Coundon*); GRAFTON; F. F. (*Newport*); NOVICE; J. K. (*Liverpool*); W. G. (*Blackburn*); H. B. (*Melbourne*); W. P. & Co. (*St. Philip's*); G. D. O. (*Oldham*); J. H. W. (*Bath*); J. J. R. (*Southampton*); WORRITT; J. B. (*Barlestown*); J. S. (*East Barry*); W. W. (*Penrith*); W. A. L. & Co. (*Birmingham*); J. M. B. (*London, W.*); J. A. (*Peterhead*); W. R. (*Hackney*); W. D. (*Newington Butts*); NOVICE; W. H. (*Penwalton*); OILY TIN; H. R. (*Manchester*); A. H. W. (*Newcastle-on-Tyne*); L. B. (*Marylebone*); M. H. (*Higher Walton*); J. H. W. (*London, N.E.*); W. J. P. (*Jersey*); J. O. H. (*Wandsworth Common*); L. L. (*Nottingham*); W. W. (*Chelsea, S.W.*).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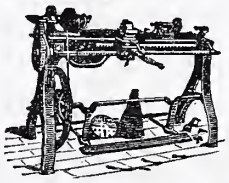

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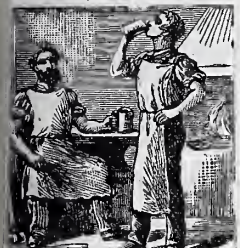

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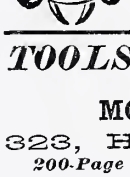

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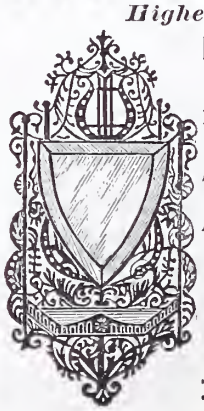

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 119.] SATURDAY, JUNE 27, 1891. [PRICE ONE PENNY.

## A MODEL RUSTIC TOOL-HOUSE FOR A SMALL GARDEN.

BY ARTHUR YORKE.

MATERIALS—THE WALLS—THE ROOF—FITTINGS.

*Materials.*—In this miniature rustic building, the materials used are what are known as "slabs" or "rough planks." These are cheap, and have, when judiciously handled, a good picturesque effect. For those who do not know them, I may explain that these slabs are the outside slices, of which two are cut from every log of rough timber when it is sawn into boards. It is only our native trees which furnish them, imported timber being hewn square before it is sent to us. These slabs generally retain their bark (except in the case of oak), and in most districts they will commonly be of elm. Their thickness and outlines are necessarily irregular: one end will frequently be narrower than the other; and this will account for the arrangement seen in the walls and door of our building. They are to be bought at saw-mills, or wherever sawing is going forward; and as they are not looked upon as a marketable part of the timber, they are sold at a fire-wood price merely. Where their cost is not sensibly increased by carriage, no other material comes so cheaply for building rough sheds. The ordinary country way of using them is as in the horizontal section, Fig. 4.

This plan, however, is not suitable for our purpose. In so small a structure, rough planks on the inner side would too much interfere with our space. It is, therefore, proposed to straighten the edges, either by sawing or by chopping with the axe, according to circumstances, and lining their inner sides with thin board. If the cost be not objected to, half-inch match-boarding will be neatest for this purpose; if economy is an object, the boards of packing-boxes, bought from the grocer, might suffice. There are, it will be seen, three sides only to be lined.

Among a lot of rough planks, it is likely that stuff may be found sufficient for the posts and other scantling, but as this is uncertain, I have shown these matters as of regularly squared stuff. As to the six pilasters, which are added for appearance merely, it is possible that stuff might be found which would, when sawn to width, do for them; but I have rather supposed them to be fir poles or elm saplings; four sticks only are needed to supply the six halves and four quarters used.

*The Walls.*—At the corners are four main posts, 4 in. square. These are shown at *a*, *a*, *a*, *a* in the ground plan. Fig. 3. These enclose (outside

Fig. 4.—Common Method of using Slabs.

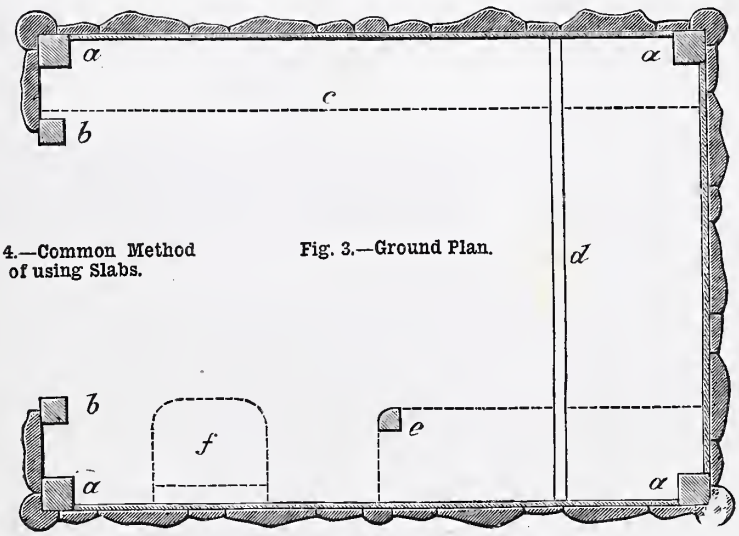



Fig. 3.—Ground Plan.

Fig. 1.—Elevation of End.

Fig. 5.—Cap of Pilaster (Enlarged).

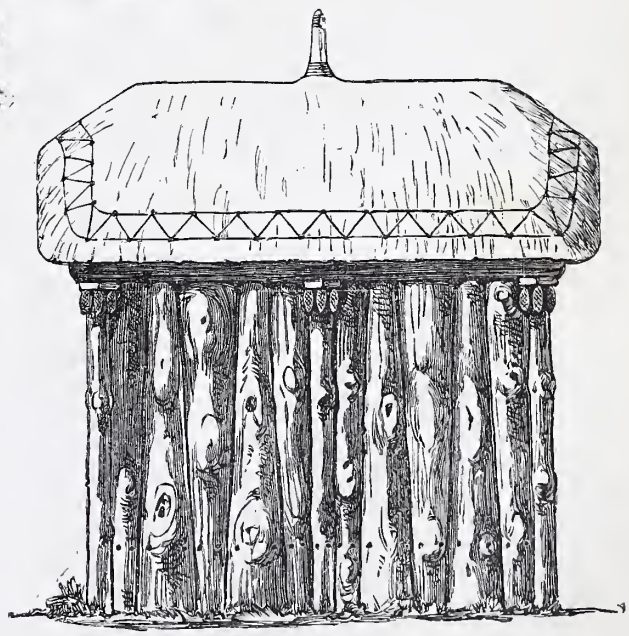


Fig. 2.—Elevation of Side.

measurement) a space of 7 ft. by 5 ft. They are let into the ground 2 ft., and rise 5 ft. 3 in. above the ground line.

On their tops, and coming flush with their outer edges, rest the wall-plates, which are 3 in. deep; these are needed at the back and sides only, and not at the front. On the same three sides will also be cross-rails, 2 in. to 3 in. thick, the ends of which will be let flush into the posts about a foot from the ground. To the wall-plates and these rails the slabs are nailed. In the side elevation, Fig. 2, the nails driven into the cross-rails appear, but not those driven into the wall-plate, a piece of rough stuff being there shown as fixed over the latter to support the eaves of the thatch.

To the front are to be seen the two door-posts, *b*, *b*, Fig. 3, which are 2 ft. 8 in. apart, and should be about 3 in. square. As their tops are nailed to the front pair of rafters, they rise to a height of 6 ft. 6 in. The space between door-post and corner-post is filled up by a single slab nailed to the two—5 ft. 6 in. long by 10 in. broad. Above these, instead of a wall-plate, comes the piece of strong slab, shown in Fig. 1 as having an opening cut in it for the head of the door. This is nailed against the door-posts, rafters, etc.

The pilasters are only a matter of ornament. As drawn, they are of halved stuff; the corner ones are so placed that their middles come opposite to the corners of the posts, on the other faces of which pieces of quartered stuff are nailed to meet them. The simple arrangement of the caps of these pilasters, with their decorations of fir cones, is shown on a larger scale in Fig. 5. The horizontal piece beneath the eaves, nailed over the slabs, has the effect of resting on the caps. Beneath the thatch at front and back corresponding pieces are fixed, those at the front being ornamented with fir cones nailed upon them.

*The Roof.*—This is shown in the elevations as thatched. No other covering will look so well, or be so thoroughly in keeping with other parts. The non-professional builder finds it easy to prepare for thatch, any rough stuff serving as rafters and laths, and no accuracy being needed in putting them together, since the thatcher, with his accommodating material, is able to make up any inequalities. The rafters for thatch should be arranged about 1 ft., the laths about 6 in., apart. In the article on Summer-Houses, Vol. II., page 67 (No. 57), it will be seen that more is said on the subject of thatch and thatching for rustic buildings.

Should there, however, be reasons for not employing this mode of covering, our building may be more quickly and easily, if not more cheaply, roofed with galvanised iron; only the gables will then best be made sharp instead of blunt, as at present.

*Fittings.*—Of these, the door should first be mentioned. Its outer slabs which appear in Fig. 1 are simply nailed to three ledgers of the same. Being of such rough materials, it will open better if hung on hooks and thimbles than on hinges.

As the space within will be strictly limited, we must take care that everything has its proper place—there is not room for confusion. The dotted line at *c*, Fig. 3, marks the projection of a set of shelves, about five in number, which fill the whole of the left-hand side. Of these, the lower will be for flower-pots, the upper for lines, setting-pins, trowels, etc. At *d* is shown a strip of wood fixed across the floor to hold the wheel of the barrow from running back when that useful vehicle is tilted up against the end wall, which will be the place assigned for it. In the gable and upper part of this end will be hooks or pegs on which to hang the riddle, watering-cans, and such matters. At *e* is an upright let into the ground, which, at the height of 2 ft., supports rails running to side and back; these form a kind of stand for spades, forks, and tools of that description. Above, against the wall-plate, may be more hooks or pegs.

It is suggested that at *f* a seat might be fixed to fold down like the leaf of a table when not wanted. As this building would form a snug shelter in a shower, such a seat would be a convenience; but the more important use of this space is that slightly below the level of the eaves it will be fitted with a rack for hoes, rakes, and similar implements. Such a rack is best made by boring ½ in. holes in a strip of wood at intervals of 3 in., and driving pegs into them 5 in. or 6 in. long. This has to be nailed so that the pegs will slope upwards, at an angle of about 45°. Rakes, etc., hung in a rack so made cannot fall.

Figs. 1 and 2 are ¼ in. to the foot; Fig. 3 is ½ in. to the foot; but Figs. 4 and 5 are not drawn to scale.

## FRENCH POLISHING—MORE ABOUT BODYING IN.

BY DAVID DENNING.

APPLIANCES NECESSARY—DESCRIPTION OF PROCESS—MOISTENING WADDING—TOUCHING RUBBER WITH OIL—APPLICATION OF MORE POLISH—HOW LONG TO CONTINUE FIRST BODYING IN—CONTINUATION OF PROCESS—SAND-PAPERING—CLEANLINESS NECESSARY—DRYING RUBBERS—EDGES.

ENOUGH having now been said about the polish—*i.e.*, the material—we may see about using it for bodying up. The wood, it may be assumed, has been prepared by filling of one kind or another, as fully explained in a previous article, and rubbed down smooth with the finest or worn glass-paper, to make it in a fit state to receive the polish; for it will easily be understood that a high degree of finish cannot be got on a rough surface. The rubber with which the polish is applied has also been sufficiently fully treated of elsewhere, so that nothing more need be said here about its preparation beyond that it consists of cotton wadding with a soft rag cover.

Wood, rubber, polish, and a little raw linseed oil being ready, bodying in may be proceeded with.

Moisten the wadding with some of the polish; put the rag cover on, being careful that at the bottom it is even and smooth, without any folds or wrinkles. Then, to distribute the polish evenly throughout the rubber, and cause it to moisten the rag at the bottom properly, dab the rubber into the palm of the left hand. The rubber is now ready for application to the wood, and the real work of polishing begins. Naturally, the beginner will not attempt to polish anything large at first, and it may, therefore, be supposed that he has got a piece of work which can conveniently be managed; and it may be well to remind him that his aim should be to spread the polish equally over the surface. The exact way in which this is done must depend to some extent on the shape of the wood, and also on the habit of the polisher; but, supposing it is a panel or flat surface which is being treated, the following method will be found as good as any, and is one that is more or less followed by experienced polishers.

Briskly rub across the grain, just to get the surface covered; then proceed by a series of circular movements, as shown in the diagram in page 54, to go over the whole of the work with a moderate amount of pressure, which should be gradually increased as the rubber dries, but at no time should the movement degenerate into mere scrubbing. In order that the rubber may work smoothly without sticking, its face should be just touched with a little of the raw linseed oil. The less of this used the better, and if it could be dispensed with altogether no harm would be done. Unfortunately, however, it cannot well be dispensed with, and the only thing is to use as little as can be managed with to make the rubber work smoothly. A very little will suffice. Just moisten the tip of a finger with oil, and touch the face of the rubber with it; that is all that is required. The rubber certainly must not be dipped in the oil, nor must the oil be dropped or poured on it from a bottle; for by any of these means more oil would be applied than is necessary—in fact, instead of being an assistance, the oil would prove fatal to good work.

As the rubber dries, more polish must be applied to it, as in the first instance, with oil as required. A very small quantity of polish goes a long way, and I must impress upon the novice the necessity of not making the rubber too wet. It should be fairly moist, and nothing more. Perhaps the best way to explain, to those who are unacquainted with the process altogether, what is wanted will be by comparing the rubber to a sponge, and illustrating what is wanted by means of this and water. Saturate the sponge with as much water as it will hold, and, supposing it to be a rubber with polish, it will be far too wet. Squeeze out some of the water till none drops from it if not squeezed, but leaving sufficient in to run out on the sponge being rubbed on anything hard. Still too wet for polishing purposes. Now squeeze all the water out till the sponge is almost dry, and will just damp anything on which it is rubbed without water flowing from it. This is just about what is wanted with the polishing rubber, and for ordinary bodying in it should never be wetter.

But, perhaps, many a beginner, noticing how tedious the work is with such a dry rubber, may be inclined to think that if he used more polish at a time the desired result would be more quickly attained. Well, if the object were merely to get the wood coated anyhow, this might be the case; but the result of using too much polish would be that, instead of a fine even coating or body, the shellac left by the evaporation of the spirit—and it is almost unnecessary to say that the spirit evaporates quickly—would be ridgy and irregular. Anything at all approaching a flow of polish from the rubber must be avoided. On the other hand, if the rubber is not sufficiently charged with polish, the labour of bodying up will be unduly protracted, if not rendered impossible, from the fact that no polish can be rubbed on to the wood.

The bodying in should be continued—that is to say, the first one—till it seems that the wood absorbs no more of the polish. There will be a perceptible gloss on its surface, but it will be streaky, and show the rubber-marks very distinctly. Never mind that, though, for all these marks will be removed later on—at least, let it be hoped so, for directions how will be given in due course.

It may be said that, if the polish is too

thick or too thin, the results will be very much the same as if the rubber were too wet or too dry. As it may be difficult for the novice to hit the happy medium, it may be as well for him to know that the principal objection to having the polish too thin is that it will take a longer time—*i.e*, more work to get a good body on the wood. It will, however, be better to run the risk of this than to have the polish too thick. An experienced polisher would soon detect any fault in either direction by the way in which the polish works, but it cannot be expected that the novice should do so. He must, therefore, be on the look-out for any irregularities in the shape of lumps or ridges which he may see, and, with a little attention, he will have no difficulty in avoiding serious mishaps.

Now, instead of hurrying on with the work, let it stand for at least a day, carefully covered up from dust; and on examining it again the body will be found to have sunk, but to what extent will depend upon circumstances. Any way, even the beginner will not fail to notice that it presents an altered appearance from that which it had when it was put away. This is owing to the polish having sunk into the wood, more or less. To compensate for this sinking, the work must be bodied up as before, always remembering to use as little oil as possible. The work will again be laid aside, and the bodying process be repeated till no more seems to sink in, even if the work is laid aside for a few days. When this stage is reached the bodying may be considered complete, and the work ready for the first polishing operations. Before proceeding to consider these, I have, however, to make some general remarks, which will enable the learner to work with more chance of success than if he were left alone, and told to glaze or spirit off. How to do these operations must be left for a future article, and meanwhile the novice will do well to note the following hints.

The number of times the work will require to be bodied up depends almost entirely on circumstances; but even for the best work, and that which is intended to be as durable as it can be, it need rarely exceed four. Fine, close-grained woods will not require so many as the more open kinds, such as oak, ash, mahogany, etc. Any reasonable interval—that is, one of several days—may elapse between the different bodies, the great object of waiting being to let them sink as much as they will. If, for example, after having laid the work aside for a few days, the polish has not sunk at all, no object would be gained by giving it another body, and so on with future bodyings. Of course, it is very seldom that the first body is enough. All the same, only one body is often applied in the trade, where either price or the limited time within which a job must be finished will not allow of more, so that cabinet-makers and others who may wish to do a bit of polishing must not suppose the process cannot be hurried.

Still, imperfect bodying is not advisable, as it will not be long before the work will want "touching up." Of course, if a job is like certain oft-referred-to razors, "made to sell," one body, and that of the slightest, is quite sufficient—from the seller's, if not from the buyer's, point of view.

Between the bodyings, especially after the first and second, the surface should be rubbed down with the finest glass-paper, not to such an extent as to rub all the body off, but just enough to smooth it. It may here be remarked that the pumice powder referred to in a previous article is, when used in moderation, useful for working down inequalities of surface. Although papering has been stated to be necessary after the first and second bodies, it must not be supposed that it may not be done after any others if they require it, which, however, they should not if the work has been skilfully done. In fact, as we shall see later on, the final bodying up may almost be regarded as the beginning of the spiriting off.

Before beginning to work a fresh body on a previous one, it is just as well to wash the surface gently with a little lukewarm water, and not too much of it, in order to remove the grease and allow the rubber to work freely. The water must be thoroughly dried up before applying the rubber, and, as is often the case, the washing may be omitted. In moderation, however, it can never do harm, and is generally an advantage, even though not absolutely necessary. When any long interval has elapsed the washing should never be omitted, as, of course, dust—otherwise "matter in the wrong place"—will settle on the work, and should not be rubbed into the polish.

Professional polishers should be careful to see that their hands are clean, or free from the old polish, which is so often seen on them, when doing any bodying up. If they are covered with the old polish or shellac, bits are apt to flake off and destroy the purity of the new work. Of course, this remark applies equally to amateurs and novices, but their hands are not so likely to have old polish sticking to them. As polishing is not altogether clean work, this may be an appropriate place to say that any polish which sticks to the hands—as some is sure to—may be washed away with hot water and soda, or with methylated spirit.

There may be some risk of novices supposing that a thick body is desirable: the opposite is the case, for it should be as thin as it can be. It is not so much the quantity of body on the wood as its quality that is required, and the way in which it has been applied, with sufficient intervals between the various bodies to allow of sinkage.

Another important matter is to dry the rubbers well out—that is to say, work them on each body till they are dry, and do not be continually moistening them. By this means the film of shellac is kept as thin as possible.

On no account should a wet rubber—or, I may say, one wet or dry—be allowed to stand on a surface while it is being polished. The rubber must be kept moving, and should, if I may so express it, glide gradually on to the work, instead of being plumped down on it. In the initial stages of bodying, care in this respect is not so important as later on, when it is absolutely necessary. The same degree of caution should be used when lifting the rubber from the work.

If it can be said that one portion of a piece of work requires more attention than another, it is towards the edges. On the "take care of the pence and the pounds will take care of themselves" principle, it may be laid down as a rule for the guidance of the beginner, that if he takes care of his edges the rest of the surface will look after itself. The reason is that the edges are apt to be somewhat neglected, and the polish to be less there than elsewhere.

With the remark that the secret of a good durable polish depends primarily on a good body, and this, in its turn, on sufficient time having been allowed for sinkage, my remarks on this part of my subject must be closed.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

### Building the Wheels.

Component Parts of Wheels—Spokes—Wheel to be Built—Dividing out Rim—Finding Length of Spokes—Fitting Oil Cup—Wiring One Side of Wheel—Wiring the Other Side—Determining Position of Chain-Cog—Loose Cone—Bottom Brackets—Direct Spoke-Wheel, why Described.

Our first practical work will be the building of the wheels. The wheels consist of hubs, spokes, rims, and tires, and there are various kinds of each of these. With regard to hubs, we have them of solid steel casting all in one piece; again, we have them of steel and gun-metal in combination, the steel parts being the two caps in the ends, which are hardened for the wear of the balls, and in the case of the rear hub the chain cog-wheel is also of hardened steel.

Spokes are of various kinds: as direct, butted, laced, and tangent. Direct spokes are those in which the wire is all of one thickness, screwed at the end next the hub; the hub being bored for them direct towards the centre, they enter the hub about $\frac{1}{2}$ in. Butted spokes also enter the hub direct in the same way and to the same depth as the above, but the end of this spoke is thickened and screwed on this thick part. The spoke itself is usually No. 11 or 12, while the screw part at the end is No. 8. Common direct spokes usually snap just at the edge of the hub where the screwing has left off; it will, therefore, be apparent to anyone that a spoke thickened to nearly double at that part will be much stronger. I may mention that the Singer Company build nearly all their machines with butted spokes, and in all my experience in repairing their machines, I have hardly ever found a broken spoke. I have found numbers pulled right out of the hub, but never broken. Tangent spokes have their heads at the hub and the screwed ends at the rim, where nipples are used to tighten up the wheel. The hub flanges are made thin, and holes bored sideways for the spokes; the spokes are bent at the neck—that is, a little way behind the head—and passed through the flange towards the rim. Laced spokes again have two spokes in each length of wire; the flanges are made the same as the last, but the spokes have no heads whatever, they are simply laced through the flanges; the wire, being long enough for two spokes, is doubled in the middle, and the ends led away to the rim at more or less of a tangent; the ends are screwed and fitted with nipples as in the last case. Tangent and laced wheels have usually hollow rims, which allow the nipples to be sunk out of the way of the rubber tire. A wheel with a hollow rim is consequently dearer, the rim alone being four or five times dearer than an ordinary crescent rim.

The wheel we propose building for our Safety is of the simplest direct order with No. 10 spokes, headed at the rim. We will describe the building of one wheel, as the building of both is precisely the same. Say you have purchased a pair of hubs, tapped and plated ready for putting into your wheels. The rear hub should have not less than forty spoke-holes, and the front hub not less than thirty. A screw-plate should be provided to screw the spokes, same gauge as the hubs are tapped.

Say you purpose building the rear wheel. Find the number of holes in the hub, and

divide off the rim all round and equidistant for the same number of holes. Wheelmakers on a large scale have division rings for boring wheel rims any number of holes, but as our cycle-maker is not supposed to possess this appliance, he must measure off the rim with a pair of compasses. Take a piece of string and pass it round the hollow of the rim, and measure the exact length it takes to go round; reduce this length to inches, and divide by the number of spokes—say forty; the answer will be two, with a remainder; reduce the remainder to $\frac{1}{8}$ths and divide again, when you will get approximately the divisions of the spokes. Go round the rim in the hollow with the compasses or dividers, marking lightly with the points, first making a mark with a centre-punch to start from; count as you go round, and repeat the operation till the leg falls into the mark you started from; then centre-punch all the marks—forty—with the rim hanging on the nose of a high anvil, or across a leg vice when shut. Next bore with a drill one size larger than the spoke wire. If the boring is done with a lathe, let the rim rest on the lathe-bed at the right hand, and bore half the holes—that is, miss and take one—then turn the rim over and bore the other half; in this way the holes have an angle in the direction of the hub, and will appear somewhat ziz-zag on the inside of the rim. Care must be taken, however, to place the spokes in the proper holes when building the wheel. Having bored the rim, the next thing is to countersink the holes with a $\frac{1}{4}$ in. drill; this should be just sufficient to let the spoke head in flush.

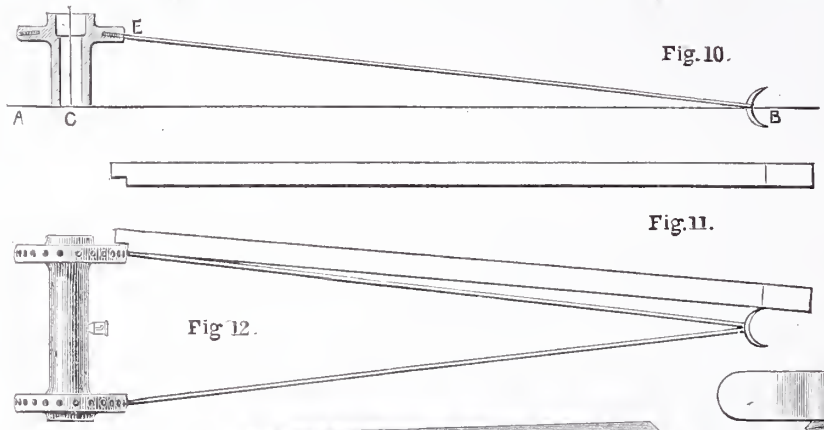



Fig. 10.



Fig. 11.



Fig. 12.

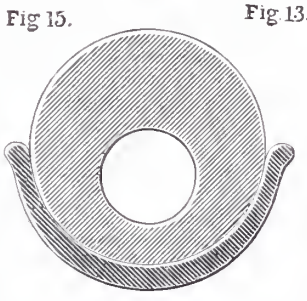


Fig. 15.

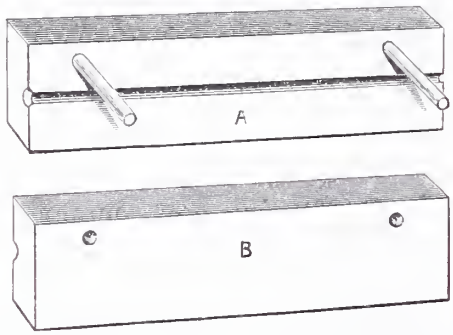



Fig. 13.

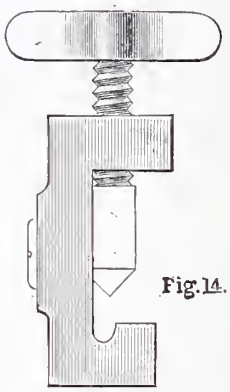


Fig. 14.

Fig. 10.—Mode of finding Length of Spokes (one-fourth size). Fig. 11.—Lath for truing Wheel (one-fourth size). Fig. 12.—Application of Lath (one-fourth size). Fig. 13.—Spoke Header (half size). Fig. 14.—Spoke Grip (full size). Fig. 15.—Cushion Tire (full size).

Now to find the true length of the spokes is an important matter, because if they are too long the wheel must come down again in order that they may be shortened. To find this true length, a drawing must be made, full size, similar to Fig. 10 here shown, which is one-fourth full size. Draw the line A B; on A B take a point C; at right angles to A B, at C, mark off half length of hub—that is, from centre of hub to the spoke-holes—and draw the half hub in section as shown: the spoke-holes should be drilled $\frac{3}{8}$ in. deep and tapped full length. Now measure exactly the diameter inside of the rim; take half this diameter, and mark the section of the crescent rim from C towards B. Next draw the line B E, which will be the length of the spoke, less the part that enters the flange, which should be not less than $\frac{1}{2}$ in. The spokes should all be cut exactly the same length, and screwed a little less than $\frac{1}{2}$ in.—say, $\frac{7}{16}$ in.; in screwing, find how many turns of the plate will do $\frac{7}{16}$ in., and give all the spokes the same number of turns. Now the holes in the hub flanges should have $\frac{1}{16}$ in. bored plain without screwing, and the full size of the wire, so that on building the wheel the screwed part will go out of sight in the flange. The spoke is in this way a little less liable to break off level with the flange, and when it does break off, it is at the end of the screwing and a little within the level of the flange, leaving a good recess for boring out the stump.

The next step before beginning to put up the wheel is to fit the oil cup, and leave it in its place. Now try a spoke in the hub, and screw it home; see that it is not too stiff to screw up, nor too easily screwed up; it should screw home with the spoke-grip without forcing, and it should not be so easy as to screw home with the fingers and without the use of the grip. Be sure that all the spoke-holes in the hub are properly cleaned out and properly tapped. Now to put the wheel together, place the rim on three or four bits of wood about 2 in. thick on the bench, stand the hub in the centre, and pass all the spokes for one side through, entering them in the hub a little way with the fingers only; of course, you will take and miss a hole in the rim, and notice at the same time the ziz-zag holes in the rim, and pass the wires through the holes that look upwards to the upper end of the hub. This, of course, will be at once clear to anyone performing the operation.

Having put in all the wires for one side, turn the wheel over and put in the other half. Now screw up the whole of the spokes with the grip till the screwed ends just disappear in the flange. Now to true the wheel, take a thin flat rod of metal, or a thin lath of wood, and make a notch at one end, as in Fig. 11; this notch rests against the flange, as in Fig. 12. Make a mark with a pencil on the lath where the sharp outer edge of the rim touches it; now apply the lath between the spokes all round the wheel on both sides, and observe where the edge of the rim falls within or without the pencil mark; this shows where to screw up and where to let down. This, I believe, is not exactly the method used by wheelmakers, but as I am a self-taught cycle-maker, I have to resort to my own methods, and I find the lath as above described to be very serviceable, as I have frequently put up wheels with it that ran dead true the first trial on their own spindle. I have, however, often found rims with a high edge and a low one, which destroys the true working of the lath as a gauge, and throws the hub out of centre—that is, gives the wheel more dish on one side than the other, which is to be avoided above all things. But assuming the rim to be truly made, and the hub flanges to be both the same diameter, if the rim all round on both sides touches the mark on the gauge, you may rely on the wheel running true on its spindle when tried; radially, it will be dead true, and if there is any side-wobble, touch it with a bit of chalk while revolving on its own spindle, and twang the spokes on the side with the chalk; if they sound tight let them down, say half a turn, and tighten up those on the opposite side, say half a turn. Try the wheel again, and any part, however little off the truth, will show with the chalk. It must be understood that a very slight tightening or slackening of a spoke makes a perceptible alteration on a wheel. One important thing to observe before the wheel can be said to be finished, is to see that all the spokes are of the same tension; this can readily be ascertained by twanging with the fingers. If they are all of one tension they will all give forth the same sound or note, being all of the same length.

Now, having finished this wheel ready for the tire, the other wheel is treated in exactly the same way, only you must see that the hub and rim are of the same diameter as the last, else you will have to make a new drawing to find the true length of spokes, or if using the same drawing, make allowance for the difference.

Now, with regard to the rear or driving wheel, you have got to determine on which side of the machine you will have the chain-cog, whether right or left; sometimes the make of the hub determines this, as the spindle having a fast and loose cone, the loose cone should always be on the *left* side of the wheel in running forward, for the reason that a loose cone is apt to turn on the spindle with the friction of the balls, especially when dry. Now, if the cone is on the right side, and turns on its spindle, the result is that it winds further *on* the spindle and jams in the hub, stopping the wheel; but if placed on the left side it turns on its spindle, winds off towards the fork side, and cannot jam the wheel, which is a lesser evil; of course, if the wheel is kept properly

adjusted and the outside nuts well up, the cone cannot run either way. Some makers of hubs, however, have both the cones loose; in this case the nuts must be kept well up, or the right cone will be sure to run in and jam the balls, stopping the wheel.

This rule with regard to the loose cone must be observed the same with the front wheel as with the back.

With regard to many of the bottom brackets in use the same rule holds good, as the pedal shaft has a fast and loose cone, with the chain-wheel keyed on immediately behind the fast cone. In this case the chain-wheel and chain should always be on the *right* side of the machine, which places the loose cone on the *left*, where it should be. I have handled many machines, however, where this rule was disregarded. In our bottom bracket, however, the two bearings are separate, being the same as those used on an ordinary bicycle, consequently we can fix our chain-wheel on either side.

I have, in this paper, described a plain direct spoke wheel on account of the difficulty of building one with butted spokes in the absence of a spoke heading machine, which costs between £4 and £5. A butted spoke being No. 14, and the butt end No. 8, the rim is bored with a No. 13 drill, so it will be readily seen the butted end will not pass through the rim; for this reason butted spokes have no heads, and are passed through the rim from the inside and a head worked on after the spoke is in the rim, hence the need of a heading machine. In the absence of a heading machine, I use a very simple contrivance which does the work fairly well. It is illustrated in Fig. 13, A, B, and consists of two steel plates, 4 in. long, 2 in. broad, and ½ in. thick. Plate A has two ⅜ in. round steel pins fixed into it; plate B has two holes to receive these pins, and the two plates when shut are flush all round with each other. Along the centre of both plates a shallow V-shaped groove is made, both grooves together being a little less than the thickness of a spoke. When the two plates are firmly caught together, a countersink is made at one end where the grooves terminate; this counter-sink is the recess to form the spoke head (see A in Fig. 13). To use this tool, the spoke is caught between the two plates in the grooves, about $\frac{3}{16}$ in. protruding beyond the plates at the countersink end. In this position it is caught in a strong vice, and the head formed by hammering the projection into the counter-sink; of course, the spoke has been passed previously through the rim. In building a new wheel, all the spokes would be cut the proper length, butt ends screwed, then passed through the rim and headed, after which the wheel would be built as described in the carlier part of this chapter. The spoke grip referred to in this chapter is illustrated in Fig. 14, and may be bought for 1s. 6d. Before closing this paper, I deem it advisable to say a word regarding cushion tires, which are the rage just now, it being just possible that our cycle builder may not be content with the ¾ in. crescent rim and solid tire herein described. If he purposes having a cushioned-tire machine, the tire should not be less than 1¼ in. diameter. A tire of that sort is shown in Fig. 15, with a section of the rim used, or ought to be used, with it, the edges being turned out and blunted or beaded to prevent cutting the rubber. The hole in this tire is ½ in., and, as will be noticed, is not central, but a little nearer the rim. Rims of this sort can be had, as well as hollow rims, formed on the rubber side in the same way, of Thomas Warwick's make.

It must be borne in mind that a 1¼ in. tire requires a wider fork to let it pass through, also a broader spoon for the break, as well as broader mud-guards. Our next work in cycle building will be at the lathe and fitter's vice.

## AN IMPROVED PIN-STOP BENCH-BLOCK.

BY J. BLACKMORE WILLIAMS.

Those workmen familiar with the common work-bench used by joiners, cabinet-makers, etc., are, I venture to state, well aware of the fact that the present bench-block mostly in use consumes a vast amount of time in adjusting, and the amount of labour required in, say, a year's time, where there are a number of workmen employed in shops and other places, is something enormous, to say nothing of the constant change of position, as the workman has usually to go round the corner of his bench to knock the block into the position he desires. The bench I use is for convenience pushed up against a wall, from which is suspended a woodrack, and in adjusting my bench-block I invariably experienced a great difficulty, which I remedied in the following manner:—

I sawed out of the end of the bench a piece, 10 in. by 2 in., and cut from the screw to the end of the bench-board on a slant, as shown in Fig. 1. I then procured an iron plate, perforated with small holes at intervals of ½ in., and grooved at the sides (as shown in plan and section at A and B, Fig. 3) for the reception of another plate, 2½ in. by 2 in., as shown at F. On to the latter plate, which

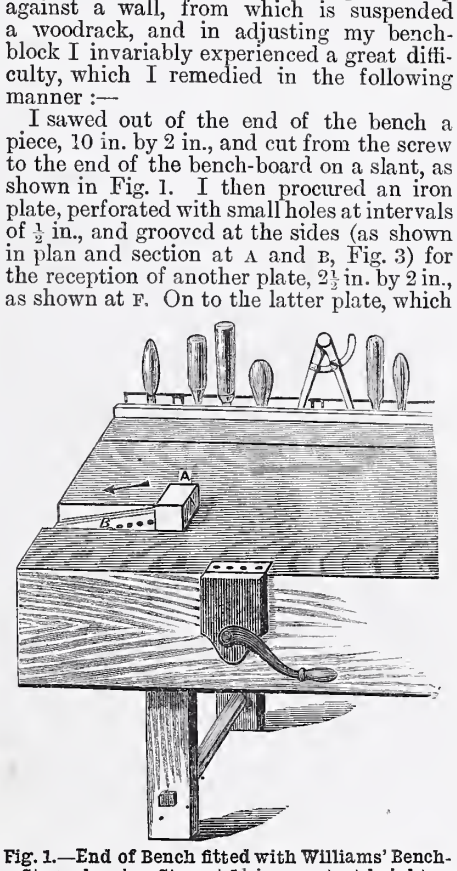


Fig. 1.—End of Bench fitted with Williams' Bench-Stop, showing Stop at 1½ in. greatest height.

was ¼ in. in thickness, I screwed from the underside of the plate my pin-stop bench-block, which must be cut on the level at the bottom, and so arranged for height that when it reaches the end of the bench, as in Fig. 2, it is perfectly level with the face of the bench. Fig. 1 will clearly show the reader the appearance of the block when adjusted, A being the bench-block, and B the bevelled groove, perforated with holes for the reception of the stop-pin, as shown at C in Fig. 3. At D is shown the 2½ in. by 2 in. plate with screw-holes, for fastening the wood bench-block, and E shows the bench-block when screwed on to the plate. At F is shown the bench-block complete. A and B, in Fig. 3, illustrate the permanent plate, B showing the manner in which the grooves are formed for securely holding the bench-block. The workman will readily see from the design the manner in which the block is raised or lowered by pushing it along the permanent plate; and on getting the desired height, he drops the stop-pin into one of the holes nearest the back of the bench-block. Some objection may be raised by workmen on the ground that when the block is at the end of the bench there is a cavity into which, say, an

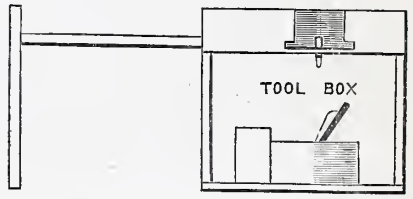



Fig. 2.—End Section of Bench, showing Pin-Stop Block at lowest height.

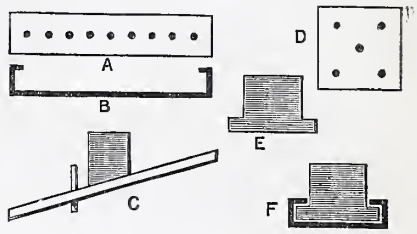



Fig. 3.—Parts of Pin-Stop Block—A, Iron Plate pierced for Pin in Plan; B, Plate in Section; C, Pin and Block.

inch board, in being shot, would fall in; but he will readily remedy this by letting in a slot-piece, fitted level with the face of the bench. Of this fact, there is no doubt that those workmen who adopt this inexpensive improvement will not only save a vast amount of time, but they will be able to adjust it without moving from the screw. I had at first thought to arrange a slot movement, but thinking of the quantity of sawdust which would tend to choke the cogs, I decided on the pin-stop, which leaves the permanent plate clear, and may be fastened to the bench by means of a small chain.

## ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

*Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.*

### Rules for Engine Drivers and Boiler Attendants.

Filling Boiler—Examining Water-Gauge and Test-Cocks — Cleaning Tubes — Lighting Fire—Examining Safety-Valves—Lubrication, etc.—Examining Bearings—Raising Steam Slowly—Regular Admission of Feed-Water—Examining Height of Water in Boiler — Starting Engine — Surplus of Steam—Testing Safety-Valves and Pressure-Gauges—How to Test Pump—In Case of Low Water—In Case of Safety-Valves Sticking—Priming—Examining and Testing Steam Exhaust.

Owing to the multiplicity of types of engines and boilers in use, it is difficult to draw up a code of rules in which the wording will apply equally well in all cases. The *principles*, however, embodied in the following rules may be generally applied,

although the phraseology may sometimes require slight modification.

1. *Filling the Boiler.*—Fill the boiler with water till it rises to the mark on the gauge which shows the water line. If there is no water line marked, fill till the gauge glass is about three-quarters full.

2. *Examine Water-Gauge and Test-Cocks.*—Open all the water-gauge and test-cocks, and see that they are in order. If the water does not enter the gauge glass freely, it must be unscrewed and a piece of wire passed through the openings in the boiler.

3. *Cleaning Tubes, etc.*—Remove all soot from the tubes, and clear the fire-bars and ash-pit of clinkers and ashes. If the flues are dirty, have them swept.

4. *Lighting the Fire.*—Light the fire, which should be kept bright and even, and of a thickness of about 4 in. to 6 in. in tubular boilers, and from 9 in. to 12 in. in Cornish or Lancashire boilers, except when there is a surplus of steam, when a thicker fire may be used. The thickness of the fire should be regulated by the nature of the fuel. Should the draught be bad from dampness, direction of wind, or other cause, a temporary artificial draught may be made by lighting some shavings in the smoke-box or chimney.

5. *Examine Safety-Valves.*—As the fire burns up examine the safety-valve, and see that it moves freely in its seat. Examine float or low-water alarm if one is fitted.

6. *Lubrication, etc.*—Fill the lubricators. A little fine powdered plumbago or asbestos may be added with advantage, especially to the cylinder lubricator. The use of the best quality of oil or grease is to be recommended. What is required is a neutral grease that will not develop free or fatty acids under the action of steam. Its melting point should be low, so that it will liquefy with a small amount of heat, and yet it should retain sufficient body, that it will not readily run from the bearing surfaces. Lubricate piston rod and guides. Examine eccentric, and see that the key is tight and the lead of the valve has not been accidentally altered.

7. *Examine the Bearings.*—Examine systematically and screw up the bearings of the engine, not too tightly; this is best done, if required, immediately after finishing work for the day, as they are then expanded from the friction of working and are in their running condition. If bearings are tightened in the morning before commencing work, which is usually the plan, they are cold, and therefore contracted. If a bearing get hot, cool with water and scrape off all scored or rough places; if it knock in working, let the faces of the bearing be slightly closer together. Lubricate well with a mixture of grease or oil and powdered plumbago, say three of grease to one of plumbago. If the bearing be large and subject to great strain or pressure, the proportion of plumbago may be increased. Replenish all lubricators before starting work, and guard all bearings as much as possible from dust. If there is undue friction on the bearings, particles of metal will be found in the oil after using if it is spread on white paper.

8. *Raise Steam Slowly.*—Always raise steam slowly and avoid forcing the fire, as this causes uneven expansion and strains and damages the seams and boiler plates. Keep an even pressure of steam, but not one that has to blow to waste through the safety-valve.

9. *Regular Admission of Feed-Water.*—Hot feed-water is in every way to be preferred to cold; but if cold is used, do not admit it into the boiler in large quantities at a time. Keep the pump working regularly, but with the admission valve only partly open. We recommend the use of a feed-water heater, but if one is not fitted, direct the exhaust steam into the water-tank, say a quarter of an hour after starting, as by that time any accumulated grease from the cylinder may have blown away.

10. *Examine Height of Water in Boiler.*—Examine height of water frequently during the day, and try gauge and test-cocks and float. Blow-out and scum taps should be opened once a day at least, oftener if the water is bad. Be sure that the float is acting properly, as it is apt to stick, especially if of very light construction. The water-level in Cornish or Lancashire boilers above the surface of the flue should never be below 4 in. in depth under any circumstances, and a working level of about 9 in. will generally be found most suitable. In finishing work at night leave a full supply of water, in case of leakage or frost.

11. *Starting the Engine.* — Supposing steam to be up to the working pressure, the safety-valve having been tested at intermediate points, turn the fly-wheel of the engine till the crank shaft is at half-centre. Before starting, let the engine cylinder be thoroughly warmed; this is especially advisable with large engines or in frosty weather. Now open the cylinder cocks and turn on the starting lever or valve gradually to about one-third of its traverse. Steam now enters the cylinder, and the engine is set in motion. When no more water is expelled from the cylinder, close the cocks. See that there is no leakage of steam from the piston-rod packings or any of the joints. Allow the bearings of a new engine to be a little slack for a time. Never start or stop an engine suddenly.

12. *Surplus of Steam.*—When there is a surplus of steam, close the damper, rake the fire-bars so as to admit the air from below, open the ashpan lid if there is one, and keep the furnace door closed. (N.B.—The author recommends, wherever possible, the use of a damper worked by steam automatically, as it is certain in its action and independent of the boiler attendant. It can be arranged to act at any desired pressure of steam, and effects an appreciable saving in fuel. It is important, whatever form of automatic damper is used, that it is arranged with a sensitive action. This may be secured by hanging the damper on a steel-pointed screw pin, and making the working parts with steel centres and V edges. This will allow the damper to open or close with rapidity when the desired pressure of steam is reached.) Where the work varies very much, automatic expansion gear should be fitted.

13. *Testing Safety-Valves and Pressure-Gauges.*—Test the safety-valve at least twice a day; if about $\frac{1}{8}$ in. to $\frac{1}{4}$ in. of space is shown between the valve and its seat for the escape of steam, this is usually sufficient if the valve is of proper area for the boiler, but some valves are arranged to lift less than this. Pressure-gauges should also be occasionally tested by shutting off the steam and letting the pointer run back to zero; for this purpose the cock to the gauge should be arranged to open to the atmosphere when shut off from the boiler. Check also the safety-valve against the pressure-gauge by altering the former to blow off at whatever pressure is at that time shown on the pressure-gauge. If they do not agree, have the gauge tested by a standard one. See that the figures on the pressure-gauge are large and plainly marked, so that they may easily be read at some distance away. It is also best to distinguish the average or safe working pressure of the boiler by a red line on the gauge; this can readily be reduced as the boiler deteriorates. If the pressure-gauge shows the blowing-off point, and the safety-valve is found to be stuck or inoperative from any cause, start the feed-pump, close the damper, and open the furnace door. Start the engine should it be standing, and let the fire out or draw it when the pressure is reduced. Never under any circumstances wedge down or overweight a safety-valve, and "wire-drawing" the steam should not be resorted to. Should the valve leak at all, have it reground at once and made perfectly steam-tight.

14. *How to Test the Pump.*—Test the pump occasionally by opening the waste-tap; if no water is expelled the pump is not working, either from there not being a vacuum, the packing or joints being out of order, the valves choked with dirt, or the pump hot. Before taking it to pieces place your hand tightly on the end of the waste-pipe, allowing the air to be discharged from the pump by the inward stroke of the plunger, but not allowing any air to re-enter during the outward stroke. If this has the desired effect in setting the pump to work, close the waste-tap, and the water will be forced into the boiler. If the pump gets hot, pour cold water on it. If hot water continually issues from the waste-cock, the probability is the check-valve nearest the boiler is choked. In this case the steam must be blown off and the fire put out, the valve-box cover must be taken off, and the dirt or obstruction that prevents the valve acting removed. If the suction or delivery valves are choked, hot water will not pass through the waste-cock; these valves may be examined when the engine is working, but should the defect not even then be discovered, the suction-valves, delivery-valves, and the packing of the plunger must be examined and the packing renewed, as the pump is probably drawing air; screw up and clean the union nut of the suction pipe, and make another trial. Occasionally a valve that has stuck may be released by a few sharp blows of a hammer on the outside of the clack cover. If a pump plunger is worn it will not act, at any rate satisfactorily, and should be seen to. In case it is necessary to take the pump to pieces, should there be no check-valve fitted or it be choked, be sure that the water stop-valve is closed, or the boiler may be drained of water and an accident occur. If a valve has too much lift it is apt to stick, and should, therefore, be adjusted periodically as it wears. Feed-pipes should in all cases be of ample size, owing to their liability to fur up. Bends in the suction or delivery pipes should be avoided. Take every precaution to prevent sand or grit getting into the feed-water.

15. *In case of Low Water.*—In case of low water—that is, where none shows in the gauge-glass or lower test-cock—draw the fire immediately; but, should the furnace crown be red-hot, cover the fire with earth or wet ashes so as to smother it. Close the damper and ash-pit door and open the furnace door. If the boiler is very hot, and the heat is likely to be much intensified by drawing the fires, it would be well to smother them instead of drawing, but judgment should be used, as no fixed rule can be laid down. If a little water is shown by the

lower test-cock, the feed may be turned on.* The Manchester Steam Users' Association say in this connection: "Shortness of water generally arises from neglect of the boiler attendant, and ought not to occur. It is by no means easy to give precise instructions as to what should be done to put things right when shortness of water has occurred, so as to meet every case. Drawing the fires when the water is out of sight must always be a matter of more or less risk, as there is a difficulty in determining how far and for how long a time the furnace crowns have been laid bare. If it is known that the water has only just passed out of sight, say from the sticking fast of the blow-out tap when attempting to shut it, the fires may be drawn with safety. But if an empty gauge-glass has been mistaken for a full one, and the boiler has been worked on in this state for some time, the case will be different. Again, there would be more risk in drawing the fires from a plain furnace tube, or from one made of ordinary plates, than from one strengthened with encircling rings, and made of ductile steel or of iron equal to Lowmoor or Bowling. Thus, it will be seen, it is difficult to give precise instructions to suit all circumstances. A fire may be safely drawn in one case and not in another."

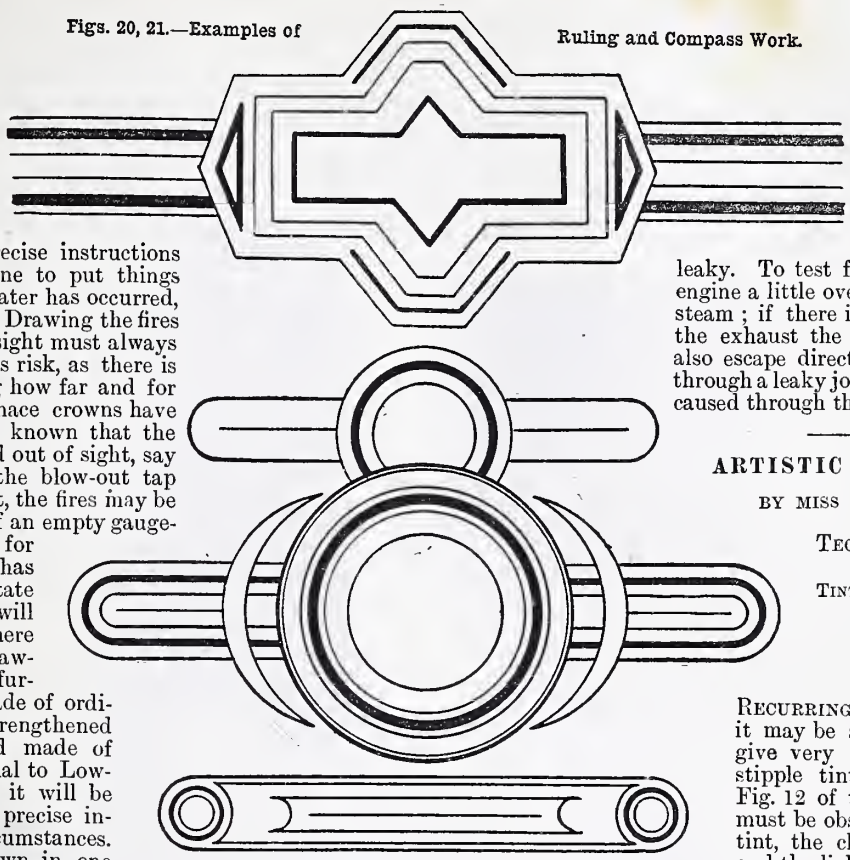
16. *In case of Safety-Valves Sticking.*—Should the safety-valve stick from any cause, and the pressure of steam be near the blowing-off point, (1) keep the engine running, and if steam is taken off for any purpose, open the valve; (2) start the feed-pump; (3) close the dampers; (4) open the furnace door; (5) if thought necessary, damp down or choke the fire with wet ashes.

17. *Priming.*—In case of priming, close the throttle-valve for a short time, find the true level of the water, and open the cylinder-cocks. If the water level is correct, blow off a little occasionally and add fresh water, but not too much at a time. Check the draught to the boiler also, and damp the fire somewhat. See that the feed-water is not dirty or greasy. In boilers where the steam space is small, great regularity of firing and water supply is necessary. If the priming is violent, stop the engine. Open the cylinder-cocks occasionally. Some of the compounds sold to remove incrustation will cause priming. Priming may also be caused by bad circulation, by an excess of steam being drawn from the boiler, or by the introduction of oatmeal or similar substances with the object of stopping leaks. In case of violent priming, the gauge-cocks will discharge a mixture of steam and water instead of plain water. It should not be attempted to stop priming by the introduction of oils, as is sometimes done, as most of these develop fatty acids, which are often highly injurious to the boiler, and by mixing with the lime or other incrustation prevent a proper contact of the water with the boiler-plates; there is therefore a much greater tendency to burn.

18. *Examine and Test Steam Exhaust.*—An experienced and careful attendant can gather no little information as to the working condition of his engine by attentively listening to the pulsation of the steam exhaust. If the piston, slide-valve, and passages are in good order, the sound of the exhaust will be regular and decisive. If the piston is out of order, or the rings broken or worn, the pulsation will be prolonged, accompanied by a rumbling, groaning noise. If the pulsation is prolonged, with a wheezing noise, probably something is wrong with the slide-valve, and it may require adjusting or re-bedding. In either of these cases steam is wasting past the piston or slide-valve, and should receive immediate attention. To test for a leaky piston, put engine on dead centre and listen to the exhaust; should there be an escape of steam the piston or rings require attention, or the cylinder may want re-boring. The piston should be tried at both ends of the cylinder. If there is a simultaneous discharge of steam through the pet-cocks at both ends of the cylinder, you may be sure the piston is leaky. To test for leaky slide-valve, place engine a little over half-stroke and turn on steam; if there is a rush of steam through the exhaust the valve leaks. Steam may also escape directly into the exhaust-pipe through a leaky joint. A leaky piston may be caused through the engine being out of line

* See "Handbook for Steam Users." M. Powis Bale (Longmans & Co.).

Figs. 20, 21.—Examples of Ruling and Compass Work.



## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

TECHNICAL WORK — MORE ABOUT STIPPLING.

TINTS IN LINES AND STARS—TINTS SHADED UP FROM SOLID—BALL IN STIPPLE WORK—EXAMPLES OF RULING—TEMPERATURE OF STONE — FINGER-MARKS.

RECURRING to the subject of stippling, it may be said that Figs. 10 and 11 give very fair examples of shaded stipple tints, worked in stars, and Fig. 12 of tints worked in lines. It must be observed that the darker the tint, the closer and larger the dots, and the lighter the tint, the finer and more open the dots are, this being an infallible rule in stipple work. Fig. 13 is another example of shaded lines, which the student would do well to copy.

In a shaded tint where the darkest part is perfectly solid (Figs. 14 and 15) the student will find it impossible to shade it to a light tint without filling in; but the better the dots are laid in in the first instance, the less work is subsequently required. In an unimportant part of the picture it is not necessary to spend so much time in making a perfectly executed tint of regular dots, as long as the necessary effect of an even tint is produced. Fig. 15 is a specimen of what would be required for a good piece of shading, such as that on a face, an arm, etc., and Fig. 16 that for an unimportant part of the picture, such as a shadow thrown by a table. When the student is able to do a ball like that which is shown in Fig. 17, he may consider he has crossed the *pons asinorum* of stipple work.

Only two examples of line work are given (Figs. 18 and 19), as every different subject requires a different treatment; and here the student's artistic knowledge stands him in good stead, as he will then understand not to put the same kind of work in drawing a vase as if he were drawing a carpet.

The above examples of tinting are merely a few specimens of what is required in lithographic drawing with regard to stipple work, as each student can only gain by his

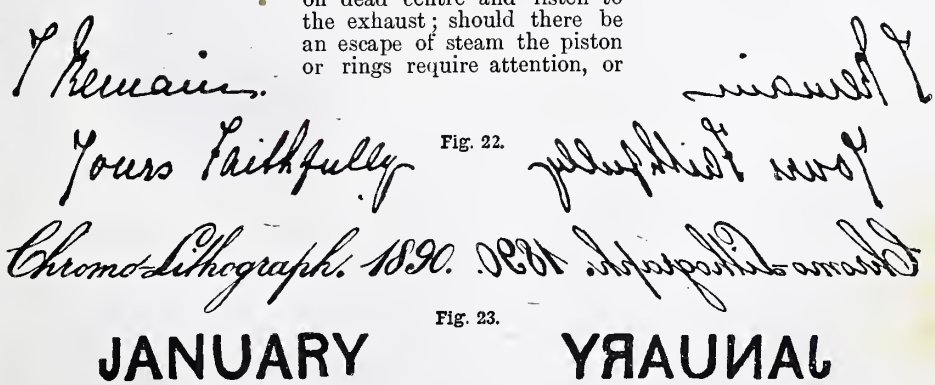



Fig. 22.

Fig. 23.

Figs. 22, 23.—Examples of Writing.

own experience the various styles and textures necessary for different kinds of work. It being found impossible to give many specimens of ruling, using the compass, lines drawn with the brush, writing, etc., Figs. 20, 21, 22, 23 must suffice at present as a slight guide to the student as to what will be required from him in that direction; but he must perfectly understand how necessary it is to practise with the different instruments before attempting any practical work. For instance, he will find the bow compass slip all over the stone, until he obtains full control in holding it firmly on one point, allowing the pen to glide easily over the stone; the same applies to the ruling pen, as it must be allowed to glide over, and not be pressed on the stone; and it will not be out of place here to observe, that it is easier to join straight lines to circles than *vice versâ*. The brush will be sure to make a thicker line than is required, until the student obtains a touch delicate enough only to work on the point.

It will perhaps be thought that lithography is made out to be more difficult than it really is, but the reader must not forget that good work is not easy to accomplish, and cannot be done without a certain amount of patience and perseverance, and if the artist understands what is required of him in starting lithography, he will not be as disappointed as if he thinks he can learn it in six, or even twelve, months.

To proceed with the work, the artist must remember never to work on a very cold stone; it should be warmed at the fire before beginning work for the day, especially if it has been kept in a damp cellar, and the back should be put next the fire in preference to the front, as the heat will then draw the dampness away from the drawing surface. Should the stone be too large to move with convenience, heat a flat piece of iron and hold it close over the stone for a short time, taking care not to touch it.

Finger-marks on the stone are apt to roll up in printing, and may appear as black smears—in fact, leaning against the stone might make it greasy, and so have the same effect as if it had been drawn in ink.

In practising tinting with the pen, it is not necessary for the student to confine himself entirely to one style of work in any one subject, such as an arm or hand, for example. It is, in fact, necessary, at times, to blend dots in lines with those in stars. For instance, when drawing an arm, in order to give force

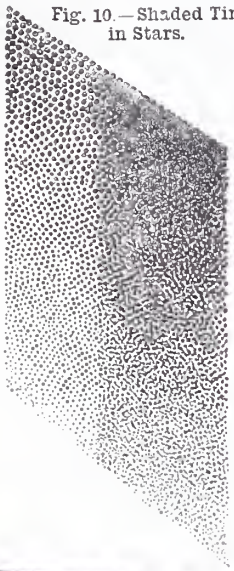


Fig. 10.—Shaded Tint in Stars.

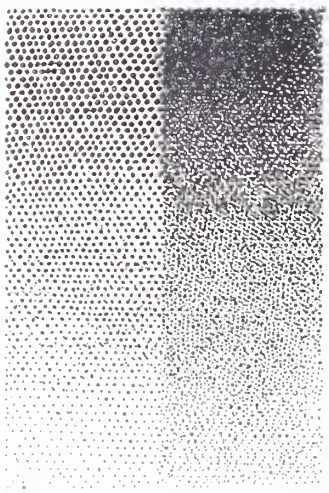


Fig. 11.—Shaded Tint in Stars.

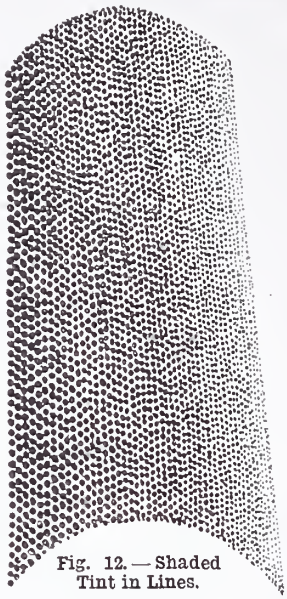


Fig. 12.—Shaded Tint in Lines.

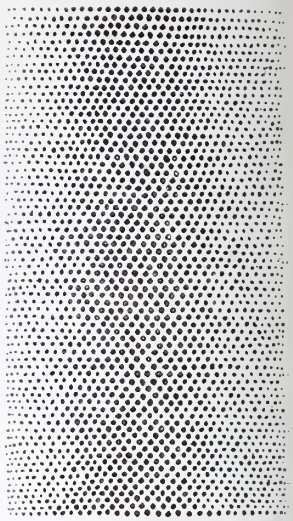


Fig. 13.—Shaded Tint in Lines.

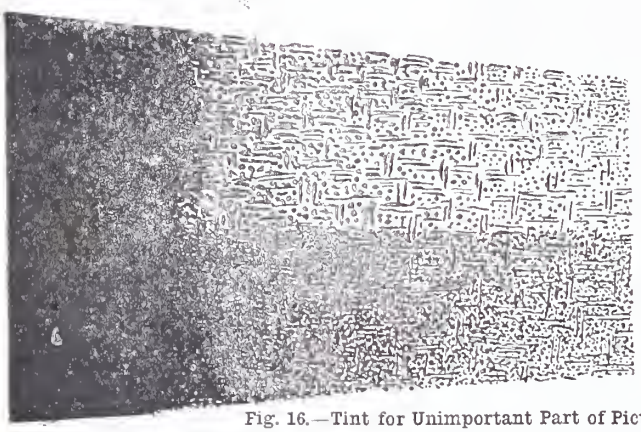


Fig. 16.—Tint for Unimportant Part of Picture.

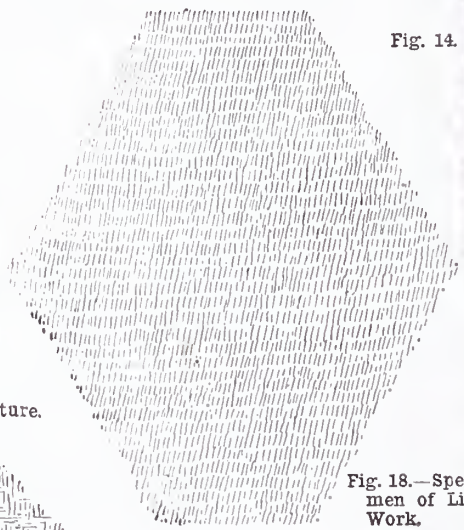
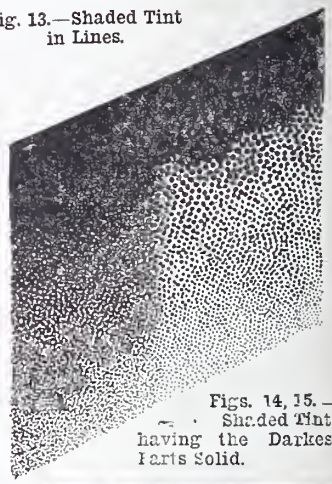


Fig. 14.



Figs. 14, 15.—Shaded Tints having the Darkest Parts Solid.

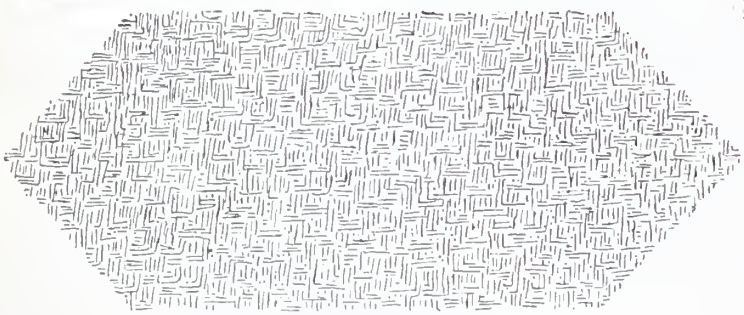


Fig. 19.—Specimen of Line Work.

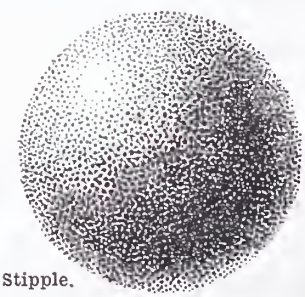


Fig. 17.—Shaded Ball in Stipple.

Fig. 18.—Specimen of Line Work.

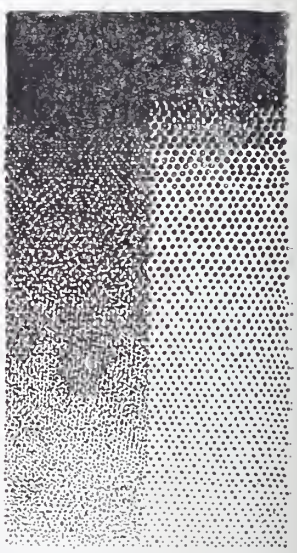


Fig. 15.

o the drawing, as there is no decided outine, about three or four rows of dots in ines should be drawn down the edge, the ast row being finer than the others to give oftness and roundness to the figure; this vould be gradually worked off into stars owards the high lights, thus giving effecive drawing and shading in the one tint by he judicious management of the dots. In he same way in drawing a face, parts, such s those under the eyebrows, round the ving of the nose, the mouth and around t, near the ear, etc., would all be drawn vith the dots in lines, in the various direcions of the features; whereas the forehead, heeks, neck, etc., would be drawn in stars, hus giving a certain amount of modelling, nd helping the shading by giving much nore character to the subject than if a flat int were laid equally all over the drawing nd then filled in, for however well it may e modelled, the drawing would always ave a flat appearance—insipid, if I may use hat expression, and without character.

In filling in a tint, the student should not ook as closely at his work as when he ays in the dots in the first nstance, for if he does so, and hen regards it from a distance f about a couple of feet, he vill, no doubt, be very surrised to see what a patchy ppearance his drawing has. his is owing to the fact that n looking so closely at his work e fails to take in the general ffect; so if he looks closely at is work, and is careful in laying in the dots clearly and venly, and then fills it in from little distance, he cannot fail o get a clear drawing and venness of texture. It is not bad plan to sit down to lay n the dots and stand up to inish it.

With regard to the student's osition whilst at work, it is etter for him to sit facing the ight for all such work as writngs, maps, etc.—in fact, that lass of work which appertains o the draughtsman; but for rtistic drawings and colour work, nothing quals a side or, if possible, a top light. Let he novice take any ordinary water-colour ketch, and, facing the light, look down pon it, and afterwards place it so that he ooks at it from a side light, he cannot fail o see the difference that I mean. Naturally, his would apply the same to copying from t on stone, for it would be a great mistake o sit facing the light to work on the stone, nd, having the copy on the right or left, be ontinually turning round to look at it. It s surprising what a different effect the lrawing has when held at a different angle o the stone on which one is working. Certainly, the best way is to have the drawng in front of you; but should this be impracticable through want of space, etc., the rtist should, at any rate, endeavour to so rrange his copy that he looks at it as nearly as possible full face—*i.e.*, at right ngles, and not sideways. Some people cannot face the daylight when at work, and many maintain that it is actually injurious o the eyes to sit with the face to the light day after day, such as regular office work ntails. Here is a case of "what is one man's meat," etc. On the whole, the best dvice I can give is this—secure the best vailable light for your work with the least ossible injury to the eyes.

## A HANGING MEDICINE CUPBOARD.

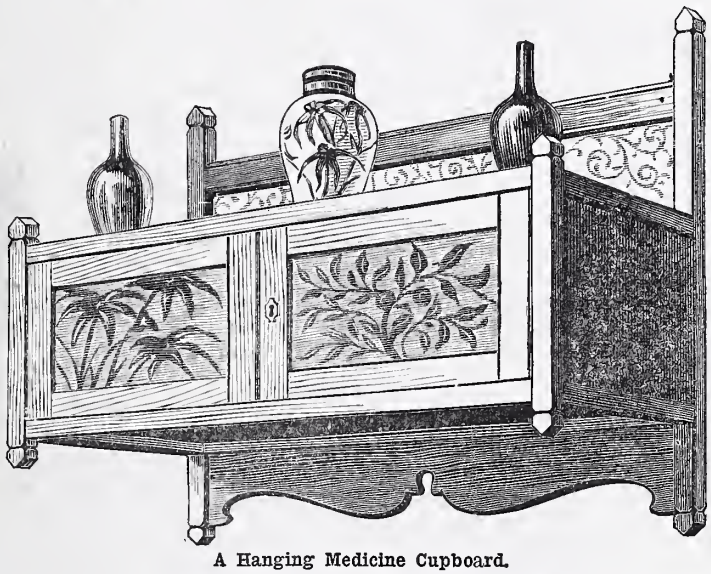
BY B. R. CONDER.

Alternative Use for Cupboard—Dimensions—Construction of Framework — Doors — Decoration of Panels—Finishing—Cost of Material.

Small cupboards are so generally used in the present day in rooms of all kinds, and are so generally useful, that many may like to know how they may be easily made.

The small article here described, though primarily intended for a medicine cupboard, can be easily adapted to answer a different purpose. By substituting glass for wooden panels to the doors, and lining the interior with some suitable decorative material, such as lincrusta, Japanese paper, or plush, it might be converted into a handy receptacle for a few small curios and knick-knacks.

Its dimensions are as follows:—Width, 2 ft.; depth, 8 in.; height of cupboard proper, 10 in.; extreme height in front (*i.e.*, of uprights), 12½ in.; at back, 22 in. This is a handy size; but it can, of course, be altered to meet individual requirements.



A Hanging Medicine Cupboard.

The framework of the cupboard, which must first be prepared, consists of twelve strips of wood ⅞ in. square, four being upright and eight horizontal. They are mortised and tenoned together; the tenons, of course, being cut in the horizontal rails, and the mortises in the uprights. It will be obvious that these joints must be carried only about ½ in. through the uprights, and that, therefore, the horizontal rails must be about ¾ in. shorter than the extreme width and depth of the cupboard respectively; also that the joints must be cut as near the outer edges of rails and uprights as practicable. It will be necessary at this stage, and from time to time as the various parts are got ready, to fit the work together, and test it with the square.

Next prepare the cross-ties, shown in the drawing, one above, the other below, the cupboard at the back. They are to be let into the back uprights from behind, the joint used being the lap-dovetail, the construction of which has been clearly explained in Work, Vol. II., page 118.

The upper tie is 1½ in. wide and ⅞ in. thick, which is also the thickness of the uprights to which it has to be joined; these joints must therefore be halved. The height of this piece above the cupboard is sufficiently indicated by the drawing, and is not material; a plain beading is cut on its front edges. A very passable beading may be easily contrived with a little care and patience, by those who do not possess beading planes or router, with a cutting gauge, chisel, and glass-paper. The cross-tie below the cupboard is ½ in. thick, or less, and 3 in. wide in its widest part; its lower edge may be cut to some such shape as shown with a frame saw, or failing that, with a keyhole saw. The panels forming the sides of the cupboard may now be got ready. They are ¼ in. thick, and fit in grooves cut in the side rails and uprights. The top and bottom next claim attention; they need not be more than ¼ in. thick, unless destined to carry more weight than usually falls to the lot of such a small cupboard.

The top, which forms a handy shelf for the display of a few small ornaments, is lap-dovetailed into the upper edges of the top side rails. The bottom rests in rebates cut on the lower front and back rails, and is secured to them by a few small screws or brads when finally fitted.

The ends of the uprights may now be cut as shown, or otherwise finished off, the various parts finally fitted together and glued up, and a thin back affixed. The back extends from the lower rail to the upper cross-tie, and thus the upper part of it forms a narrow panel above the cupboard. A small beading is fitted round the inside edges of the front, and allowance must be made for this in setting out the doors. The styles and rails of the doors are ⅞ in. thick and 1½ in. wide, with the exception of the falling styles, which overlap, and are therefore ⅝ in. wider. A rebate of that width is cut on the inner surface of the right-hand and the outer surface of the left-hand style, to allow for their overlapping and shutting level. A small beading is cut on the lock style.

The door frames are mortised together in orthodox manner, but might be halved and screwed from the inside by any preferring that method. They must be either grooved or rebated for the panels, which are ¼ in. thick.

In small doors of this kind, rebating the styles and rails and securing the panels by beadings, or simply by brads, is, perhaps, the better plan, as it permits of the easy removal of the panels at any subsequent time without injury to the framing. The appearance of the cupboard will be much improved if the panels are suitably decorated.

One very simple and effective method of doing this is to cover them with Japanese gold leather paper. This is an expensive material if bought in the ordinary way—by the piece; but one of Liberty's 1s. 6d. remnant bundles will afford sufficient for decorating several small pieces of furniture. This wrinkle I got from an early number of Work, and take this opportunity of acknowledging my indebtedness to the writer of the article in which it appeared.

A stop will be necessary to prevent the doors opening inwards, also some kind of a bolt to keep the left-hand door closed. A

very small block of wood glued or screwed to the front of the bottom, where the doors meet, acts as a stop; and a very efficient substitute for a bolt is provided by fastening a small wooden button, with a screw upon which it can be turned readily, but not loosely, to the inner surface of the falling style or top rail of the left door, about ½ in. from the top. When the door is closed this outton is turned, so that the part of it then uppermost comes behind the top front rail of the cupboard, and the door cannot then be opened until it is turned down.

All now left to be done is to cut the key-hole, fix the lock, and hang the doors, and the cupboard is complete. I have said nothing about the wood to be used, as almost any kind would do, provided it be sound and dry. As a hint to those who desire to produce their work as cheaply as possible, without sacrificing good effect, I may add, that a cupboard I made for myself of good sound deal and enamel painted looks very well, and cost for material, including a good lock, less than 2s. 6d.

## MEANS, MODES, AND METHODS.

### How to tie a Painting Brush.

Many people who need a paint-brush, buy one, and find that it is too long and limp to work well. It needs tying. This is a difficulty to the inexperienced, and here is a "method" of tying a brush.

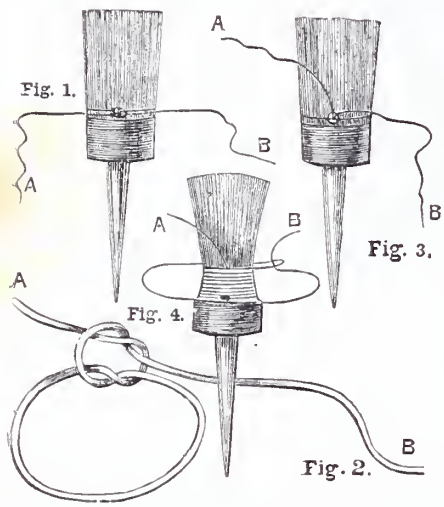



**Fig. 1.—Commencement of Process. Fig. 2.—The Knot used to secure String. Fig. 3.—Mode of laying Cord on starting to bind. Fig. 4.—Completion.**

First tie a piece of stout twine (twine like that used for Macramé work will do well) round the brush, leaving 6 in. or 7 in. at one end, marked A in the sketch. Fig. 1 shows the first tie. Fig. 2 shows the form of knot used. The end A should be made to lie along the hair of the brush, and the string should be coiled round it and the hair of the brush as many times as necessary. When enough has been wound around, the cord marked B may be bent back, drawn close, and a half knot made opposite the first knot. Both cords may now be fixed with small tacks to the stock or the handle of the brush, and the superfluous string cut off. The string need not be bound very tightly, for either paint or water will make it sufficiently tight for the purpose for which it is intended. At any time part of the string can be removed. B. A. B.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 37.—Practical Blacksmithing.

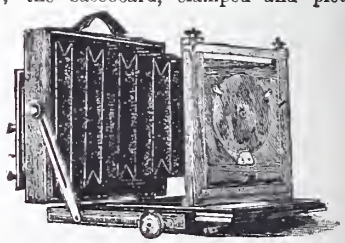
Some little time ago it fell to my lot to notice Vol. III. of a capital *vade mecum*, entitled, "Practical Blacksmithing," by Mr. M. T. Richardson, comprised in four volumes, and covering nearly the whole range of blacksmithing, from the most ordinary operation to some of the most complex forgings. It is an American publication, but is sold in London by Messrs. Kegan Paul, Trench, Trübner & Co., Limited, Paternoster Square, London, E.C., who will, I am sure, readily give any applicant information as to the price at which they supply it. Vol. I. gives the early history of the trade, with shop plans and methods of constructing chimneys and forges. Vol. II. is devoted to a description and illustration of the tools and appliances in use. Vol. III. dealt with such tools as had not been considered in Vol. II., and contained a description of a great variety of jobs of work. In Vol. IV. the last-named topic has been continued and completed, and considerable space has been devoted to the subjects of cutting, bending, welding, and setting tires, setting axles, resetting old springs, the tempering of tools, bolts, nuts, etc., and the working and welding of steel. The last chapter comprises a set of tables, giving the weights and sizes of various articles in steel and iron, used for the most part by carriage and waggon builders, and therefore of importance to all who are engaged in this particular trade.

### 38.—Photographine.

Some readers may like to try the compound known as "Photographine," which is prepared and supplied by Mr. J. Pawsey, 8, Catherine Terrace, Seven Sisters Road, Tottenham, N. He claims that by its use plates may be cleared without injury to the film years after being fixed, and that, by reason of its cheapness, it is economical in its use. Further, he claims that it hardens the film as well as clears the negative, and that this is a most desirable feature in the production of good pictures. Plates, too, that are over-developed speedily assume their proper density on being brought, it is said, in contact with this bath. The following developer is suggested for use:—For the soda solution, 3½ oz. of soda, 1 oz. of glycerine, and 1 quart of boiling water. For the pyro solution, 1 oz. of pyrogallic acid, 20 drops of nitric acid, and 8 oz. of water. For use, take 1 oz. of water, to which has been added 24 drops of the pyro solution; then add 1 oz. of the soda solution. After developing, well wash the negative in clean water, and then place it in the Photographine bath compound thus: 1 oz. of photographine, 4 oz. of boiling water, and ½ oz. of loaf sugar. This bath should be mixed twelve hours before being used. This solution will keep any length of time, but should be renewed as soon as it has lost its original colour—by turning black. *Caution.*—"Negatives treated thus print quicker and sharper than those treated in the ordinary way." The preparation is sold in 1 oz. packets, 4½d. post free, or in 1 lb. boxes at 6s., and 5 lb. boxes at £1 8s., carriage paid. The photographer whom I asked to test the Photographine sent as sample, says that it will clear a negative very much like many other agents, but that he fails to see its superiority or any advantage in its use.

### 39.—The Airedale Camera in Parts.

Messrs. Watkinson & Co., Harrison Street, New Briggate, Leeds, manufacturers of photographic cameras and scientific and laboratory apparatus, have sent for inspection an Airedale Camera in parts with finished brasswork, with a copy of their latest price list. Although mention has just been made of the Airedale Camera in parts it must not be supposed that the camera itself is not supplied complete, and that it must of necessity be purchased. It may also be bought made up and finished, and some idea of its construction may be gathered from the accompanying illustration. The makers explain that the camera "has been designed to meet the requirements of those who want a really well-made practical and useful article at the lowest possible cost. Although very light, weighing only 2¾ lbs., it is very rigid. The bellows, being attached to the front, prevent any cutting of the picture." It is a double extension camera, and is fitted with rack and pinion. It also has a good leather bellows; a leather handle, by which it may be carried; and a reversing and swing back. It is made in half-plate and whole-plate sizes only. The price of the former, with one double slide is £2 17s. 6d., extra slides being supplied at 9s. each. The price of the whole-plate camera is £3 7s. 6d., the cost of extra slides for this size being 14s. For the price it seems to be well made and well finished, and likely to prove a useful article to those who buy and use it. The same camera in parts—a decidedly new departure for amateurs—is just sufficiently advanced in its construction, and in such a state of finish, that any amateur who is fairly well acquainted with the working of a camera could easily complete it. The *woodwork* consists of the body, ready dovetailed; the baseboard, clamped and ploughed



**Watkinson & Co.'s Airedale Camera.**

ready for rack and pinion; bellows frame, reversing frame, ground glass frame, and extension frame, all mitred, keyed, and glued; slide rails front with circular cut ready for lens; double grooving for one slide and two shutters, clamped and rabbeted. The *brasswork* necessary for completing the camera includes rack and pinion, side struts, milled screws, double hinges, ground glass clips, reversing clips, box-board hinges, front bar, hook, turn-buttons, extension rods, and guide strips. In addition to this there are other necessary parts, which are neither woodwork nor brasswork, but which may be described as "sundries." These are the leather bellows, handle and bridges, ground glass, zinc partition with spring, side clips, and hinges; and in addition to these the screws necessary for the completion and putting together of the camera and one slide. The camera in parts is supplied in three different stages, as follows:—(1) The woodwork, as mentioned in detail above, with flat brasswork unfinished, but with all turned work finished, at 35s. (2) With all the brasswork highly finished and lacquered, 40s. (3) With brasswork finished and lacquered, and one double slide finished completely and ready for use, but not polished, 45s. If a polished slide is desired, an extra charge of 9d. is made. The Airedale Camera in this form seems likely to meet the wants of many amateurs who would like to be able to say that they had made their own camera, but who are not possessed of sufficient skill in joinery and cabinet-making to do all the clamping, ploughing, grooving, and rabbeting that is required in the woodwork. To carry out these operations, the amateur woodworker must not only have acquired considerable proficiency in his adopted art, but must have by him many special tools which amateurs do not usually have in stock. It is a difficult matter beyond doubt to prepare all the parts, but to put the parts together is comparatively easy.

The Editor.

## SHOP:

### CORNER FOR THOSE WHO WANT TO TALK IT.

*In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTERS FROM CORRESPONDENTS.

**Carriage Varnishing.**—H. B. (*Brighton*) writes: 'In bis well-written and practical instructions BAROUCHE on the above subject (see page 123, . 112, Vol. III.), and at the sixth line from the ttom of column indicated, J. C. K., in writing the taking off of hind seat of Stanhope phæton, vises that if the screws, by which it is fixed to dy, cannot be drawn by turn-screw (*i.e.*, screwiver), and are set fast by rust, the heads of ch screws need to be chipped off, etc. Permit to point out that this method should only be sorted to as the very last in a severe extremity. ason—because it is twenty chances to one that so doing the seat end is almost sure to be either lit or severely damaged, sometimes even requirg the ends or bars to be entirely renewed. Havg had all kinds of 'jobbing,' and many years' actice in all the endless ramifications of that anch, I have had to wrestle with hundreds of such rews, and have very seldom failed in withdrawg them, and rarely with any damage to the parts fected. I proceed as follows: Finding by the rn-screw that the screws will not move, in the se of the seat named, I should procure a piece of und iron rod of such a size that, when placed end , the rod is a trifle smaller than the head of rew. The rod may be 18 in. long, or sufficient to ve good 'cold' hand hold at one end when the ber end has been heated. Then have one end ated to a very bright red, and hold it, end on, to ad of fast screw, and in a minute or two that rew can be easily withdrawn with the turnrew. For a number of such I should have two ds to save time—one getting hot while using the her. The wood immediately round the screw ay get just a little singed, but that is of no consc ience, as compared with a split seat end; besides, e saving of time is also a most important item. nd while writing of hot irons, I may mention that here screws become rusted in the plates, etc., of nder carriage work, they can be loosened same ay by holding hot tire bars over three or four at beat, and again save much valuable time. By ese means I have drawn screws which nothing se could be made to move, and I have neither oken a blood-vessel, raised a blister, or turned hair. Another most useful application of the hot on can be effected where, through accident or relessness, bruises may have been made in new, nd even in some places in old, bodies. Thus, ppose a new panel on one of the sharp corner ouldings has received a blow, causing a very ungbtly indentation, proceed in this wise: If bare ood, well soak the part affected with clean cold ater for an hour or two, according to extent of amage; then get a piece of tire bar wider than e bruise, heat to a dull red, and hold near enough as not to scorch the wood, and as the iron gets oler approach it nearer. When cool enough not burn, lay it right on the bruise, and it will, if roperly and carefully done, draw the bruised place ut level with its surroundings, when, if glassapered off, it will never show; but if left in its amaged state and 'stopped' up in the painting, e 'stopper' is always liable to fall out and spoil e whole job. I trust J. C. K. will not feel offended my intrusion upon his ground. Should you, Mr. ditor, think it likely, please do not print this in ours,' if indeed you consider it worth inserting at ll. I am an old Polytechnic student, and had the ood fortune to sit for four or more sessions under at prince of technical teachers, Mr. John Robertn, and I feel an old boy's interest in all these atters; and having a great desire to see coachuilding in all branches more fully developed in ORK, shall always do all I can to further it."

**Rate of Circular Saws.**—ERRATUM.—A. R. *Scorrier*) writes that the letter headed "A Woodorker" (see page 187, Vol. III.) emanates from him, nd is in reply to A Woodworker's letter on page , Vol. III.

**Petroleum Engines.**—C. J. C. (*No Address*) rites:—"If J. H. D., in WORK of May 2nd, 1891, efers to the 'Priestman' petroleum engine, in he second part of his explanation of oil-engines, I ust respectfully correct him on one point, viz., hat the impulses occur at such comparatively long ntervals that they require much heavier fly-wheels, proportion to their power, than steam-engines. o doubt the oil-engines require heavy fly-wheels, nd so do gas-engines, but the 'Priestman' oilngine gets an impulse, certain, every fourth stroke f the piston, or every alternate revolution of the y-wheel. On account of its steady running, it is dmitted to be one of the very best motors for electric lighting, which would hardly be the case if the impulses occurred at long intervals. J. H. D. appears to be correct in his explanation of the mixing of air, vaporising, etc., but the bichromate battery is not of such magnitude as he implies. If I am mistaken, and J. H. D. did not refer to the 'Priestman,' I should esteem it a favour if he would inform me, through this paper, what oil-engine he referred to, as I am not aware of any other reliable except the 'Priestman.'"

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Saw Hammering.**—NEW ZEALAND asks for some plain directions as to saw hammering. The following information will be practical and theoretical. I give two or three very rough sketches, so that NEW ZEALAND may clearly understand me. Fig. 1 represents a saw-plate tight at the centre; when placing the straight-edge on the plate it shows it to be convex, and if you try to push the centre down it will spring back again; to get the plate flat or true, the tight place should be struck on both sides of the plate with the dog-head hammer. Fig. 2 represents a saw tight at and near the rim but loose at the centre; in this case the hammering should be done near the rim, or where it is tight, and with the dog-head hammer. It will be seen that this plate shows itself concave; if the plate is reversed

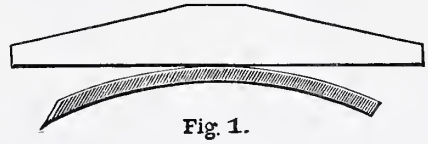


Fig. 1.

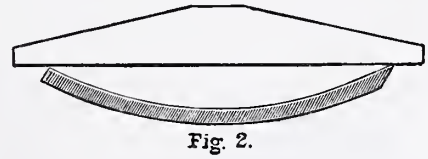


Fig. 2.

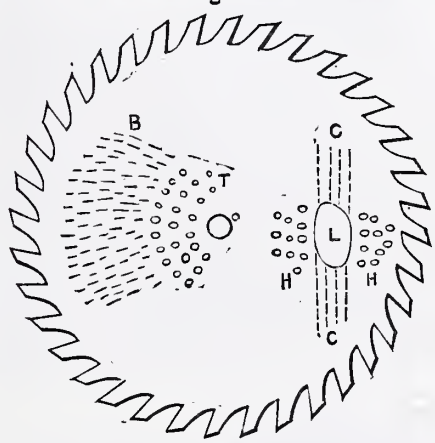



Fig. 3

Saw-Hammering Marks and Bends.

and the straight-edge placed on it, the centre drops with the least touch precisely the same as before, showing that the centre is loose. Fig. 3 represents a circular saw loose or slack at L. To take this out, the plate should be struck with the cross-faced hammer, as at C C, and with the dog-head, as at H H, or it may be struck all round with the dog-head hammer. By your statement of your 12 in. saw it must have been stretched on the outside, or rather at the rim, and pinched or twisted. I have often seen saws in this condition, but have never got them perfectly true, but if put into the hands of a man who has learned the whole art of hammering they may be made perfectly true. The way I proceed with a saw in like condition is to hammer all round the plate on both sides with the dog-head hammer, as at T, in Fig. 3, then with the cross-faced hammer all round the plate, as at B, and I have in most cases got the plate true enough to do good work.—A. R.

**Bicycle Wheels.**—H. R. (*Ewell*).—Get a shilling bottle of cement for mending cuts and splicing tyres at any cycle warehouse. Make the spliced surfaces very clean, or cut them anew with a sharp knife dipped in water. Get a bottle of Snell & Brown's Octopus cement. Smear both the splicing surfaces, and let stand for two or three hours before sticking together; then place the splices evenly and press together, and it will at once be ready for use on the wheel. With Lucas's cement you smear the splices and stick together at once, but the tire should stand for an hour or two before putting it on the wheel or using.—A. S. P.

**Bicycle Plating.**—F. S. (*Bristol*).—There is no stuff that can be put on to serve for plating. Send the parts to be plated to a regular nickel-plater's. You do not require to do anything with them in the way of preparation, except perhaps removing paint. They will prepare the articles for the bath themselves.—A. S. P.

**Painting on Silk, etc.**—SILK BANNER.—Before painting or gilding, so much of the space as is to be covered, *and slightly beyond its outline*, must be sized. This is to stop absorption, and to prevent the oil from running. A preparation for the purpose is sold at artists' colour shops, or may be made by dissolving isinglass in water or by boiling down cuttings of parchment. For gilding or silvering, oil gold size can be used on this ground; and for painting, ordinary tube oil colours. To prevent cracking, care must be taken not to lay on the colour too thickly, but to thin it down well with turps. It is better to attain the desired depth of colour by two thin coats than by one thick one. As regards varnish: if the colours are found to dry equally dead throughout, varnishing becomes simply a question of taste. Some prefer the dead painting, which shows equally in all lights. But should the colours dry dead in some parts and bright in others, varnishing becomes necessary to glaze them all alike. Some mix a little varnish with their colours, and thus get a sufficient glaze throughout.—S. W.

**Incubator.**—H. H. LINDON (*Higher Bebington*).—You are, unfortunately, not the only one who has found the same difficulty with the machine described in No. 89, Vol. II. You certainly will not get 104° in the egg drawer with the tank heat only 116°. The remedy therefore is: use more heat—a larger burner—although I must say a burner taking a 2½ in. wick ought, in my opinion, to be sufficient. Roughly speaking, tank heat should be almost double that required in the egg drawer. Turning to the article in question, I find a case measuring 16 in. by 16 in. outside is recommended, made of ¾ in. stuff, and a boiler 15 in. by 15 in. How the latter can be fitted into the case, besides leaving room for packing, is a poser. In my own experience with a 16-egg hot-water machine, I found 2 in. of sawdust packing round and above boiler, and round egg drawer also, to be about right, and could, with a burner taking a ¾ in. flat wick, get 120° in egg drawer. Judging from this, it seems to me that your machine needs padding to keep the heat in, in which case it would hold only about sixteen to twenty eggs, instead of thirty. This meaning a lot of trouble, I would advise you to put your machine away for the present, and await the appearance of my article on a Hot Air Incubator, to which you may be able to adapt your present case without much alteration, and which, I am sure, will give you satisfaction.—LEGHORN.

**Incubator.**—INCUBATOR.—Why a zinc tank should become eaten through and leak after twelve days' use is a mystery I should like solved. What zinc did you use—new or old? What did you use as a flux for soldering? and did you take care to wash off all the surplus fluid? If killed or unkilled spirits (so called) were used, and the joints left unwashed after soldering, it would account for a little, or perhaps all, of the trouble. If you took this precaution, the only solution of the matter lies in the fact that some powerful corrosive must have, by some means, been introduced into the tank. Pure rain water certainly cannot be answerable for it, so I can only conclude that it became contaminated before use. For the future, use ordinary fresh water. The small amount of lime it contains will make no difference. Your second experience is equally strange, and I can offer no explanation why a tinned iron tank should absorb more heat than a zinc one, unless your iron is very much stouter than the zinc. The only remedy I can suggest is to reduce size of tank, and use more packing.—LEGHORN.

**Bird-Cages.**—BYKER.—The articles on the above appeared in No. 54. Other small hints on the construction are given in "Shop."

**¼ H.-P. Engine.**—G. P. (*Camberwell*).—Articles are not run on in consecutive numbers of WORK, but every series of articles is completed in the volume.

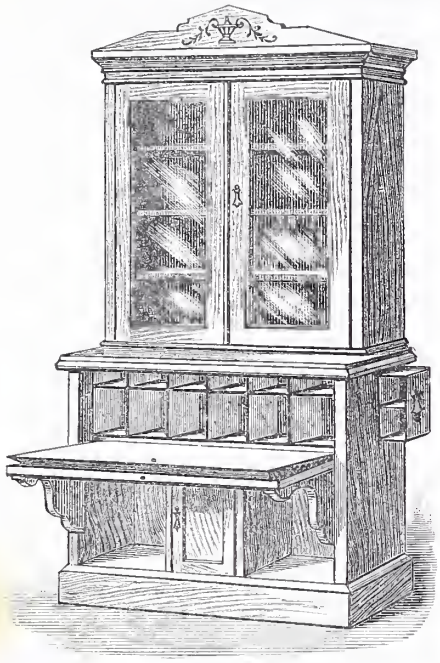
**Fretwork Machine.**—J. J. (*Fenton*).—Consult the Indexes of WORK, Vols. I. and II. Much has already appeared upon Fretwork Machines.

**Making Lantern Condensers and Objectives.**—E. R. N. (*Forest Gate*) and others.—Read reply to F. J. D. (*Stoke Newington*), on page 219, and write again should any difficulty arise.—C. A. P.

**Brooklet.**—ADMIRER OF "WORK."—If you can get some strong blue clay, and make it into a puddle, and lay the bed of the stream 6 in. thick, I do not think many worms will get through. The puddled clay must be carefully laid, especially at the joins, which should be cut on each side with a 4 in. tool, the cuts filled with water, and well kneaded with a pair of heavy boots till in one mass. As an additional precaution, before laying on the puddled clay, cover the surface with slaked lime or soot. The clay should be pure and tough, and free from any admixture of stones, loam, or gravel. You will require about thirty-five cubic yards of clay if it is required the full length. If you cannot procure clay of this nature, lay a foundation of broken stones, 3 in. or 4 in. thick, and cover this with cement concrete 2½ in. thick, formed of five parts of crushed bricks or limestone and one part of Portland cement. Lay it in lengths of 6 ft., having boards laid to the proper shape at each end. In laying miss every alternate length, and when these are set fill in the spaces left, levelling them to the

work already done. When the concrete is laid in this manner, it is not so liable to crack as if laid straight on. The foundation should be well beaten down before laying on the concrete.—M.

**Bookcase and Writing-Desk.**—AMBIGITUR.—There are several varieties of bookcase, the lower portions of which can be immediately transformed into writing-desk, exposing pigeon-holes. The article I have designed follows the usual run of such things, with the exception that I have introduced one or two new, and I think serviceable, features. It is advisable to make it in two carcases screwed together. Of the top carcase, nothing further need be said than that sufficient instructions applicable thereto have appeared in past numbers. In the lower carcase there is a small bottom cupboard and a set of pigeon-holes enclosed by a flap-door, the latter being used as a writing-desk. To facilitate its use as such, it is intended that a bracket be hinged to the inside surface of each sideboard. Bookcases are generally made 18 in. deep from the wall. It will be seen, therefore, that if the front of the pigeon-holes are flush with the front of the job, difficulty would be

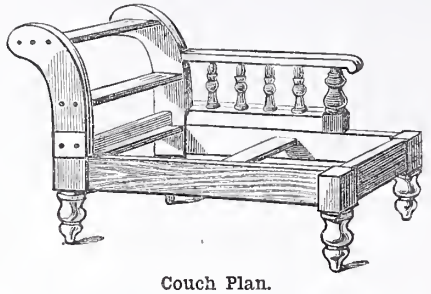


Bookcase and Writing-Desk.

experienced in obtaining any papers which happened to be far back in them. To avoid this, the front of pigeon-holes is usually some distance back, the result frequently being that the space in front of them is comparatively useless. By adopting my suggestion, all space will be utilised. Fit pigeon-holes as shown, and in back part of each sideboard cut hole to admit a set of compartments to move inwards and outwards drawer-wise, running on board to which front flap is hinged. It would be a handy course to take, also, to have a thin leather-covered board hinged at the back to the top surface of the writing-flap, with the ends closed in with loose material to form a receptacle for odd papers. For suitable details of construction, read Mr. Adamson's "Some Lessons from an Old Bureau," and other articles. Height of bottom carcase from floor, 3 ft. 8 in.; width of writing-flap, 12 in.; width of job, 3 ft. 6 in. Study dimensions a little, however. —J. S.

**Batteries for Working Electro-Motors.**—R. C. (*Mayfield*).—The cells of a battery to work an electro-motor should be large, because a large volume of current is needed to drive the machine, and this can only be safely taken from cells having a large capacity for furnishing a volume of current. Each cell should hold not less than one quart of liquid when the plates are immersed, but will be more efficient if made to hold half a gallon of liquid. The plates should be as large as the capacity of the cell, because large plates offer less resistance than small plates. In single fluid chromic acid or bichromate cells, two plates of carbon should have one plate of zinc between them in each cell. Large salt jars, pickle jars, or pickle bottles make very good single fluid cells. The charge for these is made up of 1 lb. of chromic acid and 2 ozs. of chlorate of potash dissolved in one quart of water, to which must be added, drop by drop, 7 fluid ozs. of sulphuric acid. The zinc must be well amalgamated, and should be thick. A good arrangement for the plates is shown on page 36, Vol. III., of WORK. The double fluid chromic acid battery, with dilute sulphuric acid to excite the zinc, and also the Bunsen battery, of similar construction, are both suitable for working electro-motors. See also reply to Mac, p. 93, Vol. III., of WORK.—G. E. B.

**Couch.**—J. N. (*Cork*).—A couch or lounge constructed like sketch would simply require framing together like a table frame. The legs should be turned out of 4 in. hard wood, and two of them kept about 4 in. longer than the others on the square; and the scrolls, which are made of 1¼ in. hard wood, are halved and screwed on to the squares. The rails across the scrolls are grooved in about ½ in. deep, and nailed from the outside. The back can be made first, and a stump at the end is framed into the seat rail, into which two flat rails are fitted to receive the turned spindles: the bottom one to be tenoned into the stump at one end and halved on to the scroll at the other end and screwed; the top one to go



Couch Plan.

on to the stump with a good 1 in. pin and halved into the scroll at the other end; this one receives the stuffing, and should be about 2½ in. wide. It will be seen in sketch that a middle rail or stretcher is put in to give strength; if the couch is short it will not be needed. Sizes: 4 ft. 6 in. long on frame, 20 in. wide; from bottom of leg to top of seat rail, 14 in.; height from floor to top of scroll, 2 ft. 8 in.; height of back from floor, 2 ft. 3 in. This is the size of a very short couch; you must use your own discretion about length, etc., as sizes vary to suit circumstances.—H. H.

**Case for American Clock.**—J. W. (*Kendal*).—I will leave you to decide upon the dimensions, thicknesses, etc. You cannot go far wrong in so small an article. As you are going to use a battery in addition to the small American clock, I advise you to place the former within the case, underneath the clock, if such a position is not unsuitable. Have a solid board, with a piece half circular in shape cut from it at the top, screwed within the case at the back to assist in supporting the clock. In the front of the case fix a similar piece, but let it be merely a frame, as in Fig. 2, to permit of the introduction of the battery, etc. You could, however, hang the clock within the interior by means of the ring above it. Fig. 2 explains the construction. It is an upright section. Two sides will be joined to a moulded top board, the bottom edges of them being rebated over stout plinth boards, the latter being mitred and screwed. A bottom board will be joined into the plinth pieces as shown. The back board should fit into rebates on those parts which it comes in contact with. The door can fit within the sides, or merely be hinged over their edges, as shown in Fig. 1; and it is an optional

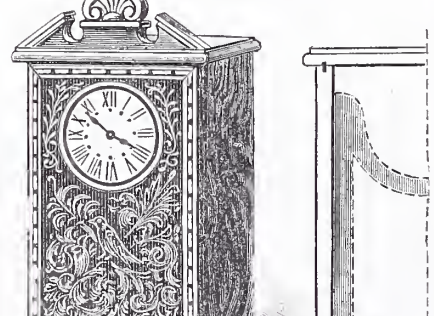


Fig. 1. Fig. 2.

American Clock. Fig. 1.—The Case. Fig. 2.—Section of Case.

matter whether it is mitred or mortised and tenoned together. Rebate it to receive the glass, which should be left clear in the upper half to expose the clock face, and painted upon the lower portion. (See indexes for articles on glass painting, recently published in WORK.) The pediment will be merely glued and screwed to the carcase. Small brackets at the sides will be found useful and ornamental. In Vol. I. there appeared a design and copious details of a very pretty clock case in wood: see it for yourself if you do not already possess it. —J. S.

**Aphengescope.**—WELL-WISHER.—The aphengescope, megascope, or opaque lantern, as it is sometimes called, is a very interesting optical instrument used for the purpose of projecting enlarged images of opaque objects upon a lantern screen. The aphengescope, as illustrated in Figs. 1 and 4, is a sort of angular box made to fit on to the draw tube of the slide stage of an ordinary optical lantern in place of the objective, which is removed and screwed into a flange attached to the front of the instrument, the object to be illuminated being placed in the body of the aphengescope facing the aperture by which the instrument is attached to the lantern. On the lantern being lighted, all the light emitted by the jet is concentrated full on the object by the condenser, and the achromatic lens in turn collects these rays and projects the image upon the screen in the usual manner, the lanterns, on account of the formation of the instrument, being placed with their backs towards the screen. The sole requirement of an aphengescope may be said to be: plenty of illumination, no matter from what direction it comes so long as it is sufficiently powerful to brilliantly illuminate the object to be exhibited. As the loss of light by reflection is so great, the instrument will be found to be almost useless for use with an ordinary oil lantern, and even a single limelight jet is barely sufficient to give a disc of a larger diameter than about three or four feet, but by means of the double form of aphengescope shown in Figs. 2 and 3, and

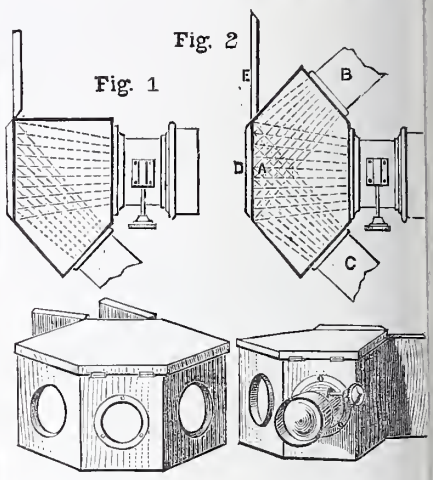




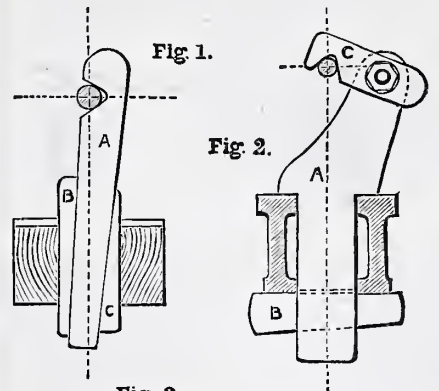

Fig. 3. Fig. 4.

**Aphengescope. Figs. 1 and 2.—Plan of Interior of Single and Double Aphengescope. Fig. 3.—Appearance of Double Aphengescope when complete, showing Doors at Back. Fig. 4.—Appearance of Single Aphengescope, with one Door shut.**

biunial lantern, *which will take apart*, it is possible to show a well-lighted disc of about six or seven feet in diameter. The double aphengescope, which is a slightly different form to the one previously described, is a wood or metal box, hexagonal in shape and provided with circular apertures in three of its sides. A couple of these holes receive the light from two lanterns, the objectives of which have been removed, and the third aperture, which occupies a central position between the other two at the front of the instrument, is provided with a metal flange to receive the objective from one of the lanterns, the objects to be exhibited being placed against the side of the box opposite to the lens. The construction of the double aphengescope is clearly shown in Fig. 2, in which it will be seen that the object placed at A is strongly illuminated by the light from the two lanterns, B and C, which are thus brought close together with their heads toward the screen, and a lantern objective is then screwed on to the front of the instrument in the same manner as it was an ordinary lantern. Two doors, D and E, are so hinged to either side of the back that when one is open the other is shut; it will also be found an advantage to have the top and bottom of each door fitted with a narrow groove on the inside, as this will serve as a means of attachment for cartes-de-visite, allowing one to be slid into the grooves ready to be shown whilst the other is being exhibited. The dimensions of the instrument are immaterial so long as the principle is retained. You can therefore construct one of either form described above of suitable dimensions according to the objects you intend exhibiting; a useful size is one having the six sides about eight inches square. You can employ wood or metal in the construction of this instrument, but I should strongly advise you to make the body of good sound dry mahogany if you are a good hand at woodwork. The sides are nailed and glued to the base, which is formed of a piece of sound wood cut to the plan of Figs. 1 and 2. If formed of wood, you may with advantage fit and hinge a metal lid to open up towards the front, cutting the metal of a sufficient size to allow of a half-inch rim. A couple of narrow rings of brass tubing of sufficient size to just slip on to the draw tubes of the lantern fronts may be fitted into the

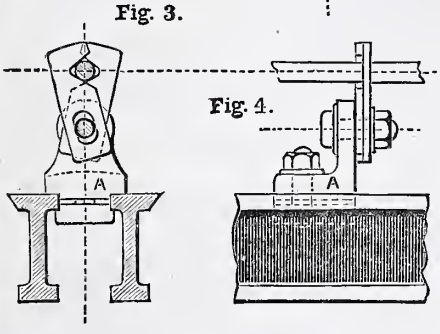
tures cut in the woodwork at B and C, and then red to the inner edge of the woodwork by ns of nails or screws driven through holes hed or drilled in the metal. The door should f wood, furnished with grooves at the top and om for the reception of cards as before deed. For the objective, what is required is a of fairly long focus and large diameter, in order it may pass plenty of light. The most suitable for this purpose will be a half-plate photoher's portrait combination. If your lantern, or erns, are fitted with ordinary achromatic comtions, one of these will be found to answer very , but not so well as a half-plate portrait lens, be reason above stated. To arrange the double of instrument ready for use, the objectives are removed from both the lanterns, which are placed with their backs towards the screen. aphengescope is now made to slide on to the tubes of the two lantern fronts by means of couple of brass collars, after which one of the ern objectives should be screwed on to the ge attached to the front of the instrument. If photograph or other object to be shown by the ected light emitted by the jet is placed against back of the instrument immediately behind the ctives, and the lantern is lit up, the light tted by the jets will illuminate the object, which hen projected by the lens in an enlarged form n the screen, and instead of a transparent ure being shown upon the screen, we get a liantly illuminated representation of some solid, perhaps moving, object. When any diagrams, wings, or cartes-de-visite, are being shown, they simply slipped into the grooved rails at the top bottom of the two doors at the back of the rument, and by this means one picture can be wn whilst another is being put in position upon other door ready to take the place of the first. er objects are either held in the hand of the rator, or placed upon the floor of the instrument. objectives will, of course, require focussing in usual manner. The aphengescope will be found y useful to microscopists, who will thus be ened to show upon the screen various opaque ects which it would be impossible to exhibit by inary means. The works of a watch, coins medals, sections of various kinds of fruit, lls, shell fish, moths, butterflies, minerals, and, in rt, anything that cannot be photographed, or ich should be shown in its natural colours, will m a suitable subject for exhibition by means of aphengescope.—C. A. P.

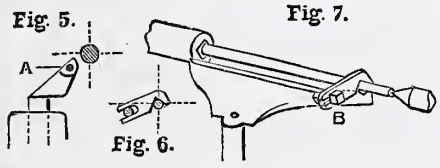
**Backstay.**—R. W. M. (*Co. Kildare*).—To prevent work from chattering when thin and turned ween centres, you require what is called a *kstay:* these are of two kinds, the *fixed* and *travelling*, which latter moves along with the l, whilst the first is fixed to the bed, and is ved along, as you suppose, "as work proceeds." I think the backstay has not been mentioned ore in WORK, and as you will be able very easily it up for yourself this useful attachment, I will cribe one or two kinds of fixed stays. To steady work when turning ramrods, I believe the ner uses nothing but the fingers of his left nd; I have never seen this done, and could not it myself, but I can fancy it would be possible. e next simplest way is to make a notch in a bit of rd like Fig. 1, and fix it in between the shears b wedges. You see it is a very simple matter en all you require is to steady a long piece of od, such as a wicket, etc. The wood smokes and s blackened where it rubs against notch, and shows you the possibility making fire, as the Indians do, by bing two pieces of wood together; would, of course, put some grease to The piece of wood (A) and the wedges y be from ¾ in. to 1 in. thick; the otch can be brought forwards by cking up the wedge (B) and down wedge (C). In Fig. 2 you have a better n which, I think, would suit you well wood. Here A is a piece of hard od, such as oak, about 1 in. thick; is a wedge, passing through a mor-, by means of which A is held firmly n upon the lathe-bed: through the per end of A there passes a bolt, and its means is secured a plate of iron ut ¼ in. thick, having at one end a otch, and at the other a slightly elonged hole for the bolt. The bracket of od (A) being placed on the bed and ured by the wedge (B), the plate (C) is ned over so as to rest its fork upon a ned part of the work to be steadied; n the bolt is fixed, and after applying ttle grease you may go ahead. In Figs. 3 and 4 seen a plan which may be adopted by those who ve a little bracket like A A, which is used to port the boring collar, and supplied with comte lathes; here we dispense with the wooden port, and require only two plates with notches, united thickness of which will about equal that he boring collar. Figs. 5, 6, and 7 show a plan trived (but never carried out) when intending to n a number of ¼ in. spindles of rosewood about long; it was, however, found quite possible to witbout any support; yet the plan looks prosing for very small work, and it is herewith sented to the readers of WORK. A new T is uired for the rest, seen sideways at Fig. 5; s only differs from the usual form in having the per edge thicker, so that a $\frac{3}{16}$ in. hole (A), shown ck, can be drilled and tapped into both ends; then two little pieces of steel would be made like Fig. 6, about 1½ in. long, and a $\frac{3}{16}$ in. screw (B, Fig. 7) provided to fix them. The view at Fig. 7 will suffice, instead of further description; the first 2 or 3 inches of the work are turned without any steadying appliance; then the screw (B) is put into the end of the rest, the little plates with their V-notches slipped into it, clasped by the fingers into the turned part, the screw fixed, and all is ready to turn 2 or 3 inches more. Thus far we have dealt with fixed backstays, which are secured to the bed; but you have a slide-rest, and would probably like to know how to fit one into the slide-rest itself, so that it may hold the work close up to the tool. This will be still a *fixed* stay, as it does not follow with the tool, keeping the same distance from it, but is fixed to the lower slide of a slide-rest, and not upon a moving saddle as on a slide lathe. Figs. 8 and 9 show a side and back view of a slide-rest backstay that has just been made to my design by Mr. Chas. Taylor, of Bartholomew Street, Birmingham; it fits one of his 3½ in. slide rests, and I have put into Fig. 8 a few lines to represent a slide-rest, just to show how the backstay fits on. Here we have the same two notched plates (A and B), but as we are now dealing with metal turning they will require holding very firmly: C C is a casting which slips into the cross-slide of the rest, and is secured by pinching the screws D, D; A B are then adjusted, the nut E firmly fixed, clamping the forked sides of the bracket C upon the plates A and B. The appliance is very quickly put in position, and as quickly removed. The plates A, B, are of iron, case-hardened. The travelling backstay is usually made to fix upon the saddle, as this one does on the fixed slide-rest; it is generally made to take two wooden dies, by means of which the work is steadied; of course, wood does not mark or scratch the work, but then the wood dies must be made and adjusted.—F. A. M.



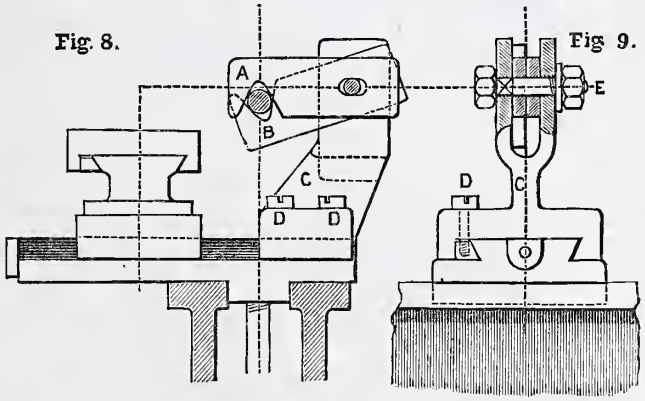







**Backstay. Fig. 1.—Simple Backstay. Fig. 2.—Better Form. Figs. 3, 4.—Stay for Slender Turning fixed to Boring Collar Support. Figs. 5, 6, 7.—Proposed Form of Stay for Slender Turning. Fig. 8.—Side View. Fig. 9.—Back View.**




**Paper Staining.** — DOWN. — Paper-stainers' colours are prepared much after the way of decorators' distemper. The firms purchase their colours in dry powder form—blue, red, yellow, etc., of varying degrees of purity and brightness. Whiting of a fine quality forms the body for the bulk of paperhangings, excepting, of course, sanitaries and so-called washable papers. Read the chapter on Distemper in "Plain and Decorative House Painting," Vol. I.—F. P.

**Varnish.**—J. B. (*Durham*).—Varnish prepared from shellac and methylated spirit, or of similar nature, such as French polishers use, is about the only variety that can be successfully made by the individual worker. If your query refers to painters' copal-oil varnish, you may at once dismiss the notion of making it from your mind.—F. P.

**Painting Bird Cage.**—BIRD FANCIER.—The reason of the enamel paints you have used on the inside of bird cages not drying is probably due to greasiness of the cage, or the enamel may be stale, or else you have put too much on, and it is only surface-dry, and not hard throughout. I would advise—assuming they are wire and metal cages—that you give a first coating of flatting paint made with white lead, or zinc white, and diluted to working consistency with two parts turps to one of Japan gold size. This will form a good ground or "key" for enamel, and if it does not then harden, the enamel is at fault. Ordinary patent size is the cheapest thing to prepare wood for staining with. It raises the grain of the wood slightly, but answers well for all common staining, and prevents the sappy parts becoming darker than the remainder. If best effects are wanted, varnish or Japan gold size may be used instead of size before oil staining.—F. P.

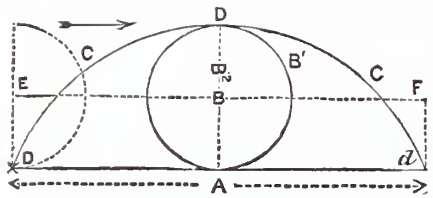
**Colouring Kitchen.**—D. P. V. (*London, S.E.*).—Ordinary wall colouring or distemper is prepared from size and whiting; the addition of dry powdered pigments gives the tints. For yellow, or rather buff, wall colour, soak 14 lbs. of whiting in sufficient water to slacken it, putting the whiting into the water. Pour off superfluous fluid, and add the colouring powder—Venetian red for pinks, lime blue for grey or light blue, and ochre for buff. These used separately, or in mixtures, will give a great variety of tints for common purposes. Having well mixed in the colouring, try a little by drying on paper, and when the desired tint is obtained, add to the above four pounds of warm patent size, or about one pound of glue properly dissolved. Before following these directions, obtain the new circular, etc., of Alahastine, from the Church Manufacturing Company, 127, Pomeroy Street, S.E.—F. P.

**Bicycle Wheel.**—PARALLAX.—(1) The wheel is out of truth, and requires to be trued up. If the spokes are direct, procure a spoke grip, costing about 1s. 6d.; if laced or tangent, procure a nipple key, costing 1s. Revolve the wheel, holding a piece of chalk at the side of the rim. The rim will touch the chalk at the parts out of truth. Tighten all the spokes on the *opposite* side of the chalk marks if they are loose. If they are tight, slacken all the spokes *on* the side of the chalk marks. Wipe off the chalk with a rag, and revolve wheel again, letting the untrue parts touch the chalk as before. Continue slackening spokes at the marks on the chalk side, and tightening on the opposite side. If you are not equal to performing this bit of work, send the machine out to a qualified repairer. (2) Cement for fastening tires can be bought at the cycle shop for 9d. to 1s. per pound, or in 6d. boxes, so that it is not worth anybody's while making it, even though he knew how.—A. S. P.

**Picture Cords.**—T. W. M. (*Burslem*). — The plan sent us, so far as we can see, is novel and useful, as well as ingenious, and certainly worth patenting, as it would answer its purpose well, besides being simple and ornamental. We think our correspondent would not be acting wisely if he did not turn it to some account, there being nothing to gain by giving it away, and letting others reap the benefit of that which he is clearly entitled to, as the product of his own inventive ingenuity. We should strongly advise him to make a search at the Patent Office Library to ascertain all that has been done in this direction, so as to see his road clear, and, if so, to go ahead with his patent.—C. E.

**Speed of a Wheel.**—C. C. (*New Cross, S.E.*).—The great difficulty in making ordinary people understand the fact that the upper part of a wheel of a cart, cab, omnibus, carriage, or locomotive, is travelling faster than the lower part, when either is in motion, arises from their being unable to dissociate their ideas from the case of a wheel fixed on a shaft or axle, which shaft or axle revolves in a fixed or stationary bearing, like the

fly-wheel of a steam, gas, or other engine used in driving machinery. In this case the wheel revolves with equal velocity over all its circumference, but the moment this wheel and its axle and bearing are caused to travel along a surface, another set of conditions come into play which did not exist in the former case, and then a compound movement takes place. First the wheel or shaft, or axle and bearing, travel along a surface, and whilst the axle and bearing travel in a line parallel to that surface over a distance equal to the circumference of the wheel, a point in the revolving wheel is describing, by the motion of its circumference, a curved line which is longer than the path travelled by the axle and bearing. Therefore, it must follow that to travel the same distance in the same time, a spot on the wheel must have travelled faster than the axle and bearing, to have described the curve which is a longer distance than the axle and bearing travel, and come again to the similar spot over the surface from which it started, in the same time. In order that this may be easily seen, we have appended the following diagram, a little study of which will make this clear and apparent to anyone. In this diagram the cycloidal path of a given point on the circumference of the wheel, starting from the surface on which it rests until it comes again over a point on the surface from which it started, may be readily seen, and if a model wheel be made of, say, 6 in. in diameter, and a piece of wood or hoard of, say, 2 ft. long be used as the surface on and along which it is rolled, it will be seen and proved that a complete revolution of the wheel will bring the point on the wheel, which was over the surface at starting, over another point of the surface at a distance equal to the circumference of the wheel from the point where it was when it started, hut that to get there it must have travelled along the curved line, which is always longer than a straight line hetween two given points, at a faster rate to do a longer distance in the same time. In the diagram, the line A represents the

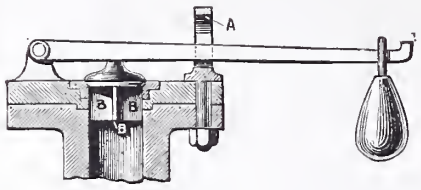



Cycloidal Curve.

distance over which the wheel has to travel, the axle moving from E to F on the dotted line. The dotted wheel shows the position of the spot D on its circumference at starting; C C shows the curved path of the spots travelled by it until it comes to a similar position on the surface at *d*, having travelled from left to right, as shown by the arrow; B shows the position of the axle, and B′ that of the wheel, when they have completed one-half of their journey, the spot D being now at the top of the wheel, having ascended the rising half of the curve. As it goes on, it describes the falling curve to *d*, where it again resumes the same position in regard to the surface as it had at starting, and so long as the wheel travels, so this spot will always continue to perform the same thing. Anyone who has watched the wheel of a hansom cab when at speed, can hardly have failed to notice how the centrifugal force throws the mud and dirt from the top, and not the bottom, of the wheel, which could not be the case if the lower part travelled with equal velocity. The formula for the diagram is as follows:—Length of the base line A=3·14159 $B^2$; $B^2$ the generating circle = ·31831 A; length of curve C C=4·$B^2$.—C. E.

**Polish Reviver.**—A. E. S. (*London*).—I am always chary about recommending to inexperienced hands any reviver containing methylated spirits or naphtha. I can well recall to mind ten years ago selling a bottle of reviver, the chief ingredient of which was spirits; my customer had a valuable piano, on which she first tried her 'prentice hand, thinking that the more liberally she used the reviver the better the results would be. Alas! this mistaken idea nearly spoiled, instead of improved, the polish. This incident, though it found me a day's work to rectify the damage, etc., serves to show that, though experienced hands can use such revivers with advantage, it is well to warn the inexperienced to use anything containing spirits with caution, and I strongly recommend using the spirits in the finishing rather than the cleaning stage, as in the following recipe, which I have used almost daily for the last four years—so giving a fair trial, and for the purpose you name; viz., "keeping your recently polished bookcase in a bright and fresh condition"—and which will, I trust, do all you might desire. Reviver: ½ pint lime-water, ¼ pint linseed oil, ¼ pint sweet oil, ¼ pint turpentine. Mix the lime-water and linseed oil by well shaking, then add the sweet oil; when thoroughly incorporated, thin down with turps. Shake up when using, and apply, rather liberally, with wadding or soft rag, rubbing all over; wipe off with a soft rag, fairly damp with methylated spirits, changing the face of the rag occasionally to enable you the better to remove all greasiness and smears. You may then, if you like, touch up any carvings or mouldings with a little French polish or spirit varnish, applied with a camel-hair brush.—LIFEBOAT.

**Valve.**—E. F. (*St. James's*).—In any well-designed safety-valve, the valve should not be able to be removed from its seat without, as you remark, first removing the pin in the end of the lever. In order to prevent the valve being blown out of its seat, there is generally a guide for the lever which allows it to lift sufficiently for the proper escape of the steam through the valve, and is then stopped by the top of the slotted guide A, which can be seen in the accompanying sketch of an ordinary safety-valve. The valve itself should be provided with




Valve.

three or four wings (B), which guide it vertically and prevent it being blown sideways by the escaping steam. This is the commonest form of safety-valve; and some are made without the guide (A), but very few indeed, in which case, by swinging the lever over, the valve can be removed without taking out the pin. The various spring safety-valves, which are innumerable, almost always have some contrivance to prevent the blowing out of the valve.—P. B. H.

**Walking-Sticks.**—E. H. (*Sunderland*).—The following are addresses of makers and carvers of walking-sticks: Henry Howell & Co., 180, Old Street, London, E.C.; J. Slugg, 27, St. John's Road, Hoxton, London, N.—H. W.

**Model Electric Lights.**—T. T. (*Harlesden, N.W.*).—Consult the Indexes to Vols. I. and II. of WORK.

**Camera.**—G. M. F. (*Falmouth*) will find in WORK, Vol. I., full particulars for constructing a whole-plate camera from one of the best makers' designs—that of George Hare. Every maker in the present day introduces some variation in pattern or movements—many of which are unnecessary, and only add to the complications of the instrument, which cannot be too simple, provided the really useful movements are retained. With regard to the quarter-plate size, if the principal measurements given are reduced to a fourth, you will practically have all the information you require. Of course, in such a small camera the woodwork may be made lighter, and some of the clamping neglected. The length of the bellows is quite arbitrary, so long as the length is sufficient for the lens used. It is quite impracticable to supply you with working drawings for any camera. If Underwood's is the one you have decided on, we see no other way out of the difficulty than that you should procure one and copy it. As to the lens, so much depends on the kind of work you intend doing. The best plan is to be provided with several of different focal lengths. If you are limited to one, there is nothing better than Dallmeyer's rapid rectilinear lens, of 6 in. focus; and the next most useful is a Ross symmetrical, of 3 in. focus. There are now so many good lenses in the market that we cannot particularise them; those mentioned are universally approved standard instruments, and if they are used properly, any shortcomings in the photograph cannot be attributed to their inefficiency. For *interiors* a wide angle rectilinear is almost necessary, other kinds not including enough subject, especially in confined spaces.—D.

**Xylonite.**—G. A. B. (*Normanton*).—Write to the manufacturers for their prices.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Wood-Turner's Pattern Book.**—T. F. (*Aberdeen*) writes:—"I shall feel obliged if any reader will tell me where I could get this."

**Crystoleum Painting.**—PAINT-BRUSH writes:—"I find that when a photo is fixed on the glass with corn-flour paste, that three out of four times it shrinks away and puckers at the edges. Would any of your correspondents tell me another medium I can use to do the same?"

**Buff Leather.**—R. S. (*Gloucester*) writes:—"Will any reader kindly inform me where I can get buff leather such as soldiers' belts are made of, with price per pound?"

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—EDISON PHONOGRAPH CO.; HOPEFUL; F. J. (*Rochdale*); W. R. R. (*Carlisle*); A. F. (*Dublin*); YOUNG ENGINE DRIVER; N. D. P. (*Manningham*); M. G. H. (*Smethwick*); J. T. (*Rawtenstall*); G. A. H. (*Islington, N.*); LITHO; A. R. (*Scorrier*); B. C. E. (*Birmingham*); E. L. C. (*Portland*); J. B. W. (*Salford*); W. G. C. (*Sierra Leone*); G. P. (*Gloucester*); INVENTOR; J. W. H. (*Chesterfield*); J. E. P. (*Accrington*); GOOD IRON; POLISHER; W. C. R. (*Glasgow*); J. G. (*Edinburgh*); W. J. (*No Address*); W. J. (*Portsea*); AMATEUR MECHANIC; J. D. (*Hull*); C. F. (*Sherborne*); BOOKWORM; L. S. (*Beaverstown*); SELF-HELPER; W. T. (*Stratford-on-Avon*); F. P. (*Dover*); T. S. (*Manchester*); W. B. & SONS (*Edinburgh*); J. P. A. (*Walthamstow*); G. M. (*London, E.C.*); H. B. (*East Hartlepool*); E. W. (*Chingford*); M. G. B. (*Poplar*); AN OLD EDISONIAN; A PLAYER; LEMUR; F. W. R. (*South Shields*); HOUSE PAINTER; S. A. (*Burnley*); R. C. (*Mayfield*); J. H. (*Cork*); NERO; A CONSTANT READER; T. R. (*Ashton-le-Willows*).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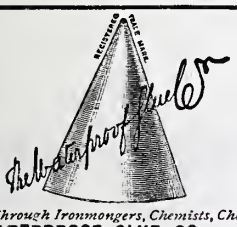


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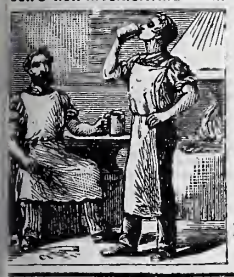

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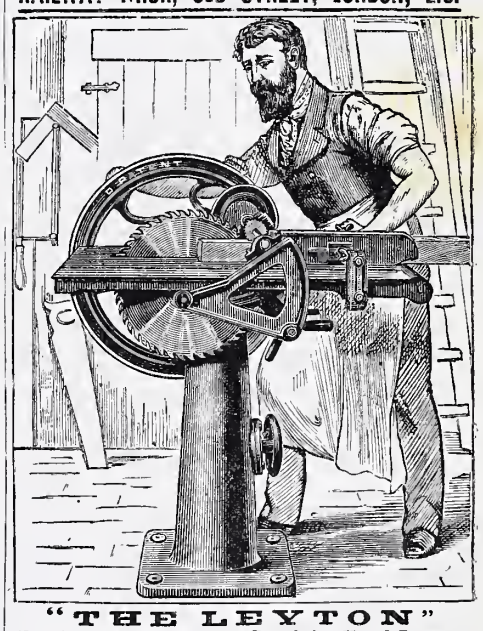

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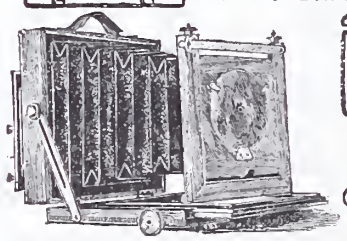

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 120.] SATURDAY, JULY 4, 1891. [PRICE ONE PENNY.

### A METAL CANOPY FOR BED HANGINGS.

BY J. WHITFIELD HARLAND.

MATERIALS — METAL PREFERABLE TO WOOD—THE DESIGN—WHERE TO OBTAIN THE PARTS READY MADE—HOW TO PUT THE FOUNDATION TOGETHER — HOW TO FIX THE STAMPED PLATES—HOW TO PROVIDE FOR FIXING TO THE WALL —COVERING THE "LAPS" OF THE PLATES AT THE ANGLES — KEEPING THE TUBES IN PLACE — THE VASES AND "DROPS"—CUTTING THE TUBES AWAY TO FIT FACE OF PLATES — GUTTA-PERCHA TEMPLATES — THE TWO END BAYS, AND HOW TO TREAT THEM—USE OF REPOUSSÉ WORK INSTEAD OF STAMPED WORK — CRESTING, CURTAIN-ROD, AND RINGS—VARYING THE COLOUR OF LACQUER—DRAPING.

ALMOST everyone is familiar with carved and gilt cornices for window curtains, and with the stamped brass imitations that have so much superseded them. The foundation of the window cornices, whether carved and gilt or stamped brass, is of wood, which in crowded cities and towns would not be advisable for bed canopies, as it would, especially from their comparatively inaccessible position, afford harbour for troublesome insects. It would therefore be far more cleanly, and sanitary also, to discard wood — which absorbs microbes in infectious illnesses — as a foundation, and construct the foundation entirely of iron. Wooden bedsteads have now almost disappeared, and metallic ones reign supreme. The bed canopy should naturally correspond and be of the same material, to be equally impregnable to vermin seeking refuge.

The perspective drawing (Fig. 1) shows an octagonal-shaped canopy made of stamped brass, lacquered and burnished, every part of which may be bought ready made from the furnishing ironmongers (those shown were purchased at A. Hawkins', London Road, S.E.), who usually keep several patterns in stock, and also have pattern-books showing hundreds of other

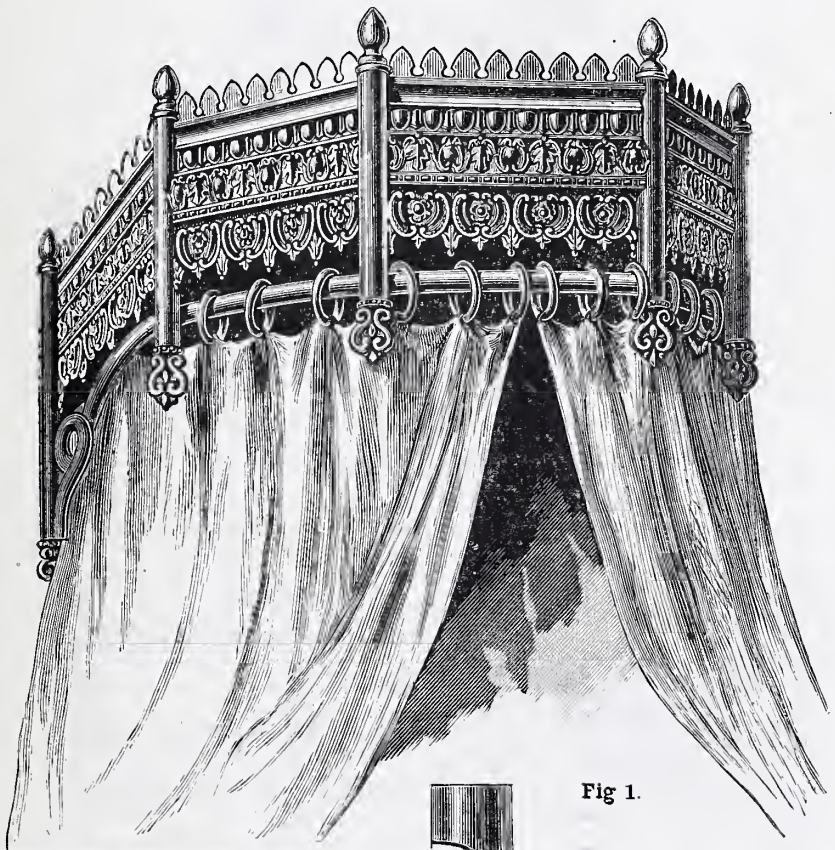


Fig 1.

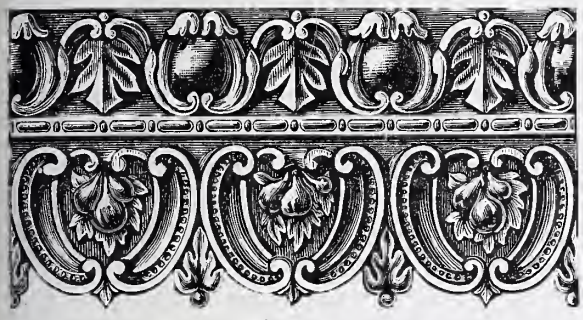


Fig. 6.

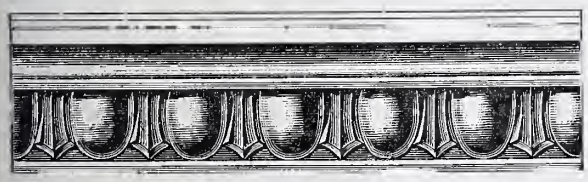


Fig. 7

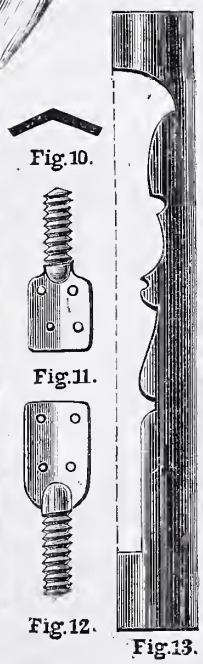


Fig.10. Fig.11. Fig.12. Fig.13.

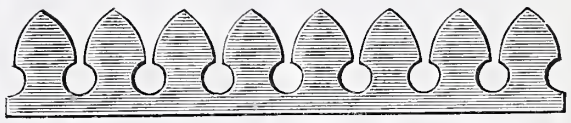


Fig. 8.

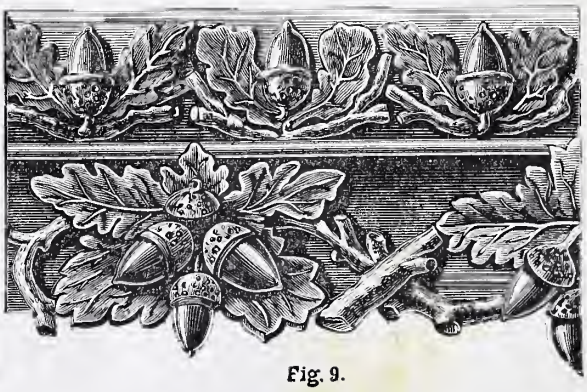


Fig. 9.

Fig. 1.—Perspective View of Canopy. (For Figs. 2, 3, 4, 5, see next page.) Fig. 6.—Enlarged Stamped Plate, 3 in. to 1 ft. Fig. 7.—Egg and Tooth Moulding 3 in. to 1 ft. Fig. 8.—Cresting cut from Sheet Brass. Fig. 9.—Enlarged Stamped Plate, Alternative Pattern, 3 in. to 1 ft. Fig. 10.—Section of Upright. Fig. 11.—Fixing for Vases. Fig. 12.—Fixing for Pendants. Fig. 13.—Enlarged Profile of Tube cut to fit Face of Stamped Plate.

designs, which they will obtain from Birmingham if preferred to those they have. Anyone, therefore, wishing to make a canopy on the lines of the present construction is not obliged to accept any of the patterns here shown, but can select others according to individual taste.

In Fig. 9 I give one of these alternative stamped plates, Fig. 6 being the one I have used. These are drawn quarter full size—*i.e.*, the full size is 12 in. long exclusive of laps—and the price per foot lineal of Fig. 6 is 1s. 4d., or Fig. 9, 2s. 3d., and the "egg and tooth" moulding about 7½d. per foot run; so that the cost is very moderate. Six plates of each are required, so that 11s. 9d. covers that. The tubes for the corners, cresting, vases, and pendants, curtain-rod and rings, and the iron for the framing, with the flower pendants or the alternative bent tubes for the bays next to wall, would cost from 7s. 6d. to £1 more, according to the design chosen.

From the half plan, which is drawn to 1½ in. scale—*i.e.*, one-eighth full size—it will be seen that each bay is the length of the plates as sold—viz., 12 in. in the clear—and the tubes at each angle cover the joinings of the plates where they lap over, thus making a finish. Any of these parts not kept by the ironmonger can be had of chandelier makers.

For the framing, iron, preferably galvanised, ½ in. by ⅛ in., will be sufficiently strong, and consists of a flat back frame riveted together and the octagonal part riveted also to it. I have shown the back frame, *e e e*, etc., in Fig. 4, made of three pieces of iron, the upper one turned on an anvil so as to form top and sides in one piece, the two rails being riveted on the back of two sides in their proper position afterwards. My reason for this is that at the top corners not only must the octagonal upper rail be riveted to the back frame, but the fixing that is to carry the brass tube with the vase, v, must also be riveted thereto, so there would be *four* thicknesses to rivet together. I evade one of these, the lug of the fixing for the vase, by planting it on the end of the side of octagonal framing, and by making the back frame in one piece, avoid another of the thicknesses, so as to have only two to rivet together.

Having bent the three rails of the octagonal framing to the proper angles, which is best done by first making a template of ½ in. board cut to shape and battened, the ends for riveting to the back frame should be turned square of an L shape, about 1½ in. long, as in Fig. 11, which is an enlargement to quarter full size of the corner of back frame and octagonal framing, showing how they are to be joined together by rivets, and also how the lug of the vase fixing should be fixed.

When these three rails are fixed to the back framing, we have to arrange for the uprights at each angle (why should they not be called *downrights*, since the ideal of the canopy is inevitably that of suspension from the top member?). These may be made of one piece, bent to the section shown in Fig. 10, or of two separate pieces, each riveted to the rails, *a*, *b*, *d*, of the framing, one on each face of the octagonally bent rails. It is to these uprights, or "downrights," that the stamped brass plates are to be attached at their ends under cover of the, afterwards added, thin brass tubes at each angle. There are two ways of fixing these stamped plates: soldering to the tinned or galvanised iron framing, or, better still, riveting with copper rivets. I say better still, as the heating of lacquered brass by the soldering "bit" is very apt to discolour it beyond the limit covered by the brass corner tube, which would be very unsightly indeed. Two rivets at each end of each plate would be amply sufficient, or, as an alternative, the uprights could be drilled and tapped for small screws, which could be removed should the plates ever require relacquering, and be replaced very readily.

If in certain readily imagined circumstances difficulty in making the back frame is shown, small bolts and nuts might be substituted throughout for rivets, and the whole canopy could be taken to pieces, packed *flat* for travelling, and re-put together again whenever required. In this connection there is very little extra trouble in the substitution of small bolts for rivets, and it is evidently worth the difference to be able to take every joint asunder for cleaning, if not for transit; whilst the back frame could be then made of five separate pieces instead of being turned so that top and ends were in one piece as shown, as the bolts might just as well pass through three thicknesses as two, whilst riveting would not be good construction in such a case, although it might answer, as there is but little strain and but little weight to carry.

At *h* in the two drawings of the back frame is a hole of the form of an inverted keyhole—a provision for hanging the canopy to the wall—the circular part of the hole being sufficiently large to allow of a brass-headed nail passing through it, the slot above being as wide as the nail itself, so that when the weight causes the back frame to drop into its place, the nail-head prevents any tendency to slip forward. I prefer builders' "spout nails" to brass-headed nails, for they are stronger and more reliable, and are made specially to hold in the joints of the bricks of the wall without plugging, which offers harbour for insects.

Having completed the iron framing, the foundation upon which to build up the ornamental exterior, the next operation is to provide means whereby the brass tubes at each angle and the longer ones next the wall may be held in position. This may be done as shown by riveting, or by screwing to the uprights specially made fixings of the form shown in Fig. 11 (quarter full size), having a forged lug to a screwed end for the vases to be tapped to, and in Fig. 12 a similar one for the reception of the stamped pendants (which in the case before us are each made of the two stamped sides of gasalier weights), and these should be tapped to screw on to the screwed shanks fixed at the lower end of the uprights of the octagonal framing. Now, the diameter shown in the drawings for these thin brass tubes is about 1¼ in.; the screw for the vases and pendants is but ⅜ in. It follows, therefore, that a discrepancy or void has to be in some way made up in order to maintain the tube in position. I use "washers," 1¼ in., filed down to fill the interior of the tube, with ⅜ in. hole in centre, one at top and one at bottom of the tubes, the outer periphery of which enters the tube and prevents it moving sideways, whilst the hole in the centre fits the screwed shank and the vase in one instance, and the pendant in the other case, well screwed up, holds everything "taut," to use a nautical but expressive phrase.

It must be recollected that the tubes, as well as the stamped plates, are already

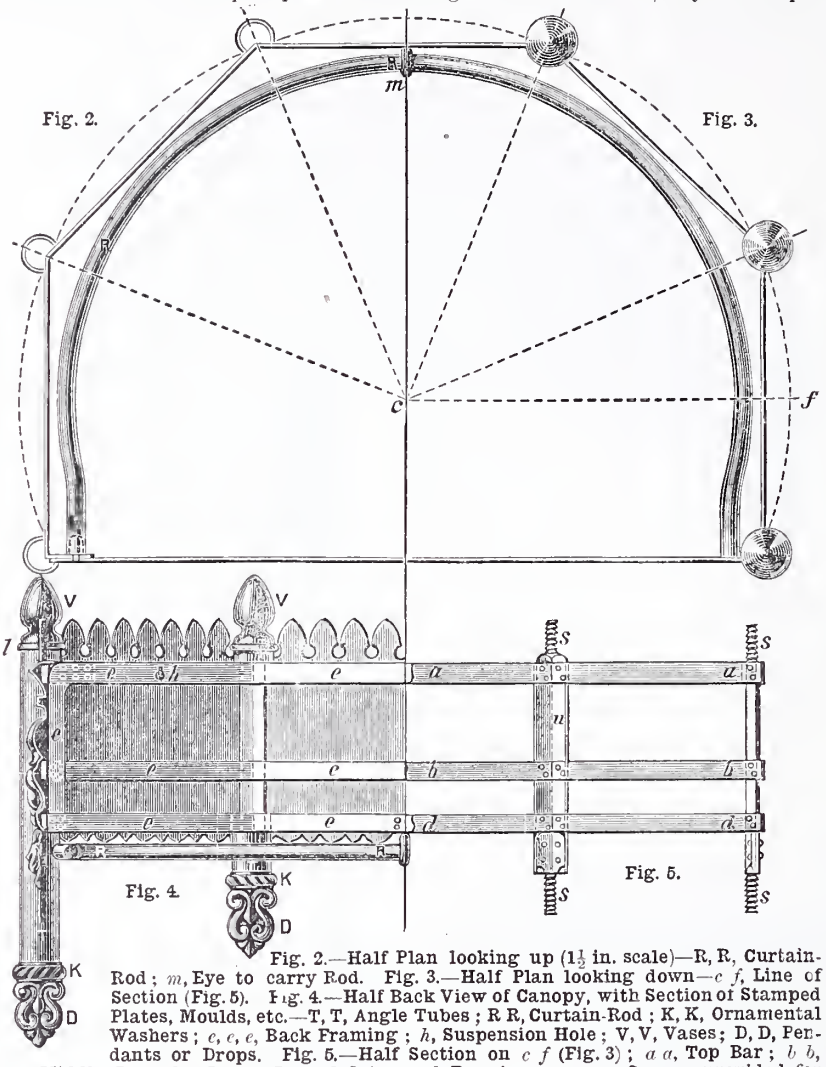



Fig. 2.—Half Plan looking up (1½ in. scale)—R, R, Curtain-Rod; *m*, Eye to carry Rod. Fig. 3.—Half Plan looking down—*c f*, Line of Section (Fig. 5). Fig. 4.—Half Back View of Canopy, with Section of Stamped Plates, Moulds, etc.—T, T, Angle Tubes; R R, Curtain-Rod; K, K, Ornamental Washers; *e*, *e*, *e*, Back Framing; *h*, Suspension Hole; V, V, Vases; D, D, Pendants or Drops. Fig. 5.—Half Section on *c f* (Fig. 3); *a a*, Top Bar; *b b*, Middle Bar; *d d*, Lower Bar of Octagonal Framing; *s*, *s*, *s*, *s*, Screws provided for Vases and Pendants (½ in. scale).

lacquered, and therefore we have to rely on the fitting, as soldering or running metal (lead) in is out of the question; but if care is taken to make the screws central, and the washers are made a "tight fit" in the ends of each tube, the tubes themselves can never even shake.

Hitherto the construction has partaken of the easiest, but we now come to the test—that pleasurable but difficult operation of fitting the angle tubes destined to cover the junction of the stamped plates.

The lengths of tube, cut off exactly the same, and filed finely to a perfectly square end, have now to be cut to the section obtained from the front face of the stamped plate which forms the various members of the canopy design. The tubes at ends, as shown, are intact, but in between they must be cut away from behind, so as to form a good joint against the face of the stamped plates already fixed to the foundation or frame which supports them in place.

Fig. 13 gives a profile of one of the tubes cut to fit the face of the plates whose joining the tube has to cover and conceal. This part of the business is the only difficult part of the construction, and affords therefore the most scope and the most delight in carrying it out. I presuppose that the rivets or screws have been put into the flat part of the stamped plates—*i.e.*, their lowest plane, which, of course is the nearest to the uprights of the framing—so as to avoid all bending of them out of shape.

A very easy dodge to make a template is to warm a piece of gutta-percha sheet at the edge and bed it firmly to the stamped plate till it takes the exact form, and when it is cool and hard again you can scribe the tube to the exact line you require. The tubes shown here are plain burnished thin brass tubes, but they may be had covered with pattern, ribbed, spiralled, or to almost any imaginable design, and of larger or smaller diameter. I never like to tie anyone down to following slavishly any design for construction; I prefer infinitely to suggest as many other ramifications of the idea as I can. When a man takes pains and trouble to make any object for his own home, its possession gives him many times the pleasure if it be unique of its kind and design than if, as is too often the case with bought fretwork patterns, he can see it carried out in fifty different homes just as he has himself done it; and for this reason I endeavour to give alternative modes of carrying out my ideas.

I have throw out the hint that instead of purchasing ready stamped plates, lovers of repoussé work may indulge their proclivities in their own peculiar way, and thus produce a much more elaborate and beautiful, and far more valuable, piece of canopy-work than the cheap though effective suggestion of the present paper. In such case the two bays or panels next the wall might be treated differently to the others, and the centre front one could be altered to suit, thus getting rid of what I confess is the drawback in my present design—its formality as a whole, necessitated by utilising what is already in existence instead of being specially designed and made expressly.

Having cut the tubes to fit against the face of the plates, and then put them into place, so as to cover up the joinings or laps of the plates, the ornamental rings at K, K, *l*, *l*, which form a finish to the ends of the tubes and conceal the supporting washers, should be next fitted. It must be borne in mind that the fixing to carry the pendants should not be riveted to the framing until the tubes and these ornamental rings are fitted, as it would not be possible to get the tubes on after these were once fixed, as is self-evident. For this reason, instead of riveting, screwing them on to the frame from the inside would be better—an operation that would thus be much more easily performed.

In order to maintain the rigidity of the octagonal framing, a round rod at the centre line should be inserted from one top rail to the other, which should be filed down a little to fit a hole drilled in each smaller than its diameter, and passed through and riveted at each end. Immediately under this rod, at the point *c*, the curtain material could be plaited in rays and stitched round the rod, thus forming a centre concealed by a covered button, if desired.

The curtain-rod itself consists of a length of brass tube bent to the shape shown, and passed through an eye which is riveted to the framing at *m*, the centre of the front lower bar of the frame, and sprung on to pivots or studs at each end, which have been tightly screwed previously into the lower bar of the back frame. Enough spring can be obtained by not bending the tube quite far enough for the width apart of the studs to maintain it normally in position, yet allowing of its being taken off at will to permit of the rings coming off with the curtain to be washed, if washable; if not, of brushing, or, if need be, re-dyeing them.

The back cloth should be plaited to a tape the same length as the top back frame rail, and two small rings which would pass over the screw below the neck of the vases next the wall before they were screwed down would form a convenient mode of fastening each end of the tape, and keep it stretched tightly across.

The curtains should each be a yard and a half wide, box-plaited to a tape to which the curtain-rings could be attached either by pin-hooks or by the ordinary stitching with strong thread, and hemmed at the bottom, and either with or without fringe. No cloth valance is required, but if preferred, it could be readily fixed with tape ends or strings to tie round the lower bar of the octagonal framing to conceal the curtain-rod and rings, as the plates when fixed leave an interstice between themselves and the frame bars, being fastened to the uprights which are planted on to these bars.

The cresting, which may be cut out of thin sheet brass, should be turned up ⌊ shape at lower edge to its inner side, so as to stand and rest upon the top of the upper member of the cornice, to which a couple of copper wire rivets in each length would conveniently attach it; or eyes could be cut at each end of each length to pass under the vases on the ⌊ flange, which is turned under, going round the screws that fix the vases, thus holding it firm at ends.

In the end bays next the wall, to overcome the stiffness and formality of the straight cornice dying into the tube, either a tube bent round as shown in the perspective view (Fig. 1), or a stamped flower finial, should be added, fastened with small screws to the endmost tube, which it will be seen is left longer than the other four. These end bays are simply to be considered as brackets, and should fulfil this idea of supporting the projecting canopy. This completes the construction.

Various modifications may be made, according to individual taste, either in the form of the design or in the colouring of the lacquer. For instance, the plates (Fig. 6) may be of rich gold, whilst the upper member (Fig. 7) might be lacquered Florentine bronze colour or dark green; and the colour also of the tubes could be varied if preferred; and no doubt other alternatives will suggest themselves.

## A USEFUL RIMER OR BROACH.

BY T. R. BLACKETT.

Sketch of Tool—Its Cutting Edge—Example of its Use—Economy of Tool.

The sketch given here will be enough to the skilled mechanic to grasp the use for which it is intended, but for the sake of our readers in general I will give a full detail of its uses.

The sketch is of a rimer, or broach, as some call it, screwed at the end. Take, for example, that the tool is for a $\frac{7}{8}$ in. hole. The screwed end is to be screwed with a good $\frac{7}{8}$ in. Whitworth thread, say, up to $\frac{7}{8}$ in. from the end; here to have a shallow recess $\frac{1}{4}$ in. wide, according to sketch; then to be squared down with a side tool in the lathe $1\frac{1}{8}$ in. from the end. This forms the cutting edge of the rimer. The rimer part of the tool, while it is being forged, must be kept large enough to be filed up in cants, whose section must be in the form of a

**Form of Rimer or Broach—A, End View at A'; B, End View at B'; Screw, $\frac{7}{8}$ in. Whitworth Thread.**

pentagon or five-sided figure. This can be carried up for, say, a couple of inches, and to be large enough to rime a hole out which will nicely fit the unscrewed part of a tap bolt or turned stud.

Now to its use. Supposing we have to fix the pedestal of a governor on to the bed-plate of an ordinary horizontal engine. The foot of the pedestal having been drilled to suit the $\frac{7}{8}$ in. studs by which it is to be bolted to the bed-plate, and as its pulley has generally to be parallel with the engine crank shaft, we set it in that position and mark with a scriber through the holes in the foot of the pedestal. The holes in the bed-plate are then drilled with a ratchet brace and a drill that will just go into an ordinary $\frac{7}{8}$ in. nut; these holes are then tapped.

Now, if we were to put the studs into their places and try our pedestal on, we would find in nine cases out of ten that we were a *very little* out. It is to rectify this error that this tool is intended.

We now place the pedestal on the bed-plate in the position in which we marked the holes. Take two old tap bolts, with their unscrewed parts filed down level with the threads so as not to touch the pedestal; these, if placed in the opposite diagonal corner holes and screwed down tight, will hold the pedestal steady. Now take the tool and screw it down the other two holes until the face at B comes through the pedestal and touches the bed-plate. Having done this, take off the pedestal, and put in the two studs (where we have had the tool); then do the same with the other two holes, put the studs in, and the job is finished.

There will be no cause to fear the possibility of the pedestal shifting by the wear and tear of its working; it will be too good a fit, and exactly parallel with the crank shaft as required.

To make such a tool or set of such tools screwed to suit the different sizes of studs, would save time, money, and trouble in the majority of cases.

For instance, a tap bolt has to be screwed into a job in a hurry. Well, the hole in the flange through which it has to go is found to be a *shade out*. It would be better just then to put a tool through of the proper size, then put in the tap bolt as required.

If we had not such a tool, we would have to take the whole job down and file the hole out, thus taking, perhaps, four times the time, not making such a good job of it, and losing a lot of patience.

This tool, of course, must be made of tool steel, kept soft until it is filed up, and then to be tempered.

[The name of the tool described above has been here given as "rimer." To save any reader the trouble of writing about it under the supposition that it is a blunder, let me say that it is generally spelt "reamer," and that this is really the right way of doing so. But it is spelt in many different ways by engineers, and usage renders "rimer" or "rhymer" as admissible as "reamer."—ED.]

thickness which the ends of the staple penetrates the firmer will the staple probably be), cut it to the desired thickness, as in Fig. 46. A pair of discs will be also utilised. These will fit securely on to a handle, as in Fig. 46. The distance between the wheels must be exactly the same as the thickness of the staple, and the diameter of each should nearly correspond to the width of it. Over that part of the handle which lies between the wheels will be screwed a piece of tubing or turning, sufficient in diameter to allow it to touch the inner edge of the staple.

The wheels might be turned from a piece of hard and tolerably thick wood, but it is advisable that the staple be of iron.

Completely through the wheels, etc., should be bored a pair of holes, close up against that part of the handle which penetrates them, each hole being in diameter sufficient to be capable of receiving the largest gauge of wire that it is considered will be used. In Fig. 47 is shown an elevation, by the assistance of which my foregoing remarks may be the better conveyed in an understandable manner.

by reason of the natural shortening of the wires.

Were the first requirement ignored, the liability remains of the wires going on excursions every now and again to either side of the imaginary straight line upon which they should travel; and in the case of the latter consideration being disregarded, it would frequently be found that the weight would appear rather dilatory by remaining where it was at first placed and allowing the wires to be drawn from underneath it.

To those who desire to be nice in everything they do, my advice is to insert a metal plate flush with the top of the bench upon which the wires will twist, or to at least work upon a part of the bench which may be comparatively smooth.

It is astonishing what can be accomplished by the aid of a machine such as I have just been describing. If proper judgment is exercised in the selection of the weight, and due care is taken in having the machine to fit nicely together in all parts, and, in addition, the work is progressed with upon smooth ground, by rapidly turning the handle for a few moments, several yards of

Letters in Diagrams represent Correspondence of Parts.

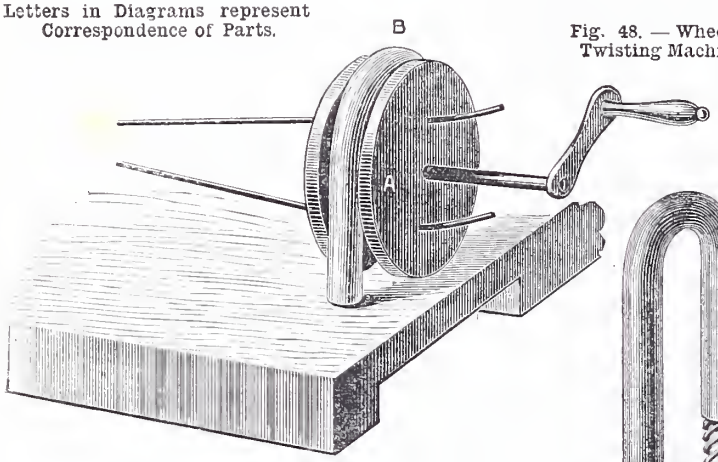
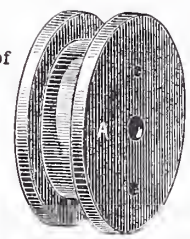



Fig. 46.—View of Twisting Machine, complete.

Fig. 48. — Wheel of Twisting Machine.



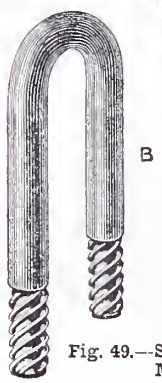




Fig. 49.—Staple of Twisting Machine.

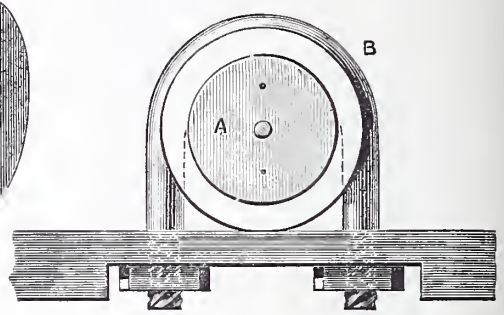



Fig. 47.—Elevation of Twisting Machine.

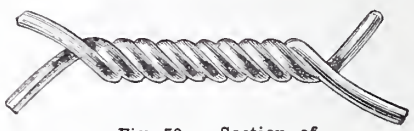


Fig. 50. — Section of Twisted Wire.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Twisting—A Twisting Machine.

Staple of Machine—Staple fitted to Bench—Discs or Wheels—Handle—Wheels, how Placed—Weighting Free Ends of Wire—Metal Plate on Bench—Rapidity of Work.

Twisted wires are utilised to a very great extent as being capable of producing better ornamental effects upon any particular work in which they may be introduced, and certainly they are to be preferred, in a number of cases, to merely plain or straight wires.

It is my intention to give, later on, designs of such articles in wire-work as I may consider sufficiently serviceable to warrant their publication, and in some of these patterns I shall represent twisted wires.

A glance at Fig. 46 will be necessary to understand one method, which is as convenient as any other, of thus twisting two wires; or, what amounts to precisely the same thing, one wire doubled together. A staple of stout iron with spiral ends is required, and nuts to screw on to the ends of it. This staple is fitted to the bench, and I must here say that should the latter be considered too thick (although the greater the

The wheels, etc., are placed underneath the staple so that they may be turned freely by means of the handle attached. The ends of the wires to be twisted should be placed through the holes in the wheels, from the bench side of them, and then tied. If they are short it will be only necessary to work at the side of the bench, but if the wires are of any great length it will be expedient to work from the end. It will, therefore, be understood that it is advisable to have a pair of staple holes at both the side and the end of the bench, to be made use of when occasion arises.

The free ends of the wires should then be placed side by side flat upon the bench, or else tied in a clean knot. Upon this end of them must be a weight, and experience will be the only adviser as to the heaviness of it. The handle is then turned, the consequence being that the wires are twisted to a certain degree, the natural result being to shorten the distance in the length occupied by the pair.

It is upon this that the heaviness of the weight just alluded to must depend. It is required to be of sufficient pressure to keep the wires in a perfectly straight line whilst being twisted, and also to be not too heavy to permit it to advance towards the staple

wire may be regularly twisted. To gain an idea of the relative proportions of twisted and untwisted wires, it is necessary only to take a couple of wires, each a yard in length and of thin gauge, and twist up to the utmost limit, and a couple of wires of thick gauge, of the same length, also treated similarly.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Ring Knots.

Slippery Ring Knot—Boat Knot—Lark or Double Boat Knot—Lark's Head—Lark's Head Stoppered—Lark's Head with Crossed Ends—Double Lark's Head—Treble Lark's Head—Backhanded Sailor's Knot—Capstan Knot—Sailor's Knot—Gunner's Knot—Artilleryman's Knot.

We have very commonly to make a rope fast to a ring, and there are a variety of methods of doing so, some of them identical with knots used for other purposes; but as they have their own names, I have thought it best to give them here. Fig. 43, where the end is passed through the ring, and a bight put under the standing part, is a ready way

of temporarily fastening the painter of a boat to the ring of a pier; as in the Stationary Knot, a sharp pull at the end of the rope frees the painter at once. This is an excellent fastening for many purposes. Fig. 44, called the "Boat Knot," is another good way of mooring a small boat. It is made in the same way as a Marlinespike Hitch, the only difference being that a thowl pin or other small piece of wood is put through the centre of the knot instead of a marlinespike. By withdrawing the pin a bight through the ring, and drawing the two parts of the rope through the bight; or where this is not practicable by reason of one end of the rope being fast, the end may be passed up through the ring behind the standing part, and down through the ring and bight again. Sometimes, instead of stoppering this knot with an overhand knot, as in Fig. 47, we seize the end to the standing part with twine or other small stuff.

Fig. 48 is a "Lark Knot" with crossed ends, and is made in the manner I have described, where one end of the rope is fast, except that the end at last comes over instead of through the bight. The ends are often stoppered as in the last knot. If we take the standing part in one hand and the end in the other, and draw them apart, we shall find, though with a name of its own, this is really nothing more than a "Clove Hitch" or "Builder's Knot" under a different name and different circumstances.

In the "Double Lark's Head" (Fig. 49) a bight is first made, and the ends passed through it; the ends are then put through the ring and through the loop just made and hauled taut. In Fig. 50 we have the "Treble Lark's Head," which, though it looks complicated, is more easily made than its appearance would lead us to expect. First bring the bight of a rope up through the ring, take one of the ends, and pass it through the bight, and up through the ring, and then down through its own bight; do the same with the other part and the knot is formed.

In Fig. 51 we have a "Backhanded Sailor's Knot." It is made by passing an end through the ring round at the back of the standing part and through the ring again, and finishing with two half-hitches round the standing part. It may also be made with the end in the last turn put under the standing part and under its own part. Fig. 52 is the "Capstan Knot." Cross the end of the rope after it is through the ring, bring it round the standing part, through the first bight and through its own bight, thus forming a sort of figure-of-eight knot.

Fig. 53 is a "Sailor's Knot," composed of

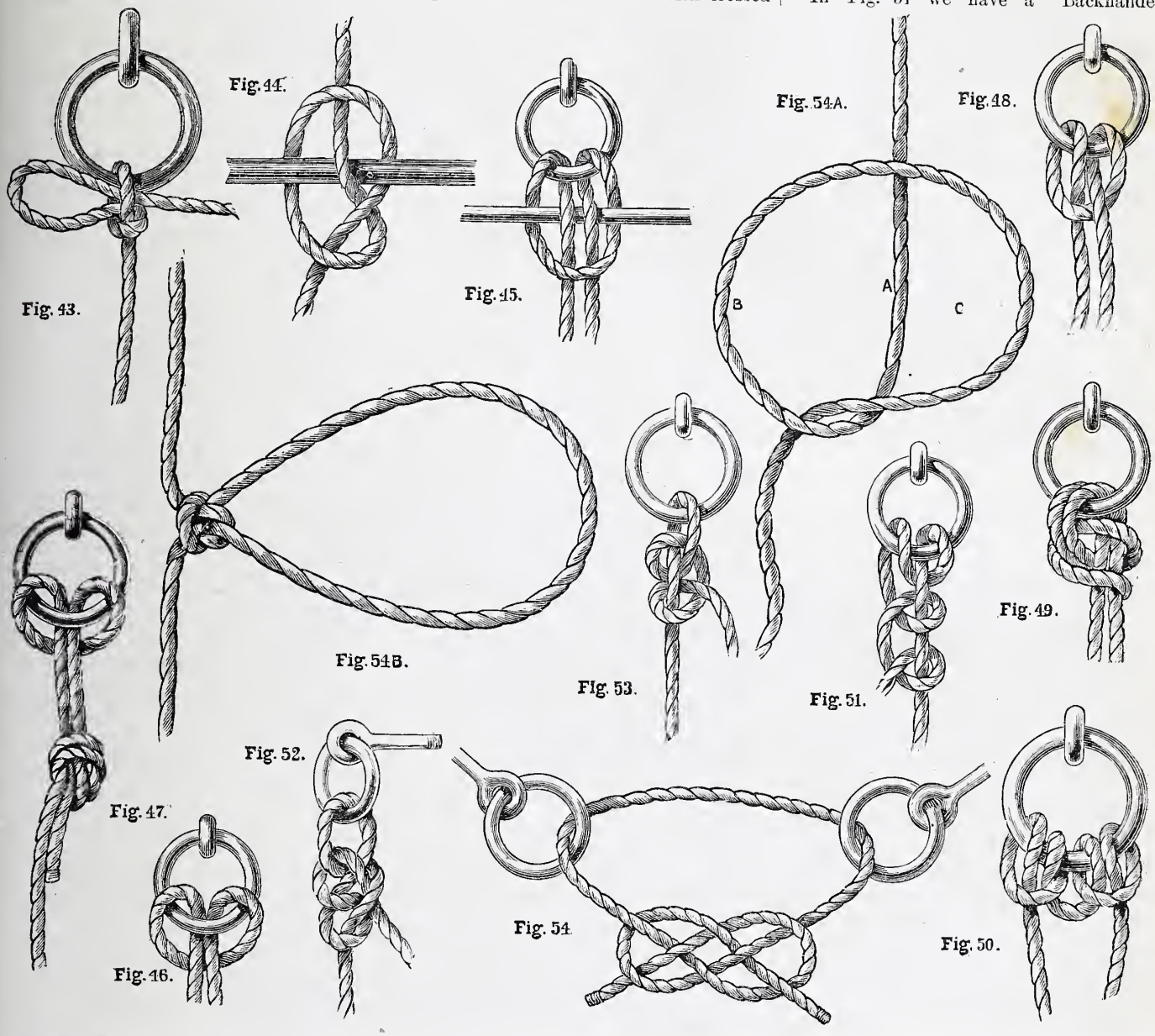



**Fig. 43.—Slippery Ring Knot. Fig. 44.—Boat Knot. Fig. 45.—Lark Boat Knot. Fig. 46.—Lark's Head. Fig. 47.—Ditto, Stoppered. Fig. 48.—Ditto, with Crossed Ends. Fig. 49.—Double Lark's Head. Fig. 50.—Treble Lark's Head. Fig. 51.—Backhanded Sailor's Knot. Fig. 52.—Capstan Knot. Fig. 53.—Sailor's Knot. Fig. 54.—Gunner's Knot. Fig. 54 A.—Artilleryman's Knot commenced. Fig. 54 B.—Artilleryman's Knot finished.**

the knot comes adrift of its own accord. Fig. 45 is another form of boat knot, called the "Lark Boat Knot," or "Double Boat Knot." This differs from the last knot, inasmuch as a bight, instead of a single end of rope, is put through the ring; a piece of wood is used to fasten it, as in the Boat Knot. It is rather the better knot of the two. If, instead of the ends being brought down outside the bight after it has been passed through the ring, they are put through it, we have a "Single Lark's Head" (Fig. 46), and in Fig. 47 we have the same knot "stoppered." It may be made by passing

two half-hitches round the standing part of the rope. This is one of the most useful and easily-made knots we have, and is very much used as a mooring knot.

A "Gunner's Knot" (Fig. 54) is simply a "Carrick Bend," made with the two ends of a rope after it has been passed through two rings. Gunners themselves call this a "Delay Knot."

The knot shown in Figs. 54 A and 54 B is called "Manharness," or the "Artilleryman's Knot." It is used when hauling guns over a difficult country, when horses cannot be employed to get them into position. It is a most valuable knot where heavy weights have to be drawn with ropes, as by its use a man can exert his strength to much greater advantage than he could by merely grasping the rope with his hands. To make it, form a half-hitch, turn it round, and lay it against the standing part. This is, in fact, a Marlinespike Hitch, and is represented in Fig. 40 (page 200). Now pass the right hand into the bight C, and going under A, as shown in Fig. 54 A, grasp the part B, and draw it through C until a loop of sufficient size is made. When using it, the head and one arm are passed through the loop, as shown in Fig. 54 B, which gives the knot finished. A little care is required in closing the knot, so that the turns may jam properly one against the other, or the knot will slip.

When several men are employed, a bowline is generally made at the end of the rope, and as many loops as there are men to haul at equal distances along it.

## CAST-IRON COLUMNS.

BY G. H. BLAGROVE.

FORM OF HOLLOW CYLINDER ECONOMICAL—OBJECTION TO FORM—TESTING METAL AND THICKNESS — BASE-PLATES — BED-STONES — FIXING COLUMN AT BASE—BOLT-HOLES—SEATING—STRENGTH OF CAST-IRON COLUMNS—ESTIMATES—PRICES.

IT is generally admitted that the most economical form for a column is that of a hollow cylinder. What we require in a column is that it shall not bend; and if we can ensure this, it will safely resist any crushing strain likely to be brought upon it. The greater the diameter of the column in proportion to its length, the greater will be its resistance to bending. This may be illustrated in the case of a cane, which is bent by a person leaning upon it. The material on the inside of the bend is compressed, while that on the outside is stretched. The greatest deflection occurs midway in the length of the cane, where the greatest tension and compression of the material occur. In a cross-section of the cane at this point there would be a neutral line running at right angles to the direction of the bend, where the material would be neither stretched nor compressed. The neutral line would probably be near to the centre of the cane, but its position would depend upon the nature of the material. If the latter were more easily stretched than compressed, the greater proportion of the cane would be subjected to tension, and the neutral line would be nearer to the inside of the bend. This neutral line may be regarded as the fulcrum upon which the two half-lengths of the cane turn like levers, the fibres of the cane being stretched or compressed according as they are situated on one or other side of the fulcrum. The distance of any single fibre, measured at right angles to the neutral line, may be regarded as the short arm of the lever; and the greater that distance is, upon the well-known principle of the lever, the greater resistance is opposed to the movement of the long arms. Hence, a cane of the same sectional area, but hollow, and, therefore, of greater diameter, would be more difficult to bend, because its material would be concentrated further from its axis. Upon this simple principle of leverage depends the truth of that theoretical formula, according to which the strength of a column varies directly as the fourth power of its diameter, and inversely as the square of its length. True as it is in theory, it is only partially true in fact; for the theory assumes that a column yields entirely by bending, whereas experience has shown that it yields partly by crushing also. Hence formulæ are employed in practice which have been modified to bring them into accordance with the results of actual experiments.

The only objection to the hollow cylindrical form for a cast-iron column lies in the difficulty of examining the inner face of the metal, and of testing its thickness. If proper precautions are taken, however, there is no reason why a hollow cylindrical column should not prove as satisfactory as any stanchion of open section. As regards the soundness of the metal, hammering affords a reliable test, and the thickness can be measured with callipers. An easier and more satisfactory method of testing the thickness is available when the core of the column runs through from end to end; for then rods can be held against the metal inside, and measurements can be taken to these rods from the outside. Even when a girder is to be carried upon the column, and a boxing is cast on to receive it, the core may run right through the column. The circular piece of iron omitted from the cap-plate would be of no utility in transmitting pressure from the girder to the column. What is wanted is that the bottom plate of the girder shall cover as large a proportion of the section of the column as is possible. As a rule, the process of fixing is greatly facilitated when boxings for girders are cast separately; and the additional cost which this involves is very trifling.

The sizes of base-plates should be arranged in proportion to the loads upon columns, and to the carrying power of their bed-stones. When we know the diameter of the column, and the load which it is to support, we must devise a base-plate large enough to distribute that load over a sufficient area to avoid cracking the bed-stone beneath. If the base-plate be square, and its diameter twice that of the column, the proportion will be just about right, as can be proved by a simple calculation. To take an extreme case, we will assume a 9 in. column of ½ in. metal, which will give about the smallest sectional area in proportion to the diameter that is safe or usual in practice. The sectional area will be 13·35 square inches; and as the safe load upon cast iron does not exceed three tons per inch, our maximum load in this case will be just forty tons. If we make our base-plate 18 in square, it will, if solid throughout, have an area of 2·25 square feet. But we must deduct from this the bore of the column, which is 50·27 square inches, with an additional 4 in. for bolt-holes, making 54·27 in., or ·36 of a square foot, in all, which deduction leaves 1·89 square foot for the actual area of our base-plate. This is the area over which the forty-ton load will be distributed, and it works out at the rate of 21·16 tons per superficial foot. If the bed-stone be of good hard Yorkshire stone, it will safely stand a pressure of twenty-five tons to the superficial foot; and if of granite, it will stand forty. The base-plate should be of the same thickness as the metal of the column. The metal should spread from the column to the base-plate in a trumpet-shaped manner, the column being slightly thickened towards the base, and the base-plate being similarly thickened near its junction with the column. The object of this spreading and thickening is, of course, to provide adequately for transferring the pressure from the column to the base-plate; but the change of thickness in the metal must be brought about gradually, to avoid any danger from the unequal cooling of the casting. Some portion of the upper surface of the base-plate will, therefore, have a slight slope. The distribution of the pressure from above can be greatly assisted by means of gusset-pieces, of the same thickness as the metal of the column, and uniting the column to its base-plate. If bolts are used for fixing, there can only be four of these gusset-pieces abutting upon the four sides of the base-plate.

With regard to the fixing of a column at its base, this has sometimes been done without bolts, by means of lugs cast on to the underside of the base-plate, and let into holes sunk in the bed-stone. One advantage about dispensing with bolts is that diagonal gusset-pieces can be cast on, which is desirable when the load to be carried is considerable. But lugs, besides being liable to break off, do not afford such a secure fixing as bolts; and if lugs are used, it is advisable to form a square sinking, about half an inch deep, in the bed-stone, of the same size as the base-plate, to receive the latter, and preclude the possibility of its shifting. If bolts are used, this sinking need not be provided. There is no necessity to run the bolts right through the bed-stone, and provide them with heads and washers on the underside, as is sometimes done, for there will be practically no tensile strain upon the bolts. A good fixing may be obtained by sinking lewis-holes in the bed-stone, and letting in lewis-bolts. If the surface of the base-plate slopes where the bolt-holes occur, level seatings, or flanges as they are sometimes called, should be cast for the nuts; otherwise, it will be necessary to provide bevelled washers, which will involve some extra labour in filing.

Bolt-holes may be either cast or drilled. Of course, it is cheaper and more expeditious to have them cast. There is no objection to casting the holes in a base-plate which is to rest upon a bed-stone, or in a cap-plate to which the flange of an iron girder is to be bolted, the holes in the flange of the girder being drilled or punched. But when the bolt-holes are cast in two castings which have to be bolted together, one above the other, the iron may shrink unequally, and the holes will not be plumb over one another. In such a case, therefore, the bolt-holes, or at least one set of them, should be drilled.

All seatings, such as base-plates and cap-plates to columns, should be planed true, as it is difficult to ensure absolute freedom from slight irregularities in castings. Very slight irregularities will often suffice to produce grave results, by concentrating the pressure upon a few points, instead of letting it be distributed over a whole surface. All bearing surfaces should be packed with lead or felt, to prevent unequal pressure as far as possible.

The ultimate strength of cast iron in columns is found by experiment to be, for every square inch of sectional area, 28·5 tons at ten, and 17·8 tons at twenty diameters high. At about twenty-five diameters high, the strength is thirteen tons per inch, at which limit built columns of wrought iron have the same strength, and beyond which wrought is superior to cast iron. The safe load should be one-tenth of the ultimate strength; and it can be ascertained at a glance from those very useful tables for engineers which are issued by Hurst, Molesworth, and others.

In making estimates for cast-iron columns, the tables published in the above-named pocket-books will furnish the practical man with all that he requires. For instance, if we want a column 10 ft. high to carry a load of forty tons, we shall find that the external diameter will be 8½ in., and the metal ¾ in. thick. A table gives us the weights, per lineal foot, of cast-iron pipes, and the pipe we want is of 7 in. bore and ¾ in. metal, weighing 57 lbs. per lineal foot. Our column, therefore, weighs 5 cwt. 10 lbs. We must add a cap and base-plate, each 17 in. square, ¾ in. thick, weighing, at 28⅓ lbs. per square foot, just 1 cwt. By not deducting the bore of the column from these plates, the surplus will allow for the spread of the metal and for gusset-pieces. The total weight of the column will, therefore, be 6 cwt. 10 lbs., and its cost, at 10s. per cwt., will be £3 1s.

The price taken for the iron would include fixing, but an allowance should be made for the bolts. Four of these will be required for fixing the base-plate, and they may be of 1 in. diameter, and each 5 in. long, weighing, at 2⅔ lbs. per foot, just 4½ lbs. Four hexagonal nuts, at 1¼ lb. per pair, will weigh 2½ lbs., bringing the total up to 7 lbs. for bolts and nuts, which, at 4d. per lb., would cost 2s. 4d., bringing the cost of the column and bolts up to £3 3s. 4d. If four more bolts were required for attaching the cap-plate of the column to another casting above, these could be each 4 in. long, weighing 3½ lbs.; they would have hexagonal nuts, weighing, at 1¼ lb. per pair, 2½ lbs.; and square heads, weighing, at 1¼ lbs. per pair, 2½ lbs.; bringing the total up to 8⅔ lbs., which, at 4d. per lb., would involve an additional cost of 2s. 11d.

## NESTS OF ENCLOSED PIGEON-HOLES.

BY C. E. MAES.

DOORS AND REVOLVING SHUTTERS—NEST WITH TWO DOORS—VARIOUS MODES OF HANGING DOORS—DOOR FOR WRITING PURPOSES—SMALL NEST—CONSTRUCTION AND FITTING OF SHUTTER—GROOVES—SHUTTER WOOD—VARIOUS BANDINGS—ALTERNATIVE CONSTRUCTION OF SHUTTER—FASTENING THE SLIPS OF SHUTTER—FIXING THE SHUTTER—NEST WITH DOUBLE SHUTTERS OPENING TOWARDS ENDS—DOUBLE BACKS.

I HAD recently the pleasure of directing readers of WORK how to make a simple nest of pigeon-holes for the classification of letters and other papers. The one described was open in front, so that the contents could not be regarded as secure from the prying eyes of curiosity. This in many instances might be undesirable, for there are few of us who have not some correspondence which we wish to keep private, and apparently this fact has occurred to others, for it has been suggested that the article alluded to should have a sequel giving directions for the construction of a nest of pigeon-holes, the contents of which can be secured under lock and key. In the interest of "my masters, the public," who are readers of WORK, I hasten to comply with what appears a reasonable request, and must, in order to avoid going over the same ground twice, refer those who want information about making the pigeon-holes themselves to pages 103 and 104 of this volume of WORK. The remarks in the present article will be confined to such alterations as may be necessary in connection with the construction and arrangement of doors and shutter fronts.

As shutter or revolving fronts entail a good deal of extra work, it may be well to suggest, for the benefit of those who either have not the time or the desire to take more trouble than is necessary, that a plain hinged door or doors may be used instead of the revolving front, and a few directions regarding the doors and their general arrangement may not be amiss. As this article, however, principally deals with the other method of closing, much space cannot be devoted to the subject of doors, which I may take for granted the reader knows how to make. Detailed directions for their construction may therefore be regarded as unnecessary, and a few remarks in connection with their adjustment to the nest must suffice.

Doors may be added to the nest of holes, made exactly as previously described, by fastening the hinges to the front edges; but this would, at the best, be a somewhat clumsy arrangement compared with the alternative mode of hingeing the doors within the ends, so that the fronts of the doors are on the same level as, or, better still, a trifle back from, the edges of the ends, top and bottom. In order that they may be so, it is only necessary to have the partitions and shelves shallower from back to front than the outer casing—to at least the extent of the thickness of the door framing, which may be about ¾ in. On the left-hand door a bolt will have to be fitted, shooting into either the top or bottom of the case, or, if preferred, two bolts shooting into both may be used. On the right-hand door a "cupboard" lock with bolt shooting to the left will be fixed. The nest of pigeon-holes so made will resemble Fig. 1, which, it will be observed, shows no superfluous ornamentation in the way of mouldings, beadings, etc. These can be added according to the taste and skill of the maker, but, it will be noted, do not enhance the value of the nest so far as mere utility is concerned in the smallest degree.

For a small nest possibly one door may be preferable to two, but this the intending maker must decide for himself. It may, however, be suggested that in a long, low nest such as that described in the previous article, if one door is preferred, it will be better to hinge it at the top or bottom rather than at the end. If hinged at the top, a stay of some kind will be advisable to keep it open when the contents are being got at. This arrangement, however, will be more awkward generally than if the door is hinged at the bottom. In this case the door remains open by its own weight, and, if not allowed to hang down, forms a convenient table on which to sort or look over any of the contents of the holes. It will no doubt occur to many that the lid in this position may very easily be used as a writing table, in which case, of course, the panel and framing must be flush on the inside, and will be pleasanter if lined with cloth or leather. To prevent the lid, or, as we may now call it, the table, falling further than required, a joint stay, obtainable at any cabinet brass shop, may be used, or a simple chain or cord fastened to the inside of the lid and inside the ends.

Many of those who intend to use the inside of the lid for writing purposes may think that if part of the space occupied by the pigeon-holes were devoted to stationery—such as note-paper, envelopes, ink, pens, etc.—it would be an improvement. If they do not quite see their way to effecting this, perhaps Fig. 2, which shows the nest with the lid down and part of the interior arranged as suggested, may be useful to them. They will also notice that this illustration gives an idea by which the article may easily have a more ornamental appearance given to it. In fact, the plain nest of pigeon-holes has become a sightly piece of furniture, which, if carefully made, would not be out of place in any library, and is worthy of being made in better wood than pine, which, however, will do very well for the shelves and partitions.

Now let us turn to the construction of a nest with shutter or revolving fronts. I daresay it is well enough known that in this form of enclosing the contents, doors opening in the ordinary way are not used—if they can be called doors at all; they slide, and, in order to turn corners, they are flexible. They are formed of narrow strips of wood, fastened close together on a canvas or other suitable backing, and slide in grooves prepared for them. Before, however, giving directions for the construction of the shutters, it will be well to take the opportunity of describing a smaller form of a nest of pigeon-holes, and one which will probably be at least as useful as the larger one for ordinary domestic use.

As will be seen from the illustration, Fig. 3, it is rather higher than wide, and is divided into sixteen holes, in four rows of four. The extra height is not only that the shape of each hole may be more sightly and convenient than if square, but is owing to the fact of there being what may be called two tops to the case—one of them the outer one, and the other immediately above the pigeon-holes. Between these two tops is a vacant space of some three inches, to hold the shutter when it is raised as it is shown to be partly in the illustration last referred to.

A suitable size for such a small nest of pigeon-holes may be named as about 1 ft. 8 in. high, 1 ft. 4 in. wide, and of, say, 10 in. in depth, from back to front, outside measurements. Of course, these may be varied to almost any extent to suit particular purposes, and the only point in connection with them to which it may be necessary to call attention is the depth from back to front *inside*. As the pigeon-holes must be set back to allow of the shutter working in front of them, see that they are deep enough to hold any papers intended for them—in other words, the shutter should clear the papers.

As may readily be imagined, the shutter slides in grooves in the sides or ends of the case, so that, in setting out these, both the thickness of the wood forming the sliding front and the width of the groove will have to be considered with regard to each other. For a small or ordinary sized nest, such as has been referred to, ordinary ¼ in. stuff will be amply thick enough for the front, although, as even the veriest tyro will know, it will be considerably less than ¼ in. thick when smoothed and worked down. If it is only ⅛ in. thick, then it will hardly be too thin, though there is no object in making it so slight. Whatever the thickness, the groove should be a trifle wider, so that the shutter

will move easily and freely in it, though not too loosely. As it may, from lack of tools or other reasons, not be convenient to make the grooves just the right width, as will be seen later on, the shutters themselves may be adapted to fit in slightly narrower grooves. At present we may assume that these can be made exactly of the required width. I must now refer to Fig. 4, which represents the inside of right-hand end of the ease. These ends, by the way, may as well be of ¾ in. stuff, for if thinner there may be a difficulty in making the grooves deep enough to give sufficient bearing for the shutter. Along the front edge cut a rabbet the width of the thickness of the shutter, and about half the thickness of the end in depth. The rabbet, it will be seen, merges itself into a groove between the two tops, and, in order that the shutter may work freely, the groove follows a circular line instead of turning sharply. The length of the groove may be determined by actual measurement, but it will be as well in the first place to make it excessive, and stop up the excess after the shutter has been fitted. The bottom and sides of the groove should be cut as cleanly as possible, in order that no obstacle may be presented to the free action of the shutter, which, when all is fitted up, should run as smoothly and easily as a well-made drawer. To ensure this, careful construction and adjustment are necessary. Both ends, of course, are made exactly alike.

The shutter itself is composed of narrow strips of wood, in length just sufficient to reach from the bottom of one groove to the same in the other. It may, therefore, be well to suggest that the case should be fitted together, if only temporarily, before the shutter is made, in order that no unnecessary waste of time may be caused by having to alter this. The width of each piece must be so that it will pass the rounded corners without jamming in them ; and to avoid any risk of this, the groove at the corners may be slightly widened if necessary. As will be seen, however, the necessity for this must be determined by the width of the slips of wood forming the shutter. As some idea, it may be said that these pieces should not be more than ¾ in. wide, but they may be as much narrower as desired. The narrower they are naturally the more work there will be in connection with them. As a happy medium, let it be supposed that ½ in. is the width of each piece. So far as actual utility goes, each strip may be perfectly plain and flat, with square edges ; but the appearance of a shutter formed of such pieces would not be so nice as could be desired. The joints between each will be unpleasantly conspicuous, so that to adopt some plan by which we may "break the joint" will be an improvement. The easiest way will be to round off each edge, so that the section of the pieces will be as shown in Fig. 5. Two of these being placed close together, the actual line of the joint is thus hidden more or less completely, so that a shutter formed of several pieces shaped thus presents the appearance of being composed of a series of wide beads. Of course, instead of being rounded, the edges may be simply bevelled, as in Fig. 6 ; or the pieces may be of any section desired. Thus the shutter may be made to resemble a series of small, half-round beads, as in Fig. 7, where the joints may be noticed as indicated between the various pieces. The shutter might be made up of a number of pieces, each the size of the beadings shown, but to do so would entail an unnecessary amount of work, and no advantage would be gained, unless it may be considered that the trifling saving in the waste space between the outer and inner top, which may be effected by the rounded corners having a sharper curve, is a sufficient one. Appearance and convenience will be equally consulted by having each piece with several beads on it. Those shown in the illustration may be taken as being of reasonable size, but there is no reason why they should be strictly adhered to. Now a few words on the easiest and quickest way of forming such a shutter, and the remarks apply more or less closely to any section that may be preferred. The case being together, cut a board of the required thickness and of any convenient width : it is understood, I presume, that the grain of the wood is to be across the front of the nest, and of such a length that it just fits within the rabbet. See that the edges are truly squared, and proceed to work beads across from one edge to the other, using the "scratch" for the purpose. Those who are acquainted with this useful tool will hardly need to be told that after having run as many beads as the cutter will admit of, say, two or three, it is only necessary to remove the iron further in the stock to cut beads over the whole surface of the wood. Those to whom the tool is an unfamiliar one may be referred, with advantage, to the article entitled "The Scratch or Beading Router," in page 101 (No. 7), Vol. I., of WORK, where they will find all needful explanation how to make and how to use this useful appliance. After the beads have all been worked, pieces of appropriate width can easily be cut off with a fine saw without any appreciable detriment to the beads between which it cuts. If no fine saw is available, then leave a slight space when setting the iron between each two or three beads, so that the saw kerf, by removing this excess, will allow each piece to be fitted closely together. If preferred, the pieces may be cut before the beadings are formed, but this will probably be found more troublesome and tedious than the way suggested.

Another way yet may be more convenient, though, for reasons which need not be stated, it may not be so easy for those who have had little or no experience in cabinet-making. In reference to the width of the wood, which it was said should be cut to fit in the rabbets, it may be requisite to mention that if these pieces are of great width comparatively—say, more than five or six inches—they will not be easily manageable with the scratch. Now, instead of having three or four of such pieces, suppose that we have a piece much longer, and perhaps only three or four inches wide ; let the beads be run on to it for its entire length, and then cut pieces from it which will just fit in the rabbets, and we get a similar result to that already alluded to. So far as workmanlike proceeding is concerned, there is little or nothing to choose between this and the first method. It must just depend on the ideas of the workman, and the material available, which one he selects. It will easily be inferred, from what has been said, that other beadings or arrangements than those named may be chosen—such as those illustrated in Figs. 8, 9, and 10, which are given not by any means as implying that no others are available, but as suggestions which may be useful. The extent to which the mouldings of each slip may be varied is practically unlimited, and the worker can hardly go wrong with them if he is careful to have the joint sunk between two members, and not on a flat or projecting surface. The pieces being prepared, the next thing will be to fasten them together. Were this to be done by gluing the edges to each other, the door would be rigid, and for the present purpose useless. They must, therefore, be glued on to a flexible backing of canvas, calico, or some similar suitable material. Perhaps nothing is better than the ordinary "Hessian" canvas used by upholsterers, but those who have not got any need not take much trouble to procure it if something else is handier. Glue alone may be used as the adhesive medium, but a mixture of it and good strong flour paste may be regarded as preferable. The canvas may cover the whole of the back of the shutter, though it will be better to leave the portion which fits in the groove bare, or it may be in strips from top to bottom. All that is needed is that the pieces should be, as it were, hinged to each other. However close together they are—and the closer the better—they will not prevent the shutter bending in the required direction—viz., backwards—when it is turning the corners in the waste space. If, as is very possible, some glue has got between the pieces, be careful to remove it before it has set and firmly stuck them together. There will be no difficulty in doing this by bending the shutter backwards at each joint, and if this is done the additional advantage of rendering the shutter more flexible than it otherwise would be will be gained.

It may reasonably be supposed that a lock is to be fastened to the shutter ; and, so far, no provision has been made for doing so, for the thin stuff is not sufficient hold for one. In addition to the narrow slips, therefore, a larger one, both in width and thickness, sufficient, in fact, in both respects for a lock to be let into it, must be placed for the bottom one of the shutter. As this piece will only work up and down in the rabbet or straight part of the groove, and will not have to be worked round the corners, it may be of any reasonable width, and, preferably, it should be plain instead of beaded. Some may wonder how a piece of the thickness proposed can work in the groove. I cannot tell them how to perform an impossibility ; but this need not be attempted, as it is only necessary to reduce the thickness of the ends of this bottom piece sufficiently for them to fit within the grooves. For various reasons it will be better to have the extra thickness at the back of the door—*i.e.*, the front of this piece should be flush with the remainder of the front of the shutter. This, of course, can easily be managed by removing whatever wood may be necessary from the back only. I suppose it is not necessary to do more than hint that the lock may as well be got, or at any rate its size be decided on, before this bottom piece can accurately be determined. It will certainly be better to adapt the size of the wood to that of the lock than the reverse.

After the glue is dry, a trial of the shutter may be made, in order to see if it fits and runs well. The top strip should be high enough to enter the rounded groove while the bottom one is in its normal position, so that when all is finished the front will be quite closed. If care has been taken, there should be no difficulty in working the shutter backwards, or, as may perhaps rather be said, upwards, so that it runs within the groove easily and without catching anywhere. When it has been opened till the bottom of the lowest slip is on a level with, or a little below, the inner top, the remainder of the groove, if any, may be filled up by gluing a piece of wood in it, to act as a stop ; for, of course, the shutter will never have to be pushed further than the position named. Now, should the wood of the shutter be too thick to fit easily

within the grooves, just bevel it off till it is sufficiently thin to do. If much has to be removed, do so from the back; but if only a little, it may be done from either back or front. Possibly a little rubbing down with glass-paper may be sufficient.

Up till now the spaces which the shutter slides in in front can hardly be called grooves, as they are merely rabbets, and the door hangs in them curtainwise, so that it can be lifted forwards, instead of merely sliding up and down. To make grooves of them, or rather, to enclose the sides of the shutter, a couple of knobs fastened to the bottom piece will be found a convenience.

We may now proceed to apply the principles so fully explained of shutter construction to a nest of pigeon-holes such as we started with, so that when finished it will be like Fig. 11. As readers will remember, it was oblong in shape, considerably so, there having been three rows of nine holes each. Without saying that there might not be a fall-down front, like that described for a smaller nest, such a construction would, to say the least, be inconvenient, and therefore unusual. Instead am wrong in this supposition, I shall be happy to explain anything which may not be quite clear in "Shop" to any inquirer who may meet with a difficulty which he cannot surmount. At the same time, I must ask him to remember that "Shop" is rather overcrowded than otherwise, and not to write for a solution of any difficulty which a little consideration on his part, or experiment, either in working or drawing, might have removed. If he will read the directions for making and fitting a fall-down front, and then imagine that a nest with a double door,

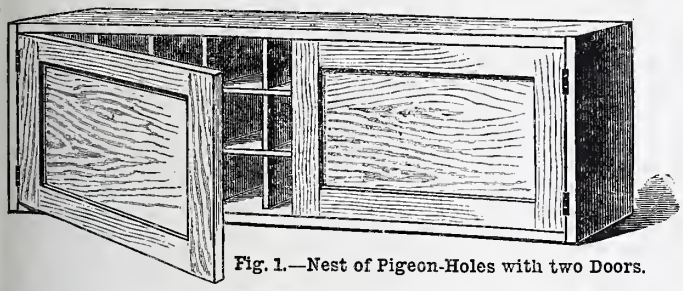


Fig. 1.—Nest of Pigeon-Holes with two Doors.

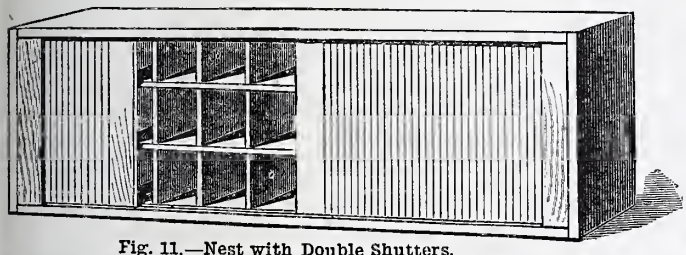


Fig. 11.—Nest with Double Shutters.

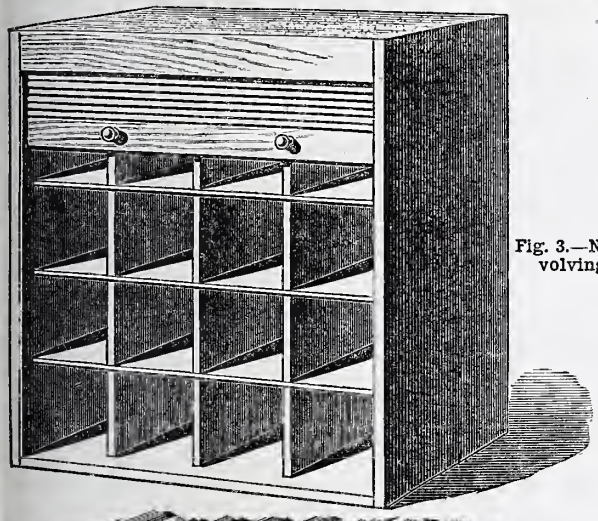


Fig. 7.—Three Strips all Beaded.

Fig. 5.—Shutter Strip with Round Edge.

Fig. 6.—Shutter Strip with Bevelled Edge.

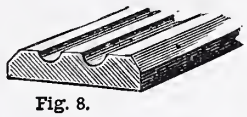


Fig. 8.

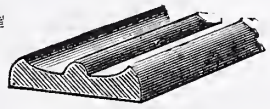


Fig. 9.

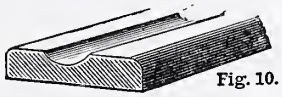


Fig. 10.

Figs. 8, 9, 10.—Alternative Forms for Strips.

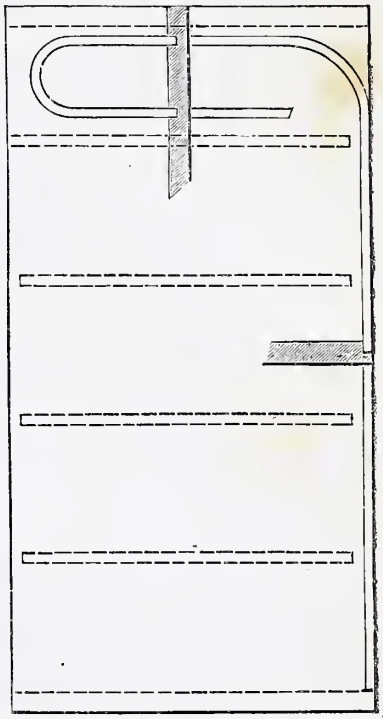


Fig. 4.—End of Nest showing Groove and Rebate on Front Edge. Dotted Lines show Position of Shelves.

Fig. 3.—Nest with Revolving Shutter.

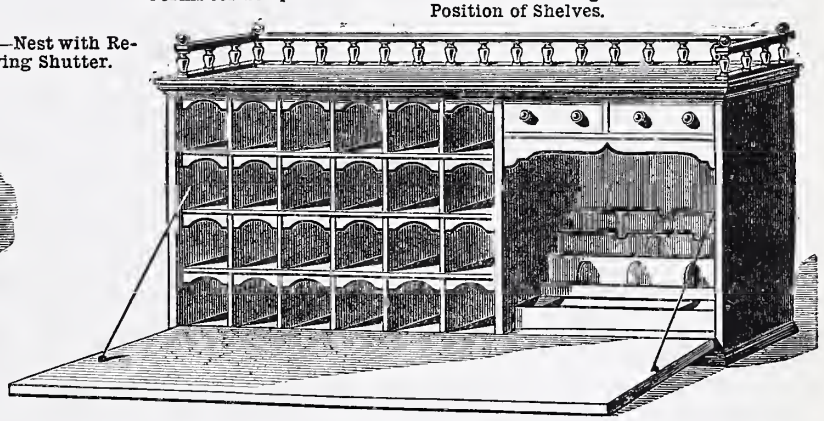


Fig. 2.—Nest with Fall-down Front for writing on.

glue thin slips of wood on the front edges. Provided these slips overlap the sides of the shutter, their width is not important, but it may as well correspond approximately with the thickness of the ends. The shutter being in its place before these pieces are glued on, is now securely fastened, so that it can only move up or down. To bring up the edge of the bottom flush with the ends, a similar piece must now be glued on to it. The same must be done at the top, but the piece there must be of a suitable width; and it may no doubt occur to many that a piece of moulding may be planted on it and carried round the ends. In order to raise and lower the of one shutter sliding up and down, it will be better to make two, opening sideways from the centre. In this case no double top will be wanted, as the shutters will turn into the ends, each of which, therefore, must be made double. The rabbets must be on the edges of the top and bottom, and the grooves will naturally be in the same pieces. Is it necessary to say anything more about this construction? Surely not, for those who have not got a sufficient amount of common sense to see what is required, if they have read all that has been said, could hardly undertake to make a nest with double doors even with full directions. Still, if I sliding sideways, is merely a double-ended one with what was the top for one end, I do not think any mistake can be made.

To prevent the doors when locked from being pushed on one side, and so allowing of access to any of the holes being obtained, and to prevent either door being drawn too far, a stop should be placed at the centre in the rabbeted groove. This can easily be managed by cutting a small corner out of the doors, just where they come in contact with the stop.

With a few general remarks this article must be brought to a close, for the principles of folding-shutter making have been

sufficiently explained to enable almost anyone to do what is requisite, provided he has the manual skill necessary. Instead of the shutters when opened being folded entirely by the ends and top, they may simply pass through the space and in behind. In this case naturally two backs will have to be made, so that the labour involved in making the nest is increased. When the height or length of the nest is great in proportion to the depth from back to front, it will be plain that this form of construction is better than the former, and may be the only one possible.

The amateur will rarely have occasion to make a very large shutter-front, but with the professional cabinet-maker the case may be different. It may, therefore, be well to suggest for his benefit that when the shutters are heavy and open sideways it is sometimes advisable for them to run on rollers. The fitting in of these he will, however, require no special directions about; but should anyone want to know, it is, as I have said, only necessary to ask for a reply in "Shop." Anyone doing so will please note that the dimensions of the case and thickness of the wood used *must* be given.

## MEANS, MODES, AND METHODS.

### A Novel Use for Clothes Pegs.

The ordinary wooden clothes pegs, which are sold at one penny per dozen, of all hardware merchants, can be turned to a variety of uses by the worker in wood.

The peg, if cut off above the point in which it divides in two, forms a very respectable substitute for a turned pillar in the manufacture of "antique" furniture, especially if it receives a few thread-cuts in the lathe, but this is not at all necessary. I have used dozens of them without any further addition than a rub of sand-paper,

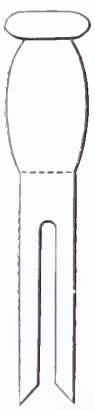


Fig. 1.—Turned Wooden Clothes Peg.

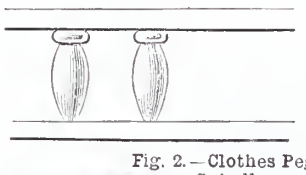


Fig. 2.—Clothes Peg as Spindle.

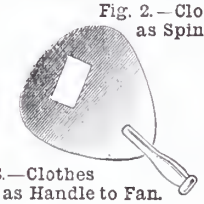


Fig. 3.—Clothes Peg as Handle to Fan.

and my friends have been greatly surprised when told of their origin.

Another use to which they can be effectively put is in the manufacture of handles for the numerous class of substantial "fans," such as have spaces for portraits cut in their surfaces.

All that is necessary is to cut off the two sloping tips of the peg and insert the leaf of the fan between the two sides, securing it in position with either a nail, screw, or glue, and painting or gilding it, according to taste.

A form of the wooden clothes peg as made by the turner is shown in Fig. 1; in Fig. 2 an example is given of its use as a spindle; and in Fig. 3, how it may be used as the handle of a fan. Without doubt the suggestions here given will prove useful, and many will be led to adopt them.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

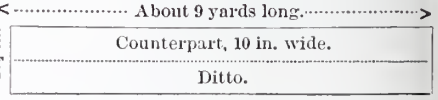
### 40.—Engel's New Transfer Graining Sheets.

There are many amateur workmen—yes, and many professional workmen, too—who can use the brush and contents of the paint-pot well enough as far as plain work goes, but who would be utterly nonplussed if they attempted to take a turn with the graining comb and cloth, or sought to do anything in imitation of natural wood or marble. The work of the amateur is confined to painting in unbroken stretches of various colours, or to staining and varnishing; and the painter who does mere ordinary work is obliged, through lack of natural ability or mechanical aid, to leave the imitation of woods and marbles to men who make this kind of work their speciality. But, thanks to Mr. George Engel, 18, Castle Street, Falcon Square, London, E.C., who manufactures and supplies the "New Transfer Graining Sheets," and who, I presume, is the patentee, natural ability for graining and marbling is put into the shade altogether, and mechanical aid is brought within the reach of anyone and everyone who may care to avail themselves of it. Having seen the sheets and the results produced, I am longing to have a turn at the work, but the pleasure must be deferred until leisure permits, and when that will be, "goodness only knows," as the ladies mildly put it, for with me, as time turns on, toil seems to increase instead of lessen, and I don't care to follow the fashion and go on strike—just yet awhile, at all events, although there is no knowing what the force of example may bring about in the future. However, I can readily endorse Mr. Engel's statement that these sheets are a boon to decorators and painters, that graining by hand is—in many cases—completely surpassed, and that the working is remarkable for its simplicity, rapid, and economical, and the results obtained as effective, certainly, as many of the best attempts at imitation that we see, and often as telling as natural wood or marble.

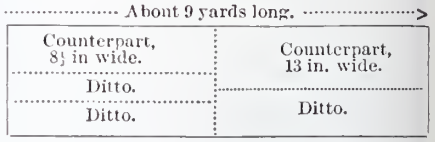
That these assertions are such as will hold water will fully appear when it is explained that, after the fashion of the coloured transfers which are sold for the amusement of children, these sheets are so prepared that the grains of oak, walnut, maple, ash, mahogany, rosewood, etc., as well as every kind of marble grain, can be transferred on to surfaces painted in the ordinary way by simply wetting the back of the paper. Everybody knows—or I presume that it is so—that when a surface is to be grained it is first painted over with the proper colour that forms, so to speak, the groundwork of the graining. This being done, the following are the instructions for graining with the transfer paper:—"Cut the transfer paper a little larger than the size required, place face downwards on a dry, clean table, and wet the back well and evenly with a *half wet* sponge, taking care not to let the water stand on the back of the paper. Let the paper soak for another three or four minutes until the grain print begins to get glossy. Wet the surface to be grained with a sponge, distribute the water well by rubbing over with a stiff hair brush, that the surface becomes *evenly damped, but not too wet*, place the transfer paper face downwards on the moistened surface without creases, rub the back well with the same brush, take off the paper, and go over the grained surface with a softener *at once, while wet*. The paper will make four or five *good* impressions while wet." The operator is advised to use stale beer instead of water for wetting the paper, or a mixture of half stale beer and half size water. After the grain is perfectly dry, it should be smoothed over with glass-paper, and boiled linseed oil applied by means of a rag. When dry, the graining and the surface to which it has been applied should be varnished in the usual way.

"The work is simple enough, anyhow," many a reader of Work will doubtless say. Yes, that is so; and it is as rapid as it is simple, for, after a little practice, inexperienced hands—that is to say, hands who cannot grain or marble in the usual way—can use the sheets, and by their instrumentality do the work twenty times quicker than any artist can grain by hand. As to its effectiveness, it need only be stated that the manufacturer says the designs are impressed on the paper from natural woods and marbles, and that the work thus done is scarcely distinguishable from the wood or marble it represents.

As to its cheapness, and therefore economy in the use of the sheets, it may be said that the cost of material used in graining a square yard may be estimated at being about a penny, and that the application of the paper to such a surface takes only five minutes. The manufacturer says that "to grain and varnish a yard takes only five minutes," but as this involves a duplex operation, I am not prepared to go with him as far as this. As to the form in which it is given to the public, it should be said that the "Patent Transfer" is sold in rolls of about 9 yards long in two widths —20½ inches and 26 inches. The 20½ inch wide rolls are made in one continuous grain of 20½ inches, and also in two counterparts, each of 10 inches wide, as shown in the accompanying diagram:—




The 26 inch rolls are made in one continuous grain of 26 inches, and also in two counterparts, each 13 inches wide, or in three counterparts of 8½ inches wide, as shown in the diagram given herewith:—




From these sketches it will be apparent that the paper can be cut to the required sizes for any kind of work, with little or no waste. The varieties of wood grains usually supplied are—*Oak*, light, medium, and antique; *Walnut*, American and soot; *Ash*, in two varieties; *Maple*, bird's-eye, silver, grey, and yellow; *Cherrywood*, *Rosewood*, and *Mahogany*. Marble grains are made in all varieties in rolls of the same length and width as those of imitations of woods. There are over a hundred designs from which a selection may be made, and the maker will send a sample roll 20½ inches wide for 2s. 6d., post free. Otherwise, the 20½ inch rolls are supplied at 2s. per roll, net, and 26 inch rolls at 2s. 6d., postage per roll in each case being 3d. extra. For orders of at least fifty rolls discount is allowed to the trade.

I have dwelt at length on the Patent Transfer Papers, because I regard them as being among the best things to which I have been privileged to call attention for some time, for any amateur who is so inclined may grain a chest of drawers or the woodwork in his house with the utmost ease; and the professional painter in any country town or village who has not ventured hitherto to attempt the higher branches of his art, may do so now without any fear of failure or of causing disappointment through want of success in any imitation which he has undertaken to effect, whether in wood or marble. I mentioned them to a jobbing carpenter the other day, who does a good deal in house-repairing, and he jumped at the notion like a trout at an attractive looking fly on a dull day. It showed him, in fact, how he might venture on painting of a more ambitious character than that which he has hitherto attempted.

The Editor.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

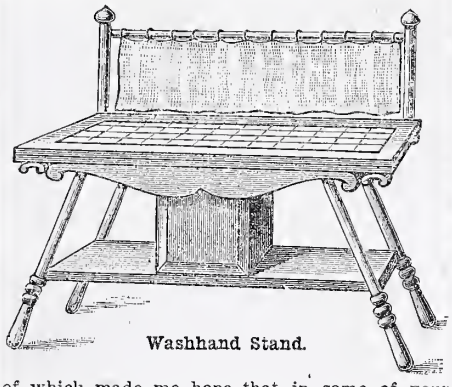
**Drawing One's own Specification for Patent Office.**—Another Inventor writes:—"I have been very much pleased in reading the article by Inventor, entitled, 'Some Words to Would-be Patentees,' in No. 116 of Work; and having obtained a protection for an idea of mine (thanks to Work), I thought that perhaps a few lines from me would be of help and encouragement to others who, like myself, wish to protect an invention, but do not care to pay the sums generally charged by patent agents. So having worked out my idea, I was about to go and see an agent, in whose hands I intended to place the job; but on calling on a friend who had done a little business through the Patent Office, he advised me not to, but to get the forms and do it myself. So after getting home, I referred to my Index of Work, Vol. I., and read the articles by C. C. C. and others. After getting the forms from the post-office, I started to fill them in and draw out the specification, which I found easy after the advice given in Work, and then posted them off to the Patent Office. The next few days brought me letters from firms at London, Paris, Brussels, and Berlin, all offering to render me assistance on very reasonable terms; and one kind friend wrote to inform me that my specification was informal, and not so full as it ought to be, and that I should have it returned in due course from the Patent Office: that if I would place the matter in his hands, he would make what alteration was necessary for 5s. 6d. It is, of course, unnecessary to state that I took no notice of these letters, but waited patiently for my specifications to be returned—which really did take place, as prophesied by my friend. In the course of a few weeks I received my specifications back for amendment, which amendment consisted of the alteration of three words, and which alteration my friend offered to do for 5s. 6d.—very reasonable indeed! After altering, I again sent them up to the Patent Office, and in a few weeks received a form saying my application was granted. I really think, with Inventor, that the officials at the Patent Office do all in their power to assist inventors. But I think I am mainly indebted to the advice and help given in Work, which so materially assisted me in filling up form and specification; and as I have Work from its first number to this week's—the two first volumes bound and indexed—I shall prize it more so because of the help it has rendered me on this particular occasion."

**Rate of Circular Saws.**—Chopstick writes:—"I cannot resist the temptation to reply to Woodworker's letter on the above subject (see Work, No. 116, page 187), as the arguments he makes use of are not only very misleading, but altogether absurd. In the first place, can he find any joiner who will cut a 3 in. plank with the rip saw? if he can, I think they must be fond of work in his neighbourhood; and secondly, I will defy any man to cut wood of that thickness at the rate of speed he mentions for any length of time. And now a word in favour of the machine which he condemns so strongly. I have, on a home-made machine, cut 3 in. deal, and the man who turned the wheel preferred doing it that way to cutting it with a rip saw, and it was certainly cut in half the time and in a better manner. For cutting thinner stuff, and also for rabeting, grooving, etc., the advantages are far greater; and I will even go so far as to declare that no shop should be without one of these useful tools, as they will repay their cost double and treble. If the cost is too much for an iron one, a wooden one does equally as well, only the bearings should be well fitted, and the fly-wheel should be heavy. Then, with a labourer to turn, you will soon find out the fallacy of Woodworker's arguments."

**Fillers in French Polishing.**—W. D. (*Newington Butts*) writes:—"I know of no better filler than what is given by David Denning (see page 166, Vol. III.). All new work will sweat in time, as the oil used in polishing will find its way through the film of lac. I use Russian tallow mixed with plaster of Paris, with rose-pink for walnut and mahogany. A good filler-in for oak and ash is water and methylated spirits (used as water), and plaster of Paris, coloured with rose-pink, for brown oak, and yellow ochre for light oak or ash. Pumice powder can only be used with advantage by experienced French polishers. A preliminary rub with polish before filling-in will not only keep the grain smooth, but stop the sweating to a great extent, as there would be a foundation of polish. 'Filling-in' is the term used by French polishers."

**Holes in Girder Webs.**—A. B. (*Salford*) writes:—"Mr. J. W. Harland, in an article on 'Constructive Strength in Metal Work,' in Work of 30th May last, speaking of cast-iron girders, remarks that 'it is very bad construction to drill holes in the web itself,' and proceeds to give his reasons for this statement. He also says that 'the nearer the hole to either flange the less dangerous it becomes.' I think it necessary to point out to your readers that *Mr. Harland's view of this question is entirely opposed to the teaching of all the leading engineering lecturers of the day, as well as to practical experience.* The one place, above all others, where it is possible to drill a hole in a girder with the least damage to the strength of the girder is in the neutral axis, or the line passing along the web where the compression of one flange gradually fades away, if I may use the expression, into the tension of the other flange. Any good work on mechanical engineering will explain this. At present I will refer your readers to Professor Perry's 'Practical Mechanics' (Cassell & Co.), where, in Chap. XI., they will find the statement that the neutral axis passes through the centre of gravity of the section of the beam; and what is more to the point, to Sir John Anderson's work on the 'Strength of Materials,' Chap. XII., where they will find the words: 'The neutral line is the part where holes for fixing other parts connected with the girder may be made with impunity.'"

**Washhand Stand.**—A. H. W. (*Newcastle-on-Tyne*) writes:—"I venture to send you a rough sketch of a washhand stand in the suite, the sight



Washhand Stand.

of which made me hope that in some of your numbers I should see a paper on simple artistic furniture. In my sketch I have not reproduced enough elegance, I know."

### II.—Questions Answered by Editor and Staff.

**Electric Belt.**—A. C. (*Burnley*).—Commencing at the left-hand end of your belt, as sketched, let the top dise be of copper, the next below it of zinc, the lower disc of copper, the lowest dise on the next row of zinc, the middle dise of copper, and the top one of zinc. This will form one battery of three pairs of elements in that section of the belt. Connect them in pairs, copper to zinc. Treat each section of the belt in the same manner. You will then have four batteries in one belt. You may adopt another arrangement, if you choose to do so, by having each alternate row of discs made of copper, and the other of zinc. I see no advantage, however, in your arrangement over that recommended to G. F. R. (*Woolwich*), p. 827, Vol. II. The current generated in your belt (if any) will be of low tension, owing to absence of outside discs. I should advise you to sew pieces of magnetised crinoline steel in the belt instead of the copper and zinc discs. Let the steel strips lie in the same direction as the whalebone, and cover them with flannel. A magnetic belt of this kind will do you as much good as an electric belt.—G. E. B.

**Magnet, etc.**—A. G. (*Sheffield*).—(1) The diameter of the magnet is not a point to cause much thought; it may be anything. I think I mentioned it in my article; if not, I have unconsciously omitted it: I meant to have stated ⅜ in. Get it that diameter, and you will be all right. (2) Where can the magnets, etc., be obtained? At the address given on the circular or any other electrical supply store. (3) I cannot give instructions here for making a transmitter like the one in the cut on the circular, for two reasons; the first being I do not know what kind of a transmitter the cut represents; the second being that it would require too much space—more than is available in this column. I have already given instructions in "Shop" for making a very reliable form of transmitter; and an article is in the Editor's hands, giving details of a switchboard and method of connecting up bells, etc. All the instruments can be joined up with one line wire. (4) About No. 28 wire will do for the line—about 1d. per yard.—W. D.

**Blocking Cards.**—Anxious.—There are several methods by which cards can be blocked with Dutch metal. You ask for a dry process. The most simple is the following: Get some common resin and pound it very fine; tie it up in a cotton rag, and dust it over the part where you want the metal to stick. Now, having heated your blocking press and stamp, take up a leaf of the metal and lay it over the stamp; place your card in the press, and block in the usual manner. It will be easier if you can take out the plate of the press readily upon which the stamp is fastened, and replace again. There are small presses for this class of work made and sold now by most makers. After the blocking has been done, the superfluous metal is dusted off with a piece of rag. Let your stamp be very hot.—G. C.

**Faulty Dynamo.**—T. S. (*Hull*).—You have not described the castings of the dynamo, so I am left to guess what it is. I suppose it to be of the Gramme type, but even now do not know its size, so can only guess this also. Readers asking advice respecting dynamos, must give full dimensions of the magnets and armature, and also describe the type of machine. I think you have enough wire on the fields and armature to give current equal to 30 c.-p., but not enough to send current through a lamp requiring 30 volts. Your lamp is a 30 volt 8 c.-p. lamp. If you connect the three lamps in one circuit in parallel, the resistance of the circuit will be reduced, and you will be able to light the three lamps where you have failed to light one. If you have room on the armature for a few more turns of wire, put them on, and balance this with about 200 yards more of wire on the fields. When amateurs find their machines going wrong, they should first write to the vendor of the machine or the maker of the castings.—G. E. B.

**Bicycle Building.**—J. S. (*Wimborne*).—A series of articles on Bicycle Building is running through the present volume (III.) of Work.

**Seal Gas Engine.**—Nemam.—The address of the maker of this engine is: J. Seal, 67, Carthew Road, Hammersmith, London, W.

**Incubator.**—Chick.—A description of an incubator appeared in "Shop," page 651, No. 41, Vol. I.; also an article on same in No. 89, Vol. II. On page 762, No. 99, Vol. II., you will find some remarks of mine on the subject; and on page 75, No. 109, Vol. III., some further remarks, with a description of a regulator. Get these four numbers from your bookseller, or the publishers will send them post free for five stamps. In the course of a week or two an article describing a "hot-air" incubator will be in the Editor's hands, and will doubtless appear in good time for you to prepare a machine for use next season. It is too late to think of commencing one for work this season.—Leghorn.

**Incubator.**—G. H. (*Hackney*).—See reply to Chick above.—Leghorn.

**Mending and Stopping Terra-Cotta.**—R. L. (*Ruabon*).—If R. L. has not tried shellac dissolved in spirit for mending, he should do so. For stopping cracks or faults, we presume that fresh, quick-setting plaster of Paris, with some of the terra-cotta pounded to dust to give the required colour, would suffice.—M. M.

**Duplex Telegraphing.**—R. B. (*Edinburgh*).—This subject must wait for an article. It would occupy too much space in "Shop."

**Purfling Gauge.**—H. McC. (*Kilmarnock*).—Refer to the advertisement columns in the last few numbers of Work, and you will find the address you require.—B.

**Xylonite.**—Tevot, A Fretworker, and others.—The address of the Xylonite Company is: The British Xylonite Company, Limited, 124, High Street, Homerton, E.

**Carpenters' Society.**—J. R. (*Kilmallock*).—We know of no branch to recommend.

**Toy Cylinder.**—Cylinder.—This is a question that can only be answered by describing the entire mechanism of a steam engine, for which there is not space in "Shop." If you will read the article now appearing on a Quarter Horse-Power Engine, you will obtain a complete answer to your query.—J.

**Drills.**—W. G. (*No Address*).—These drills will do very well if tempered a little harder. They go through brass, but I find they lose their edges on iron. But I do not see any advantage in using common umbrella ribs, when you can buy steel wire suitable for the purpose, wire that will temper better.—J.

**Galvanising, Enamelling, etc.**—Holly Reader.—It is not within the province of amateurs to enamel iron plates. It requires special and expensive plant and material.—R. A.

**Green Stain for Holly.**—P. O. C. (*Cork*).—This is usually made by dissolving verdigris in hot vinegar till the required shade is procured, or the crystals of verdigris in hot water. But the aniline dyes, as sold in packets or tubes for a few pence at most druggists and drysaltery stores, will be found to meet all requirements, if only a small quantity—say a quart—is needed, especially if a little vinegar is added as directed. It will be well to bear in mind that the hotter these stains are applied, the more deeply will they strike in.—Lifeboat.

**Accordion Reeds.**—H. C. (*Whetstone*).—As accordion reeds cannot be sharpened more than quarter tone, a new reed should certainly be fitted to the instrument. The method of tuning these is as follows:—To sharpen, file the reed thinner at the free or vibrating point; to flatten, thin it near the fixed end.—G

**Enamelled Paper Letters.**—A. J. R. (*Norwich*).—Beit's patent enamelled adhesive waterproof advertising paper letters and figures, in all colours and sizes, can be had from makers, 17, Arthur Street, New Oxford Street, W.C.—H. L. B.

**Case Hardening.**—C. T. & Co. (*London, E.C.*).—No process of "hardening" will make iron or steel rust proof; highly polishing it has a tendency to prevent rusting. If the goods are only required to be rust proof during transit, heat them a dull-red heat, and let them cool in the air, when a thin film of the insoluble black oxide is formed. If the goods are now brushed over with oil, they would travel ten times round the world without rusting. Galvanising iron or steel goods is about the best protection, and is largely being adopted for all exposed ironwork. I have often wondered why exposed ironwork is not more enamelled, as all kinds of shades and tints could be used, even transparent enamel. Such would last for ever, never want painting, and every shower would wash it clean.—J. H.

**Bookshelf for Bedroom.**—J. C. (*Halifax*).—A convenient form of bookshelf for the bedroom is the one herewith drawn. Its advantages are that it can be removed in an instant, and replaced elsewhere without leaving or causing any disfiguration to the wall. It is much to be preferred, for the use required of it, to a shelf supported by brackets; and, as is apparent, requires less labour in its construction. Again, the side strings form a kind of preventive against the books slipping off endways. A very small nail, driven into the wall at each end so as to allow its head to press against the end edge of the shelf, will retain it in its proper position; for without such an aid it would slip to the right or to the left, according to which side happened at the time to bear the most weight. You can see from Fig. 2 that it is merely a board supported by strings whose knots are underneath it, slung round large-headed nails.—J. S.

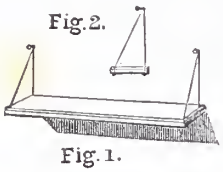
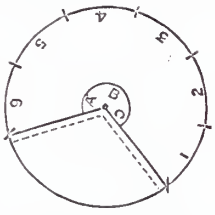


Fig. 1.

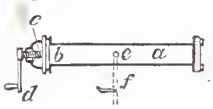
Bookshelf for Bedroom. Fig. 1.—Bookshelf in Perspective. Fig. 2.—End of Shelf in Elevation.

**Paraffin Bottles.**—BLACKSMITH.—You do not state what size bottle you want to make, so I here give you the sizes to cut the bodies of 1 qt., 2 qt., 4 qt., and 8 qt. I expect these will be as many as you will require: 1 qt., 13½ in. by 4⅜ in.; 2 qt., 19½ in. by 6⅜ in.; 4 qt., two pieces 11 in. by 7½ in.; 8 qt., two pieces 13¾ in. by 9¼ in. To cut out the tops, set your compasses at a radius of three-fourths of the diameter of the body, measuring from out to out of edge, and draw a circle; then set the compasses to *half* the diameter of the body measured as before. Set off six parts round the circle previously described, and draw lines to the centre; see sketch, which will explain it clearly. The dotted line shows allowance for seam about ½ in. each side. This is a rough method of getting at the pattern for the tops, but it gives fairly correct results.—R. A.




Pattern of Bottle Top—A B C, Small Circle for Neck of Bottle.

**Bending Tonkin Bamboos.**—J. W. P. (*Leeds*).—Probably our correspondent has no very complete apparatus for bending his bamboos, or we see no reason why he should have found difficulties with his tonkins. They bend readily from such a steamer as that shown in the annexed diagram. In this *a* is the receptacle for bamboo, etc.; *b* is its lid, which has an elastic washer, and is opened and closed by the screw *c*, worked by the winch *d*; *e* is a supply pipe from an engine boiler, which has a stop-cock at *f*. The strips of wood are placed in the receptacle, the lid screwed close, and the steam turned on. Ten minutes more or less may be required, according to its rigidity, to soften the wood sufficiently; the tonkins will need full time or perhaps super-heated steam. When the wood is softened, the steam is turned off; one man works the winch, and opens the lid just so far as to allow a second man to take out a strip, which he bends and wedges in place *instantly*, and so on till the whole are bent. But quickness of action is essential; a minute's delay may chill the wood and cause a breakage. Steam is mostly used to bend, dry heat to straighten.—S. W.




Steamer for Bamboo.

**Opaque Objects.**—F. B. (*Taunton*).—F. B. asks for a "liquid to make a dull black background for mounting microscope objects." The following will, I am sure, answer all F. B.'s requirements: Brunswick black mixed with a small quantity of a solution of indiarubber or mineral naphtha. This latter will prevent cracking. Place the slide on the turn-table, and make a central disc, having first warmed the glass. Give it two or three applications, if need be. Let the last coat be dry before another is applied. By repeating the operation on the edge, form the cell to the desired depth. Some mounters cement a disc of cardboard or black paper on the underside of the slide, in addition to the black cement, but if carefully done, I do not think there will be any need.—O. B.

**Ladies' Work-Table: Joints for Legs.**—J. J. A. (*Wandsworth Common*).—Connect columns to the middle and bottom boards of my Ladies' Work-Table and Escritoire (No. 56, Vol. II.) after some such manner as I hereafter illustrate. By preference, adopt my suggestions concerning middle board in Fig. 17, page 53, in the same number. You can then dowel it by means of three or more pins to the column blocks. For sufficient details dealing with dowelling, read my article, "Combined Music-Stand," etc. (No. 35, Vol. I.). An alternative

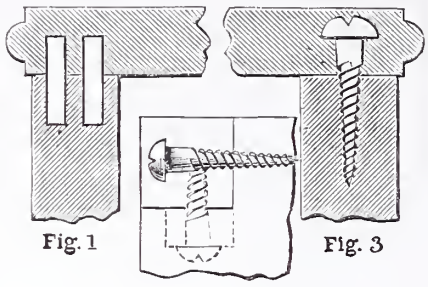


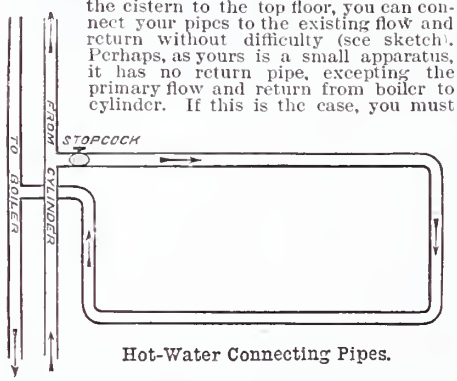
Fig. 1 Fig. 3

Fig. 2

Screws for Leg Joints.

method will be to secure both by utilising strong stout screws, as in section (Fig. 3). If, however, you desire to build the article exactly as it is shown in my drawings as complete, you must join the middle board in the same way that I am about to describe the junction of the bottom board with the pillars. You may have two stout dowel pins to one inner side of the column block, and have a stout screw passing through the remaining inner side; or drive a screw in as in Fig. 2, and insert a separate and rather small square of wood against the block, touching the underside of the bottom board, and there screw and glue it to all adjacent parts. Afterwards fill up all screw holes.—J. S.

**Hot-Water Service.**—RELAW.—If you remove the cistern to the top floor, you can connect your pipes to the existing flow and return without difficulty (see sketch). Perhaps, as yours is a small apparatus, it has no return pipe, excepting the primary flow and return from boiler to cylinder. If this is the case, you must




Hot-Water Connecting Pipes.

carry a return pipe from your coil into the side of the cylinder near the bottom, or you may carry it into the primary return from cylinder to boiler.—T. W.

**Lasts.**—S. T. (*No Address*).—(1) Evidently the last is out of range for the height of heel you wish to make. If it is not much, it can be counteracted by feathering the insole, and sewing close and full, as explained in answer to A. B. (see page 796, No. 101, Vol. II., of WORK); but the last being very bad, it must be remedied by altering its construction. The plain lines describing the lasts in Figs. 1, 2, and 3, are all the same; and it will be seen by Fig. 1 that it is somewhat dead, or flat in the waist. Well, by building a high heel, one lift above the other, without reducing them at the breast, will throw the heel out of range, as shown at A, B, and C (Fig. 1); and if they are reduced at the breast to give a better range, when the boot is worn, and the pressure of the foot put on D, it will press it down to the ground line, and again throw it out of range. To fit the last to prevent this there are two ways, and if the last fits anyone, and has still to have low heels made on them, it will be best to alter them in a way that they may quickly be brought back to their original shape with little trouble. For this, first take the measure of the last round the joint at A B (Fig. 2), and then peg a piece of leather—that has been wetted—on the bottom of the last from C to D and right across; skive the leather down, as shown by the dotted line at B, tapering to nothing at C and D, but making it more gradual from B to C than from B to D. Then rasp the wood away, as shown by the dotted line at A E, until it measures the same as when it was first measured. Then peg another piece of leather on the heel. Let it be quite thick at F, and tapered to nil at G; a little can be taken off the wood at H the other way, and if they are to be used for high heels only, it will be the best. Rasp a piece off the bottom at the toe, from A to B (Fig. 3), as shown by the dotted line, and also from C to D, taking it away most at E, and then this deficiency can be made up at F and G with leather. The plans of the two bottoms are given in Fig. 4, to contrast the pitches of the same heel on the two different lasts. (2) Yes; the insole of pegged boots should be made broad, and thinned down at the edge, but it should be left its original substance where the pegs are going. To bring the range right for pegged work (as it cannot be feathered and sewn full to set it right), it must have a wedge-lift pegged to the insole, before lasting (as A, Fig. 5). This is done to have the same effect as produced by altering the last, only that it is left in the boot where it is not seen. It need not be a whole lift—a split lift will do—but it must be thick at A. But I would advise you to alter the last as much for one as the other. (3) A split lift is put in, in building the heel of sewn boots, to level the seat (to receive the whole lifts), which would otherwise be round in the centre, and necessitate cutting the centre away, and making a part of the boot weak that should be most solid. (4) If you are making light pegged work, the "slip" sole

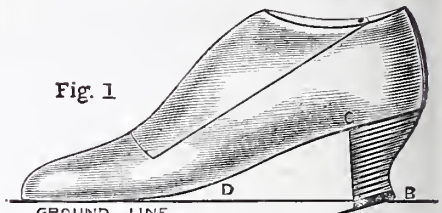



Fig. 1

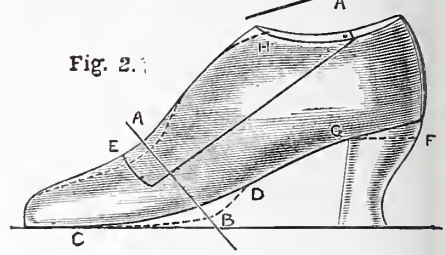



Fig. 2.

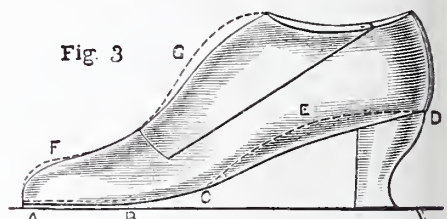



Fig. 3

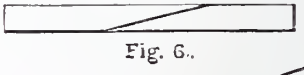


Fig. 6.

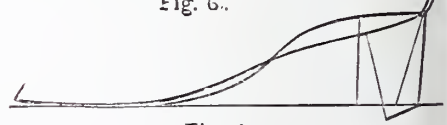


Fig. 4.

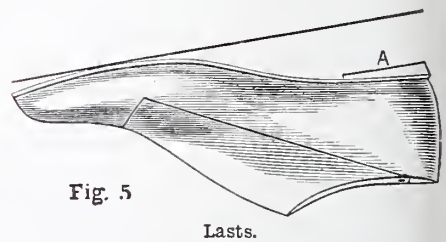



Fig. 5

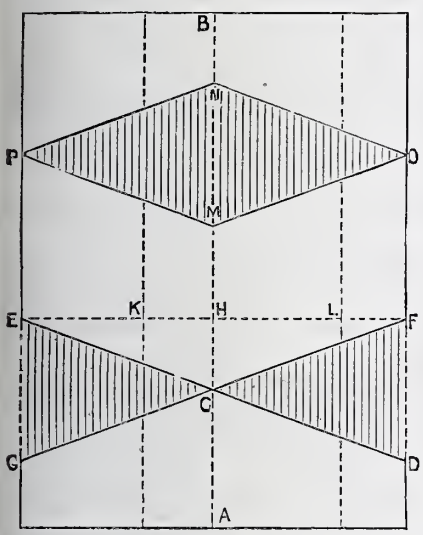
Lasts.

(or middle sole) need not be a sole at all, but simply a runner. Measure the forepart from joint to joint, and cut a piece of leather the length, and about 1½ in. wide. Split this down the centre as you would a split lift, letting the cut be only ½ in. wide (as Fig. 6); this will give ¼ in. each side of solid stuff to peg through. Skive it a little wider and thinner at the toe, that you may get it round smoother. It should be a firm piece of leather (first cut is best); it can be any substance you like. Hammer it, peg it on, cut the pegs off, and skive it down to what you like towards the centre; fill the bottom up in the ordinary way. By this means you have it as flat or round as you choose. No matter how broad the bottoms are to be, the pegs must be sufficiently far enough from the edge to let them go well through the insole—quite ⅛ in. from the edge of it. You will find it best to slant the edge with an ordinary knife, but be very careful not to cut the upper. Hold the piece you are cutting away in the left hand, and keep twisting it between the thumb and finger, and only use the extreme point of the knife, guided by the second finger of the right hand. The forepart iron will do, as for sewn boots. (5) To

hole the soles of pumps, use a sewing awl—the one you are going to sew with, or one a shade larger will do. (6) A welt iron is used for the welt side of the edge, while a forepart iron is used for the sole side; or in other words, a double iron is a welt and forepart iron combined, but a more superior piece of kit, and much harder to learn to use. (7) For bevel work the welt should be thin before sewing in. It is the sole that needs to be bevelled to fit the iron. To fit all leathers before using them for their varied purposes is most essential in all parts of boot making.—W. G.

**Filling Lamps—Erratum.**—(See page 93, No. 110.) In line 16, the word "specimen" should be *specification*.

**Junction for Rain-Water Down Pipe.**—J. G. (*Glasgow*).—You have sent, as you say, a half full size model of a rain-water down pipe, 4 in. by 2 in. outside measure, for front of building, intended to go over a return plinth, with 3 in. projection and 3 in. rise. You say that "the block on which it" (your model) "rests shows the rule-of-thumb way we take to get the proper bevel of joints, keeping the centre piece long enough, and by repeated trials arriving at the right thing. This is very unsatisfactory, and takes a long time." Now, what you wish me to do is to show you how to mark out the three portions of piping corresponding with the three pieces of wood, of which your model is formed, accurately and proportionally on a plane surface. This I have done on a scale of one-sixth size in the annexed diagram, and if you mark it out on a piece of zinc, making allowance for overlapping parts beyond the outlines of the three pieces necessary




**Pattern on Flat Surface for Rain-Water Down Pipe to go over Return Plinth, with 3 in. Projection and 3 in. Rise.**

for joining them together, which you, as a practical workman, know how to do, you will arrive at once at the desired result, without any rule-of-thumb trials. First of all, set out on the zinc a central line, and in it take a point C; through this point draw two straight lines, D E, F G, making the angles D C A, B C E, and A C G, F C B respectively, with the line A B. These four angles are angles of 70°, and must be set out in relation to A B with a protractor. Figures in pencil on your model, verified by actual measurement, show that these angles are angles of 70°, but you and others must understand that this angle is not a fixed quantity, but will vary according to the dimensions of the rise and projection over which the pipe may have to pass. Having drawn the straight lines D E and F G through C at the proper inclination to A B, the rest is easy. Draw a straight line from F to E at right angles to A B, and cutting A B in H, and from H set out along this line H K = 2 in., K E = 4 in., and H L = 4 in., L F = 2 in. Through the points K E, L F, draw, parallel to A B, the vertical lines shown in the diagram as passing through these points respectively. The dotted lines through the points L, H, K, show where the zinc is to be bent to form the parts of the pipe. Set out from C, along C B, C M = about 5½ in., and through M draw M P, parallel to C E, and M O parallel to C F. Again, through P draw P N, parallel to C F or M O, and through O draw O N, parallel to C E or M P. Cut out the shaded triangles D C F and G C E, and the shaded equal-sided part O M P N, called in mathematics a rhomb, or rhombus. When the three parts that are left are joined up, and their edges brought into contact, you will find that you have arrived at your junction for rain-water down pipe without much trouble, and no needless waste. Possibly, to some people, this may seem a very long-winded reply, but all plumbers and zinc-workers will know that it is nothing of the sort. Moreover, it is no use whatever to attempt to give a reply on a matter of this kind to a practical man who has been accustomed to work by rule-of-thumb, unless you put it in such a way as will make it perfectly clear to his comprehension. I have said nothing about the horizontal lines passing through A and B. They merely define the extent of the upper and lower pieces in accordance with your model, but practical men will recognise that the limits which they represent may be determined at any length from C and N as may be necessary.—ED.

**Cracked Saw.**—R. W. A. (*London, W.C.*).—The little inequality in the wood should not have caused your accident. You ask whether it is best to break the saw off or to braze it. To break or to try to break it off would be folly, and to braze it you would have to cut the piece straight across first, and then have both ends filed to a bevel before brazing, which would not only reduce the length of the saw, but would spoil the temper for a certain distance, and perhaps render it useless. You did not say how far the crack is from the point. You say it is 2 in.; therefore I judge it to be 2 in. *in length;* but if the crack is not more than 2 in. from the point, and your saw is 28 in. long, should you cut the piece off it will be then the length of an ordinary hand-saw; and if the crack is a little further up from the point, my advice is to cut it off and file the point square, and you will find it useful for some work, and in its place lay out a shilling or two more than you gave for it, and get a good saw. Now, there is a right and a wrong way in cutting off a piece from a saw. If you are not careful, you may ruin your saw. First get a wide chisel in the form of Fig. 1, and grind to an obtuse angle (as shown in Fig. 2), and temper it very hard. Then place the saw on the anvil, with the handle towards you, and the point from you. Take the chisel (holding it straight across the saw, with the head slightly inclined towards you), and strike a blow with a fairly heavy hammer; then move the chisel, and strike another blow, not too heavy, just making a mark with the chisel across the plate. Then go over the same spot again, striking the chisel pretty smartly, taking care to hold the head of chisel a little towards you, or you may get a serious crack or flaw in the plate, and your saw will be of no use. After the piece is off, file the end, and it will not be perceived whether the saw has been cut.—A. R.

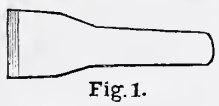


Fig. 1.

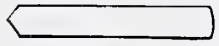
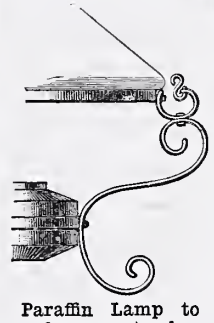


Fig 2.

**Fig. 1.—Wide Chisel.**
**Fig. 2.—Ground Angle.**

**Paraffin Lamps.**—W. W. (*Eastbourne*).—Half in. by ⅛ in. flat wire is strong enough. Have you seen the lamps on p. 696, Vol. II., of WORK? They are made to hang or stand. As sketched, your lamps would be top-heavy. If you do not want to use castings as shown on p. 696, why not shape the side supports as I show in the figure herewith? The piece into which the S hook is inserted is riveted or screwed to the rest of the support, and is thus much more secure than you show in your sketch, in which, apparently, you intend soldering a piece on. Do not put curves of too small a radius, or the metal may break, notwithstanding you may have softened it by heating. To bend it, use, if possible, the tool used by smiths for a similar purpose, which is shaped something like a tuning fork, with short, thick, round prongs sufficiently wide apart to admit the metal to be bent. It is fixed in the hole in the anvil or in the vice, or held in the hand and used as a wrench. If you cannot obtain it or a makeshift substitute, bend the wire over anything round by means of a mallet. Whatever is used to bend, it must not have sharp edges where the metal touches, or nice curves will be impossible. You must give up your evident idea of lifting the lamp with one hand. It is too large for that. If you use hard solder there will be no need to hammer-harden the metal afterwards.—THOMASO.



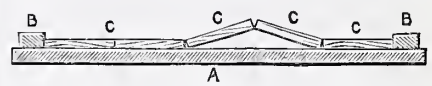
**Paraffin Lamp to hang or stand.**

**Banjo Tailpiece.**—G. C. (*Waltham Cross*).—If you wish to make money out of a patent, it must be something in advance of anything at present in use; if not, instead of being in pocket you will be considerably out of pocket by it. Again, if your article is good, and you can see a chance of making some money with it, patent it yourself. Do not take it to someone, and ask them to buy it from you before patenting it.—J. G. W.

**Violin Varnish.**—W. G. (*Derby*).—The violin must not be stained; the varnish itself should contain the colour. Following the papers on violin making, the subject of violin varnishing will be treated as concisely as possible. I think that anyone requiring only a small quantity of varnish—say, as much as would be required for two or three instruments—would be well advised to buy, rather than make, the varnish. I am at present experimenting with a varnish which is, or will be, in the market, and it gives promise of being successful. As the essential oil of turpentine, which will be the solvent of the gums required for the varnish, does not take up colour in sufficient quantity, it will be necessary to use alcohol as a means of charging the oil with colour. Make a saturated solution of sandal-wood, or any desired colour, and concentrate this solution, by evaporation, to half its original bulk. Mix this concentrated solution with oxidised essential oil of turpentine, and evaporate all the spirit in a water-bath. As alcohol evaporates before reaching the boiling point of water, it will not be necessary for the water to boil. When the little bubbles cease to rise, the spirit will have gone, and the colour will remain in the essential oil. To every ¾ gill of coloured essence, 5½ dr. of mastic tears, 3 dr. of dammar, 5½ dr. of raw linseed oil, and 5½ dr. of roughly-powdered glass; the latter is added to prevent the gums from adhering to the vessel. First put in the mastic, which will take twenty-four or thirty hours to dissolve. Then add the dammar, reduced to powder; this will take about the same length of time. Shake the bottle two or three times a day. Afterwards add the linseed oil; shake a little, and the varnish is made. Let it rest a week or two, and then filter through fine cotton or filter-paper. It must not be used for six or eight months.—B.

**Double Bass.**—BASSO.—A double bass is only a big fiddle, and the materials and method of making are necessarily the same for both, the dimensions only being different. By all means try your hand at fiddle-making before commencing to make a bass. The work is very heavy, the models very cumbrous; and for one instrument the cost in time and materials would run up to something like £20.—B.

**Cramps.**—L. M. (*Lee, Kent*).—The best plan for you to adopt is to plane the edges of the boards accurately; neither cramp nor anything else will make bad joints good ones. Obtain a flat board, larger than your work; on the side, close to the edge, fix firmly a strip of wood; lay the prepared wood on the board, close to the strip; mark the width on the board, and fix another strip, say, ⅛ of an inch nearer to the first strip. You can now, by putting down the outer edges of your boards in contact with the fixed strips, force every joint into close contact by pressing on the boards thus:—




**Cramp Boards.**

When the joints are glued, leave a weight on the boards to prevent the middle rising again. Some precaution is needed to prevent the glue fixing the whole affair together. Some grease or soap will do, but my plan is to lay a strip of paper where each joint will be, and it answers the purpose with little trouble. This mode of gluing is excellent for panels and similar work. L. M. had better get the back numbers in preference to investing in second-hand wooden cramps, as new ones are cheap enough, and there are many hints on cage-making in previous numbers.—B. A. B.

**Colours for Cornice.**—GRADUATE.—The "peculiarity" of distemper colours in drying much lighter is scarcely a thing peculiar to that process of work. If a dry colour is saturated with any colourless liquid, water or oil, the difference is about the same; with *tempera* work, however, we get back the original colour, because the water evaporates off, whereas the oil remains in the form of a semi-transparent film. Flatting paint would to a certain extent meet the case, but even the action of the turpentine evaporating makes an appreciable difference between the colours in the pot and when dry. As, however, flatting should be used almost as a wash, the previous coating, or ground, as it is termed, has to be coloured with a view to assisting the final colour—opacity cannot be ensured by flatting paint alone. Even pure powdered pigments, when used with water or size, undergo the same change. Body colours, as you term them, are simply finely-ground pigments, having sufficient gum or other binding power already added, to dispense with using glue or size. There is no doubt the tints of alabastine, made by the Church Manufacturing Company, would answer your purpose. Were the Company to find a demand for, say, 2 lb. packages for tinting and gesso-work, they would soon meet it. Write for all particulars to 127, Pomeroy Street, London, S.E.—DECORATOR.

**Cleaning a Fox-Skin Carriage Rug.**—A. B. (*Nottingham*).—Take newly-made bran, warm it in a pan over the fire—stirring all the time to prevent burning—and having spread the rug as straight and flat as possible on a table, rub the hot bran well into it for some time. When the fur is sufficiently cleaned, shake and brush the bran out. The cleaning will be done most effectually if the lining and stuffing are first removed. Another way is by moistening bran with hot water, and rubbing it into the fur with a piece of clean flannel; then drying the fur with dry bran and a dry, clean flannel.—M. M.

**Iron Trade Work.**—ONE IN TROUBLE!—I should say: Stick to the fitting. You must allow yourself six or seven years to learn it, instead of two and a half. A good fitter can always be sure of regular and remunerative work. The union will be glad to admit you to membership as soon as you can earn the average wages of the district in which you happen to reside; but not otherwise. It is not

necessary that you should belong to the union in order to obtain a situation.—J.

**Galvanising.**—J. P. (*Handforth*).—Galvanising is a somewhat similar process to tinning; in fact, the only difference is that the articles are dipped in a bath of molten zinc instead of tin. To prepare them for galvanising, the goods are first "pickled" in a tank of sulphuric, or sulphuric and hydrochloric acids mixed, and diluted with water. To quicken the action of this, it is often heated by steam-pipes. When sufficiently clean, they are dipped in killed spirits of salts, and then dipped in the molten zinc, which is covered with a layer of sal-ammoniac. For small things—such as nails, staples, etc.—a sort of cage must be used to dip them in.—R. A.

**Lacquering Brass.**—BRASS.—The address you require for lacquers, etc., is the Frederic Crane Chemical Co., 22, Newhall Hill, Birmingham. Charles Harrop, Esq., is the manager.—R. A.

**Walnut Stain and French Polish.**—W. H. P. (*Birmingham*).—The best French polish for your purpose will be that made by dissolving about 6 oz. of best orange shellac in 1 pint of methylated spirit. A good walnut stain is made as follows: ½ lb. American potash, one pennyworth vandyke brown, one pennyworth nut-galls, a little brown umber, and one gallon of hot water. I strongly advise you not to take your first lessons in polishing on your bookcase; rather try your hand on some plain, flat surface. You will then be enabled to do your bookcase with far more satisfaction to yourself.—LIFEBOAT.

**Varnishing.**—X. Y. Z.—The loss of brilliancy in the varnish might arise from many different causes. I should not think the fault was in the varnish. You should speak to the traveller about it, and hear what he has to say, if you have not already done so. Sometimes it is in the varnish, it being too new; and, on the other hand, using the bottoms or last of the varnish, in which the driers have settled; by standing, this would be likely to cause the trouble. Then, again, the varnish not being sufficiently hard when the carriage is first used; or standing near a manure heap, when the ammonia from the stables will very soon take the brilliancy off the varnish. In many cases the coachman is in fault in washing the carriage instead of sluicing the mud off *whilst it is wet*. Many will leave it till the morning, when it has dried on; then they take the spoke-brush or sponge, and scrub and scour away to get it off; the consequence is, they flat off all the face of the varnish: then the blame falls on to the painter's shoulders. But we must not entirely blame the coachman, as there are some who are very careful in washing off wet mud. I understand you give the vehicle three coats of colour: first, priming, and second of ground colour. You mix them with boiled oil and turps, and sugar-of-lead for driers—you do not give proportions—then two coats of varnish. If you use boiled oil in the first coat of ground-colour you should not use it in the second; that should be mixed with varnish and turps and linseed oil. Sugar-of-lead driers should be used very sparingly. Here seems the cause of mischief. You will seldom find two painters work alike; they each have a different method of working or colour mixing and painting. I would suggest you try the following method, by which I have always found good results, using Noble's or Hoare's and other makers' varnishes. If it is an old vehicle to be repainted, clean off thoroughly with soda and water, touch in all the bare places with lead colour to keep the wet out while you are rubbing down, then rub all the cracks out with pumice-stone and water in the usual way; then paint with a coat of lead colour. This should be mixed thus:—One-third linseed oil to two of turps, mixed with patent driers —½ lb. to a little lampblack, and 3 lbs. of white lead. "Stop up," face off, and sand-paper down in the usual way. The ground or body colour is made with one-third linseed oil to two of turps, and half the quantity of coach-makers' gold size to that of the oil. Second coat is made with no oil; mix body colour with turps and hard carriage varnish in equal parts. Third is a coat of glaze or varnish colour. Now two coats of varnish are laid on—one flatting varnish, the second finishing. This should be a full coat. Let it stand for three or four days before using the carriage. The under coating, or flatting varnish, should be of the same maker's, as varnish of different makers will not always agree, and the best grade finishing varnish cannot impart its wearing quality to worthless under-coating varnish. Are you quite sure your "filling-up" stuff is made properly, and free from red lead? The sum of my suggestions is: never use boiled oil—it is often made up of the worst of oil and driers, only fit to paint fences with, not carriages. Be sparing of driers, as they are corrosive in their action on oils and varnish. Gold-size contains a considerable amount of driers —*i.e.*, sugar-of-lead, sulphate of copper, etc. Turps is a vegetable drier in its action, and always safe to use when mixed with varnish; it should be done while both are warm, to make them blend thoroughly. Give plenty of time for each coat to dry before applying a second coat. Keep the paint-loft at an even temperature, free from draughts, dust, and damp. Remember, water solidifies the surface of varnish; and by washing off the vehicle when varnished, you ensure a hard, lustrous surface, to stand better the action of mud and manure, and the scrubbings to clean off dry mud.—J. C. K.

**Carved Oak Cabinet.**—X. L. U. MAY (*Hebden Bridge, Yorkshire*).—I congratulate you on having made so handsome a piece of furniture from an old oak chest. As the name you give seems to me to be a *nom de plume*, I retain your drawing, until I hear from you again.—ED.

**Razors.**—H. S. (*Oxford*).—If H. S. will refer to Volume II., No. 100, page 782 of "Shop," he will find an article on "How to Set a Razor;" and by reference to Volume III., No. 105, page 7, he will find a short account of "How to Strop a Razor." These two combined will give him, I think, all the information he desires on that subject.—P. B. H.

**Electric Signalling.**—J. H. (*Leigh*).—Electric signalling is generally performed by the telegraph. You will find a popular account of this in Cassell's "Popular Educator." Electric signals may also be made with electric bells; and a system for doing this, arranged by myself, is clearly explained in Mr. Bottone's book, "Electric Bells and all about Them," post free for 3s. from the author, Mr. Bottone, Wallington, Surrey.—G. E. B.

**Corrosive Sublimate.**—AMATEUR TINKER (*St. Austell*).—Corrosive sublimate is sometimes sold under the name of chloride of mercury, sometimes under the name of perchloride of mercury, and sometimes as bichloride of mercury. It may be distinguished from the other chloride of mercury by being soluble in water—1 part of corrosive sublimate being soluble in 16 parts of water—and this forms a saturated solution, as mentioned on p. 714, Vol. II., of WORK. If you get 1 oz. of the corrosive sublimate, and dissolve it in 16 oz. of cold water, it will form a saturated solution. The subchloride of mercury (calomel) is not soluble in water. Corrosive sublimate is a virulent poison.—G. E. B.

**The Praxinoscope.**—A. H. (*Oldham*) thinks that to have the construction of this instrument described would be of interest to the readers of WORK. I could give such a description as he suggests, but I should not be justified in so doing, nor would the readers be justified in working from my description, as M. Reynaud, of Paris, the inventor of the praxinoscope, has patented it in this country. A. H. also asks where pictures for it are to be obtained. He might try the Scientific Toy and General Novelty Co., 14, Cross Street, E.C. Some time since, the shop of Messrs. H. G. Clark & Co., Garrick Street, W.C., was a good place for such matters, but I am under the impression that they are not now at that address.—M. M.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Coal Box.**—W. J. D. (*Earlswood*) writes:—"Will H. B. (*Haydon Bridge*) kindly give dimensions for constructing a coal box to hold a sack (2 cwt.) of coals, as shown in his design, No. 109, Vol. III., page 75?"

[As the plan of one has already been given, W. J. D. should be able to construct a box to suit his own requirements. "Shop" space is too valuable to go on duplicating designs.]

**Model Electric Lights.**—J. H. (*Wolverhampton*) writes:—"Will Mr. Bonney or some reader of WORK kindly tell me where I can obtain the carbon plates for model electric lights, as described in WORK of Nov. 29, 1890; also, if possible, the cost of them?"

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Turned Balusters.**—H. (*London, N.*) writes, in reply to F. E. H. (*Lancaster*) (see page 158, Vol. III.):—"The following dealer will supply T. E. H. with price-list of turned, square, and spiral balusters, etc. Address, H. R. Mace, Ekman's Wharf, 33, Wharf Road, City Road, N."

**Petroleum Motors.**—M. (*Bishop Auckland*) writes, in reply to CONSTANT READER (see page 142, Vol. III.):—"These are worked by ordinary petroleum, require no attention while in operation, and can be stopped immediately. As compared with gas engines, they require less cleaning, the valves running for months without cleaning or attention. If you apply to Messrs. Priestman Bros., Holderness Foundry, Hull, they will give you all particulars, being the licensees and manufacturers."

**Cotton Belting.**—J. N. (*York*) writes, in reply to S. A. & Co. (*Stockport*) (see page 158, Vol. III.):—"I have had cotton ropes that run at 56 ft. per minute, and I send him the following recipe: 3 lbs. of tallow, 2½ lbs. black-lead, ¼ lb. beeswax. If a little more grip is required, then add more wax."

**Glossy Ticket Ink.**—W. E. B. (*Peel Causeway*) writes, in reply to A. H. (*Oldham*) (see page 158, Vol. III.):—"The above-mentioned ink can be obtained from Messrs. Brodie & Middleton, 79, Long Acre, London. Red, 6d. per bottle; black, 6d. per bottle; per parcels post, 4½d. extra on each bottle, or on a bottle of each 6d. in all. This ink writes easily, and dries quickly and glossy."

**Fire Balloons.**—H. R. JONES (45, *Barking Road, Canning Town, E.*) writes, in sequence to T. S. (see page 134, Vol. III.), that he is one of the largest fire balloon makers, and that he sells balloons to carry fireworks or parachutes.

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—THE ARTISTS' ALLIANCE; FRETWORK; PUZZLED; F. W. B. (*Huddersfield*); F. W. J. (*Fulham, S.W.*); J. MCN. (*Glasgow*); LONG READER; INQUIRER; HALF-TONE; J. T. N. (*London, N.*); A NEW SUBSCRIBER; JEAN; J. R. M. (*Peckham*); APPRENTICE; J. G. P. (*Woolwich*); F. S. (*Normanton*); B. A. W. (*Croydon*); J. M. (*Manchester*); J. B. (*Salford*); BANJO SLOGGER; A. R. (*Scorrier*); E. W. (*London, W.C.*); G. B. (*Edinburgh*); R. W. (*Bradford*); SILVERSMITH; T. M. (*Birmingham*); L. S. L. (*No Address*); G. B. (*Walthamstow*); C. P. (*Crowborough*); H. J. M. (*Bristol*); T. T. & SONS (*Cardiff*).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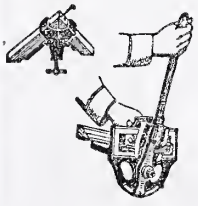

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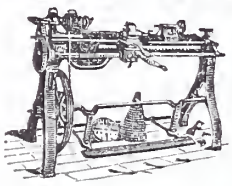

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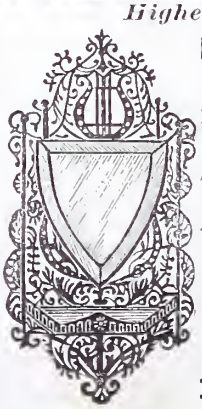

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 121.] SATURDAY, JULY 11, 1891. [PRICE ONE PENNY.

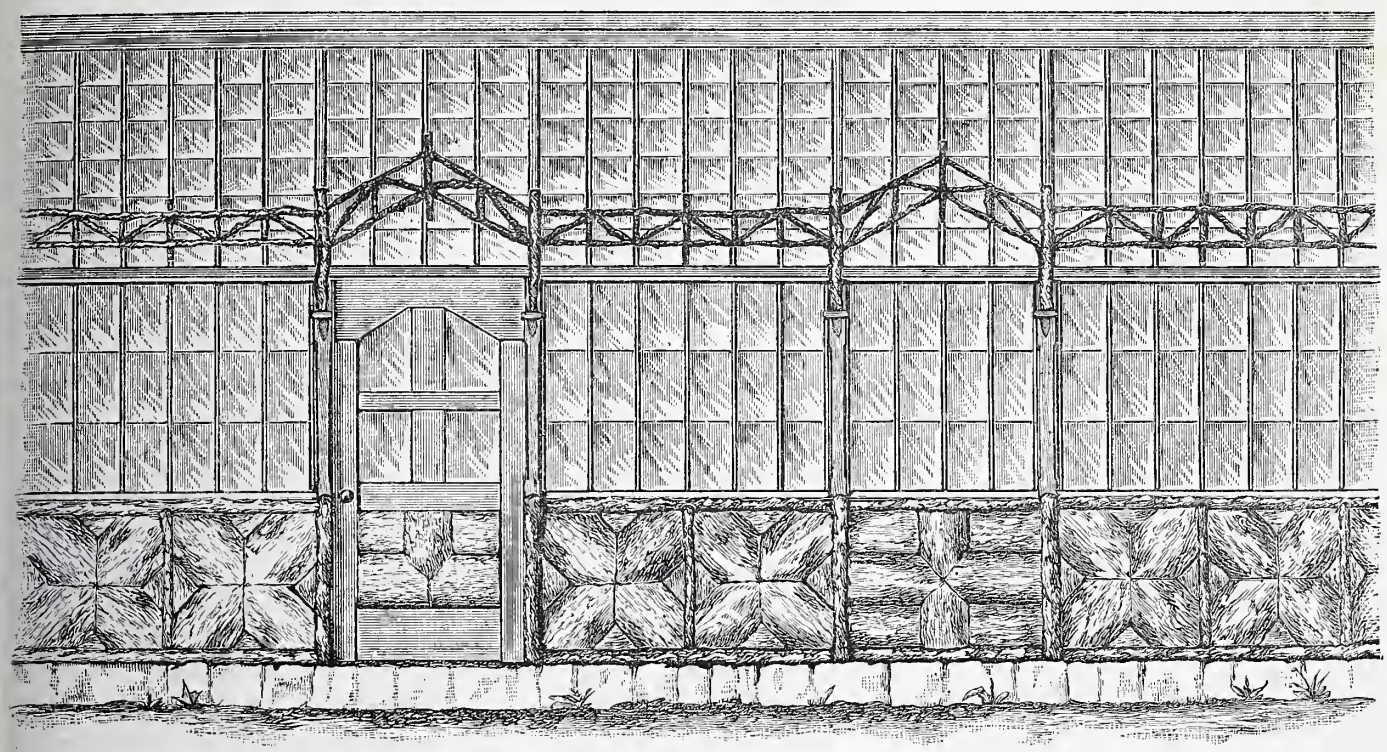


Fig. 1.—Front Elevation of Glazed Rustic Verandah, to be utilised for Grape Culture.

## A GLAZED RUSTIC VERANDAH, TO BE UTILISED FOR GRAPE CULTURE.

BY ARTHUR YORKE.

THE APPLICATION OF RUSTIC-WORK TO GLASS HOUSES — MATERIALS — CONSTRUCTION AND ORNAMENTATION.

*The Application of Rustic-Work to Glass Houses.*—It has been asserted by some who consider themselves authorities in matters of taste that nothing of the nature of a greenhouse ever harmonises with natural surroundings, or is otherwise than an eyesore in a garden in other respects beautiful. This, though rather sweeping, must be admitted to have a certain amount of truth in it. We are all agreed as to the utility of such buildings, and habit has in some sort deadened our perceptions as to their looks; but it must be owned that the hard, straight lines of wood or metal, and wide surfaces of shining glass, are not pleasing, and are too suggestive of the shop and factory to accord well with natural objects; nor have the attempts made to render glass houses ornamental been, as yet, attended with much success.

It has been suggested that the difficulty might be overcome by combining rustic-work with glass. This, at the first glance, looks like a thing which might easily be done; but, on consideration, it will be seen to be otherwise. Rustic carpentry is in its nature irregular, and cannot be brought to those level planes and straight lines essential to glass-work; whilst for interiors, and especially those of houses intended for vines, rough bark-covered surfaces afford too much shelter to insect pests—so that, in reality, rustic-work can only be made applicable to a very limited extent. In the grape-growing verandah before us, therefore, I have introduced a limited amount of rustic-work only, and that on the outside, leaving all within to the plane and the paint-brush.

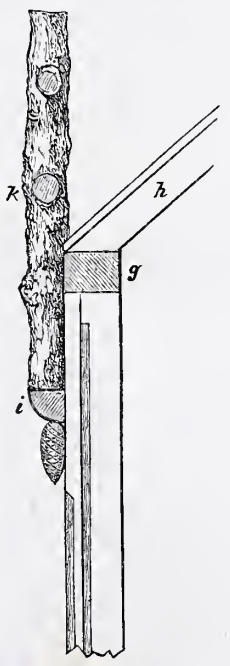



Fig. 3.—Top of Post (side view).

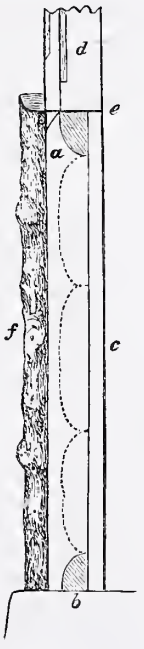



Fig. 2.—Bottom of Post (side view).

*Materials.*—Such of the materials as are of a rustic kind are, for the parapet and uprights, some rather small larch poles or other tolerably straight round stuff, and for the panels, some of those "slabs," or rough outside planks, of which fuller mention was made in my recent paper, "A Model Rustic Tool-house" (page 225). As to the posts, and such parts as are not rustic, they are supposed to be of good deal. The sash-bars, which carry the glass both in roof and walls, are to be bought struck by steam at a lower price than they can be worked by hand, or sashes may be bought ready glazed. For glazing work of this kind, 16 oz., or sometimes 20 oz.,

glass is used, the former, I believe, being generally thought sufficient.

*Construction and Ornamentation.*—As in the design recently given for an open rustic verandah, it is intended that the collar-posts should be set upon and dowelled into a raised platform of masonry. The present structure is, of course, intended for the warmer sides of a house, south or west. The width, to meet particular cases, can be varied, but is, according to the drawings, 4½ ft. The posts are 6 ft. high and 3½ in. square. They are set with spaces between them alternately of 3 ft. and 4½ ft. On their tops rests a wall-plate of the same width as themselves, and 2½ in. deep. The rafters, which are sash-bars rebated to carry the glass, rest on this wall-plate, and against a second vertical one fixed to the house wall.

Fig. 1 is a front elevation of a portion of the verandah, whilst Fig. 2 gives a side view of the lower half of one of the collar-posts. At *a*, in Fig. 2, is seen the section of the upper cross-rail, which has its top 2½ ft. from the ground; at *b* is the lower cross-rail, or sill. Both are of quartered rough stuff, and are mortised to the post ¾ in. from its inner edge, so that when the ¾ in. boarding, *c*, is nailed against them, it will come flush with the inner side of the post. At *d* is indicated the sash-frame, with its rebate for glass, which occupies the upper part of the opening; and at *e* is a metal flashing between rail and sash to throw off rain. It is proposed that the sashes in the narrower openings only should be made to push outwards at bottom for ventilation. At *f* is a piece of halved rough stuff nailed to the front of the post.

The panels, which occupy the lower part of the space between the collar-posts, are filled with pieces of rough plank or "slab," as shown in Fig. 1. These pieces should wear their natural bark as far as possible; they are nailed to the inner boarding.

In Fig. 3 the upper part of a post is in like manner shown in profile: *g* is the wall-plate in section, and *h* is the lower end of a rafter. At *i* will be observed a strip of quartered stuff nailed across the post (with a fir-cone bradded beneath it), which gives a starting-point to the upright *k*, by which the openwork rustic parapet is supported. These uprights are of small round stuff, slightly flattened on the side towards the post. The openwork parapet is too plainly figured to need description; it is intended to break to a certain extent the straight lines, and partially to conceal the glass-work of the roof, without seriously interfering with sunshine.

So much of the planed wood-work as shows outside should be painted of a good brown, to assimilate with the rustic-work; in the interior the time-honoured white or drab paint will probably hold its place. But internal arrangement—and, indeed, everything which is purely greenhouse construction—is beyond my province, such matters having already been ably treated in WORK. (See the Articles at p. 177, Vol. I., etc., to which I refer the reader.)

Of the illustrations, Fig. 1 is drawn ½ in. to the foot, whilst Figs. 2 and 3 are on a 1 in. scale. Of course it must be borne in mind that these are somewhat small for practical work, and that the reader, before he begins to carry out the idea, should make a working drawing on a larger scale, after having made such modifications in the structure as circumstances may suggest as being desirable.

## HOW TO MAKE DRAWERS SLIDE EASILY AND TRUE.

BY E. W.

DRAWERS THAT JAM AND THE CAUSE OF JAMMING—IRREGULAR AND UNUSUAL SHAPES—HOW TO OVERCOME THE DIFFICULTIES ARISING FROM UNFAVOURABLE PROPORTIONS OR IRREGULARITY OF FORM.

*Drawers that Jam and the Cause of Jamming.*—Everybody knows how troublesome some drawers are to move in or out; they seem as if endowed with a prodigious amount of mechanical perversity; first they jam at one end, and then at the other, occasioning at times considerable exasperation of spirit, and I fear that not a few regretable outbursts of profanity may be traced to this cause. It will almost invariably be found that the drawers that give so much trouble have fronts that are long in proportion to the length of the sides, though at times the trouble is wholly, or partly, due to the particular form of the drawer. In well-made and well-fitted drawers, the liability to jam is not so great as with those loosely

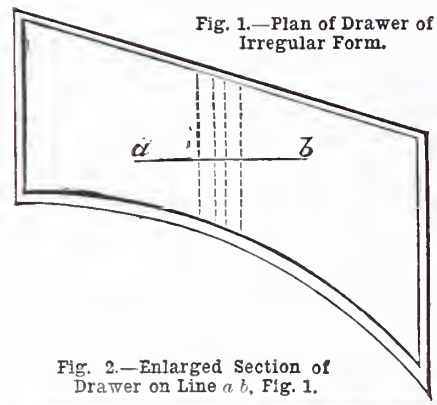



Fig. 1.—Plan of Drawer of Irregular Form.

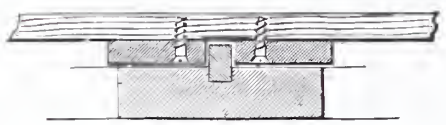


Fig. 2.—Enlarged Section of Drawer on Line *a b*, Fig. 1.

thrown together to sell; but however well made and fitted, drawers of the character referred to are very apt to stick fast by jamming endways, if unequal opening or closing force be applied at the two ends, especially so when the drawer has been drawn well out and but a small portion is within the case. This difficulty may easily be got over by a very simple device that I have found to work well, and that deserves to be generally known.

*Irregular and Unusual Shapes.*—Fig. 1 is the plan of a drawer I once had to make for a circular corner of a counter, and this, it will be seen at a glance, is of a form that, under ordinary circumstances, would prove a continual source of annoyance to those whose lot it would be to use it. It was this case that led me to specially consider the conditions necessary to secure free and easy running of drawers in particular, and sliding bodies in general, and finally to the adoption of the following method of treatment for all drawers of troublesome form or proportion.

*How to Overcome the Difficulty.*—Across the bottom of the drawer, from front to back, and parallel to the sides, a narrow groove is formed, that may be in any convenient position, but preferably in mid-length, and such that a hardwood tongue or fillet, fixed to a transverse rail of the framework below the drawer, can freely slide therein.

The drawer, Fig. 1, was joiner-made, and consequently minus the centre rail in bottom that a cabinet-maker would in this case have put, and wherein a groove might with advantage have been ploughed. A couple of fillets were, therefore, glued and screwed to the bottom, as shown by the dotted lines, Fig. 1, and the enlarged section at *a b*, Fig. 2. This answered admirably, and made the drawer the nicest working one in the whole place.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### BORING THE CYLINDER.

DESCRIPTION OF WORKING DRAWINGS—MAKING THE BORING-BAR AND CUTTER—FIXING CYLINDER CASTING ON SADDLE—SPEED AND FEED—OTHER WAYS OF BORING—TURNING THE FLANGES AND ENLARGING THE ENDS OF BORE—TURNING THE CYLINDER COVERS AND SCREWING THE STUFFING-BOX AND GLAND.

*Construction of Engine.*—Fig. 4 is the elevation of our engine; and Fig. 5, the plan. Fig. 6 shows the back view, and Figs. 7-29, the various details, the most important dimensions being marked in figures, as is done in engineers' workshops. These, making a full page of cuts, will appear in the next article. Paper expands and contracts slightly, according to the weather; so that, besides the trouble of measuring the drawings with the rule, such measurements are never to be depended on; whereas, when the draughtsman has written the dimension upon the drawing in feet and inches, it is read at a glance without measuring, and reads always the same. It is usual, instead of writing "ft." or "in." upon the drawing, to designate feet by one dash or accent and inches by two: thus, 2 ft. 3 in. would be written 2′ 3″, the figures being placed about the middle of a blue or dotted line extending the whole distance measured, and terminating in an arrow-head at each end.

The writer well remembers seeing, some ten years ago, working drawings of a small power engine similar to Figs. 4 and 5, but smaller and less complete, which drawings were offered for sale with the requisite castings and other materials. The charge for the drawings alone (lithographed) was one guinea. Now, however, such drawings can be obtained at about two shillings, without, however, showing pump or governor. It is believed that these plans now offered to the readers of WORK surpass any hitherto published in completeness and fulness of detail, every important part having been drawn out separately, as is usual with larger engines in engineers' works. The facilities usually possessed by amateurs have been considered, and slight departures have been made from the usual practice (when that could be done without injury) in order to simplify the work.

It is a great satisfaction to the present writer to know that the design has the approval of J. H., and that Olla Podrida will probably write on a boiler of suitable size.

Looking at Figs. 4 and 5, it will be seen that the cylinder overhangs the bed-plate, which latter is cast with a round flange at the back end, against which the front cover of the cylinder is bolted; thus the length of bed-plate which would have extended under the cylinder is dispensed with, as also the

feet, which would have had to be cast on the cylinder. A small amount of fitting is saved, and some weight of metal; moreover, the cylinder, being attached by one end only, is free to expand lengthways when heated by the steam.

Taking in hand the cylinder first of all, it should be bored with a bar, which will require a slide or self-acting lathe. Possibly a boring-bar to bore a 2 in. cylinder 5½ in. long may be borrowed from a neighbouring shop, or hired; but we will suppose it must be made. Get from the blacksmith a piece of 1¼ in. round iron 14 in. long; make him square the ends, to save you filing, and then take it to your lathe, and after centring it rather deeply, finish the ends and turn it up true. It will now be about 1¼ in. diameter. At its middle, scratch two fine lines round the bar with a point tool, ⅞ in. apart; between these lines and through the middle of the bar a hole or slot must be cut, ⅞ in. long and $\frac{3}{16}$ in. wide, to take the cutter and wedge. To do this, we must first mark the position of the hole on both sides, the marks being exactly opposite, so as to ensure that the cutters shall pass through the middle. Wrap a slip of paper round the bar, and cut it so that it will just meet; by folding this in half, we can measure half round the bar. Take $\frac{3}{16}$ in. in the dividers, and mark that distance off upon one of the lines marked on the middle of the bar; measure half round with the folded paper, mark two other spots on the other side of the bar, and indent these marks with a centre-punch. To draw four lines from each of these four points, parallel with the bar and with each other, we must use the point of a tool held in the slide-rest, the work being held still by advancing the back-centre by its screw so as to jam the bar between the centres. A point tool turned over to lie on its side will do this best; the bar would be turned round till the dots of the centre-punch come to the point of the tool; the screw of the back-centre would then be forced a little, to prevent the bar from turning; and the tool moved sideways by the screw of the rest after advancing it to touch will mark the lines. Fig. 30 will make this quite plain.

Having marked the place for the hole on both sides, we must now remove as much of the material as possible by drilling with a $\frac{3}{16}$ in. drill, boring half-way through, first from one side and then from the other, and placing the holes so as almost to cut into one another. A narrow cross-cut chisel will now be used to cut out the metal between the holes, and the hole will then be finished by filing, cutting away just up to the lines at both sides, and trying to keep the sides and ends of the hole flat, and not rounded; which is a rather difficult matter. Several such holes will have to be cut in the course of our work; it will be well, then, to do our best with this one without being discouraged, though it is not a very easy job. Now obtain for the cutter and wedge two pieces of tool steel ½ in. wide, $\frac{3}{16}$ in. full thick, and 2½ in. long. File these up, flatways first, to exactly $\frac{3}{16}$ in. in thickness, trying them with the callipers to ensure their being the same thickness throughout, and trying them in the slotted hole; when you can get them in about ⅛ in., file them no thinner, but fit the hole to them. This is done because, in spite of the utmost care, the sides of the slot are sure to prove round, causing the hole to be wider at each end than in the middle, which you will find out as soon as you try to push in the slips of steel. Your efforts then should be directed to filing away the metal in the middle, without enlarging the mouths of the hole, and this must be continued until the wedge and cutter can be pressed in with the fingers. It will greatly help in filing the sides of the hole flat if the bar be placed between the centres of the lathe, and filed while free to turn on its own axis. Now square up one edge of each of the pieces of steel, round the corners a little, and use them to finish the ends of the slot, carefully filing them out till the steel pieces will bed down solidly upon either end. Fig. 31 is a section through the bar, showing the cutter and wedge in position; and Fig. 32 is an end view. The cutter may now have the shallow notch filed in one edge, but this notch is not so wide as the diameter of the bar, because there must be a small flat filed across the mouths of the hole on each side of the bar, so that the shoulders of the notch on the cutter may bed down on the flats so formed, and not on the round surface (Fig. 32 shows these flats). The cutter having been well fitted, so that it requires pressure to force it into place, its back may now be filed across and tapered to suit the wedge; a workman would know by instinct how much taper to give so that the wedge may not jar loose in working, but the amateur had better go by rule; and the rule for the taper of "fast" keys is ¼ in. per foot=$\frac{1}{16}$ in. in 3 in.; since, then, our cutter is 2 in. long, the width at one end should be less than that at the other by $\frac{3}{64}$ in., or, say, $\frac{1}{16}$ in. bare. Having thus finished filing up the cutter, file up the edges of the wedge, making sure that it fits the whole length of the hole, and not merely at one end; then shorten its ends as in Fig. 31, put the cutter in position, drive in the wedge firmly, put the bar in the lathe, and turn up the ends of the cutter till it measures 2 in. long; take also a cut down the front or cutting edges of the cutter, to ensure those edges being true. The cutter must now be removed from the bar, but before doing so, be careful to mark both it and the bar, so that you may be able to put it back the same way, otherwise all your trouble in turning it will have been wasted. Having taken out the cutter, proceed to "back off" the cutting edges with the file; these edges which do the work are marked *a*, *b*, in Fig. 31. In Fig. 32 the letters *a*, *b*, are placed close to the leading or sharp edge. The file must slope the cutter back from these edges, so that they may have a cutting angle of about 80°. The edges will have to slant in contrary directions, and in doing this "backing off" be careful to leave just a trace of the tool-marks left by turning so as to ensure that the edges shall cut equally. Having finished the cutting edges, proceed to back off the guiding or scraping edges, *c*, *d*, removing rather less in this case than in the first, and the cutter will be ready for hardening. Any fire will do for this, provided there be a good amount of red coals; twist a piece of stiff iron wire round the cutter, leaving a foot or so of the wire for a handle; have about a quart or so of water ready, which may be slightly warm, and when the cutter is thoroughly and equally red, plunge it endways into the water, and leave it a minute. Now take out and try with a file, when, if quite hard, it is to be taken to the grindstone, and the edge slightly ground: it does not require to be "let down" or tempered, because the edge being 80°, it is quite strong enough without, and, thus treated, it will go right through the cylinder without showing any sign of wear, coming out as sharp as it went in. The boring-bar and wedge are very likely to come in useful for other work, as many cutters may be made for it of different lengths, so as to bore holes from 1½ in. to 2½ in. in diameter.

The next thing will be to secure the cylinder casting upon the saddle in such a way that its centre line may be true with that of the lathe centres. Figs. 33 and 34 show one way of doing this, which may perhaps suit the majority, though each will have to manage so as best to suit his own lathe. The upper part of the slide-rest is supposed to have been removed, and in its place is bolted a flat plate of iron from ¼ in. to ½ in. thick; two pairs of wooden clamps are prepared to fit the cylinder, and bored through for the four holding-down bolts, made of ¼ in. round iron, tapped into the square plate at their lower ends, and fitted with nuts and washers at the top. Our aim here will be to cut away the lower clamps by degrees till the cylinder comes level at the exact height of centres; it can be taken out of twist by slacking the two holding-down bolts, and turning round the square plate, A, which plate will require to be hammered fairly flat by the blacksmith, and it must have two thoroughfare holes in it to pass the holding-down bolts which secure it upon the slide, as well as the four tapped holes which receive the ends of the bolts which secure the wood clamps. The side on which the plate A is bolted would be fixed by tightening the screws of the gib *b*.

Having fixed the cylinder firmly in position, so that the boring-bar occupies the centre of the hole at both ends of the cylinder, put the cutter into the slot in the bar, and fix it with the wedge so that it presents its two cutting edges towards the hole; put on the requisite change wheels to give a feed of about seventy to eighty cuts to the inch; put in the back gear with the band on a slow speed, to give about one turn of the bar to three or four treads, and you are ready at last to begin cutting. This cut should be carried right through without stopping, and it will take perhaps about half an hour. It will be well, therefore, to oil up the lathe before you begin, and to choose a time when you are not likely to be interrupted; the lathe should drive easily, and the cutter should remove an equal amount of metal all round, and take off as much with one edge as with the other. The cylinder casting will soon get pretty warm under the cutting, which will cause it slightly to expand in size; if the cutting were stopped for long, so that the metal began to cool, there would be produced a slight groove or inequality in the bore quite perceptible to the finger. This suggests that it would be an additional precaution, just before beginning to cut, to slightly warm the casting, which could be done equally all round by holding inside it a red-hot poker till it felt warm to the hand, then replacing the bar, and beginning to work at once. The cutter can take a cut of $\frac{1}{16}$ in. all round, and one cut should be enough to finish the bore, leaving a fine surface, bright and smooth, and perfectly parallel. If it is not so, and for any cause it were necessary to take another cut, the cylinder would be left as it is whilst another cutter was made a little larger than the first, to bore, say, 2⅛ in.

As soon as the cylinder is removed from the lathe, rub it out carefully with an oily rag, to clean and preserve it from rust, and examine the bore on the side of the port-ways: for it is possible, unfortunately, that the boring may expose a blowhole in the casting, making a communication between

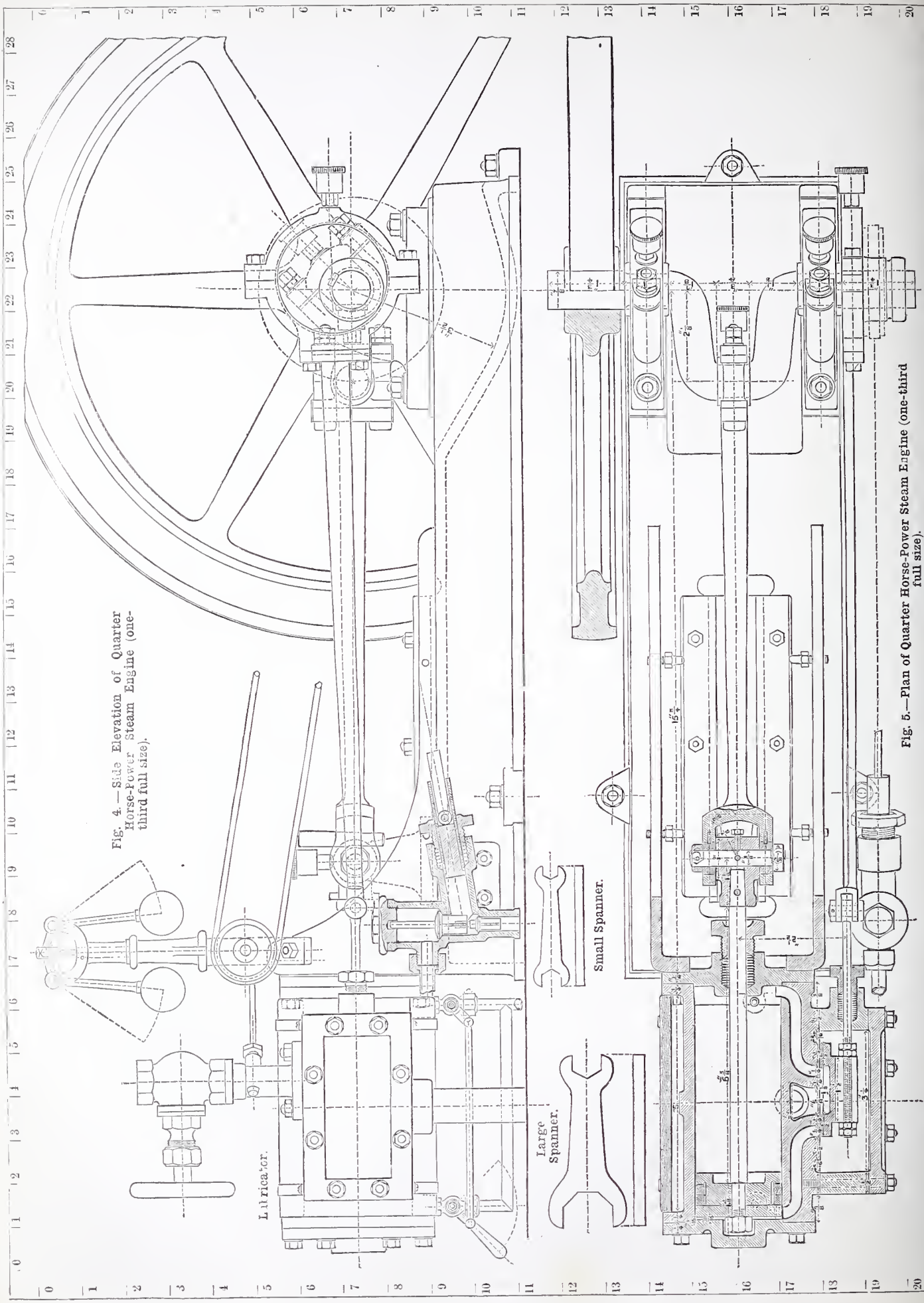



Fig. 4.—Side Elevation of Quarter Horse-Power Steam Engine (one-third full size).

Fig. 5.—Plan of Quarter Horse-Power Steam Engine (one-third full size).

the inside of the cylinder and the port. If the blowhole is a bad one that you cannot stop by screwing in a little plug with red lead, the casting should be returned for another.

But what, it may be asked, are those to do who have only a slide-rest, and no self-acting lathe, with a saddle, on which the cylinder casting can be bolted? Without going into details, it may be said that if the slide-rest have a traverse of at least 5½ in., and the mandrel of the lathe be strong and not too short, the cylinder might be mounted upon the face-plate, and bored with a strong inside tool of about 1 in. square. The cylinder, however, will stand over-neck a good deal, and so will the tool. Perhaps a strongly built 6 in. or 7 in. lathe might do the work tolerably well. The hole would be made slightly larger at the mouth, and then carefully corrected until a solid gauge, made something like the piston and rod, will fit perfectly all the way down. Yet another way would be to use a couple of flat drills, such as would be used for boring a pulley or other hole in cast iron; and this could be done by one who had no slide-rest: both these plans would produce inferior work, and would render necessary the use of a grinder to finish the bore true and smooth; moreover, a person who wished to make up this engine without having a slide-rest, ought first to begin by making himself a slide-rest, or he will find himself most seriously embarassed further on. The reader will pardon so lengthy a description of this first stage in our work when he understands that the greater part of the friction of the engine is due to the piston, and that any want of truth and perfection here would cause serious waste of power and steam. Let him, then, not try to hurry his part, but rather to do it well; it may take three days to make the boring-bar and cutter and to fix the cylinder in position, although the actual boring can be quickly done.

The next operation will be to turn the flanges of the cylinder true with the bore, and to slightly cone out the bore at each end for ½ in. (See the section of the cylinder in Fig. 5.) This is done so that the packing rings of the piston may pass beyond the surface on which they rub; if it were not so, they might wear a slight depression in working, and leave a ridge at each end of the bore, which would make it impossible to get them out. This precaution is always taken in similar cases; as, for instance, in the slide-valve and the slipper guide. We have then to chuck the cylinder true with the bore, so that a flange and part of the bore shall be accessible to the tools. Fig. 35 will show how this can be done. Obtain a piece of round iron, about a foot long, which you can turn up to a diameter of 2 in.; reduce it carefully till you can drive on the cylinder to within about an inch of one end; now you can turn up one flange, and also enlarge the bore by slightly coning it out at that end. When this is done, drive off the cylinder, and drive it on the other way, so as to treat the other end in the same manner. M is the mandrel; D the driver chuck; P a pin driven or screwed into the mandrel to catch the arm of the chuck, in case the workman has no 2 in. carrier. The cylinder must not be driven on very hard, or it may burst. Do not grudge the iron for the mandrel, as it is very likely to come in useful again; turners have quantities of such, of all sizes.

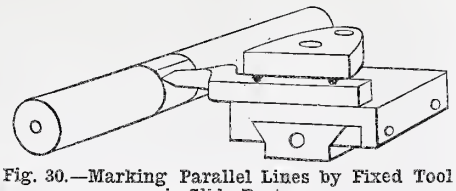


Fig. 30.—Marking Parallel Lines by Fixed Tool in Slide-Rest.

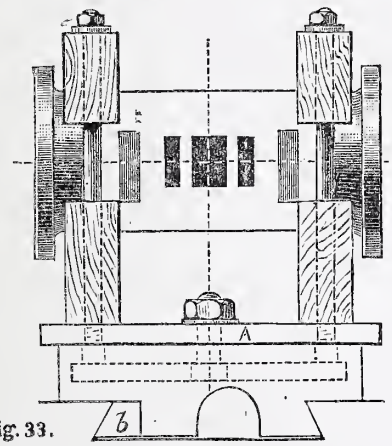



Fig. 33.

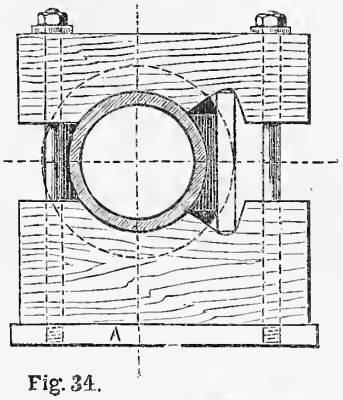



Fig. 34.

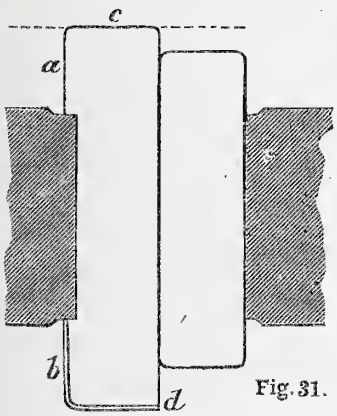



Fig. 31.

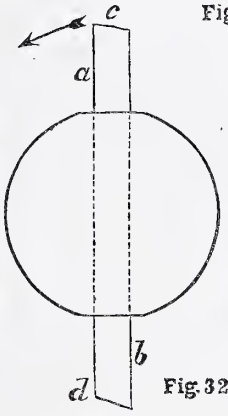



Fig. 32.

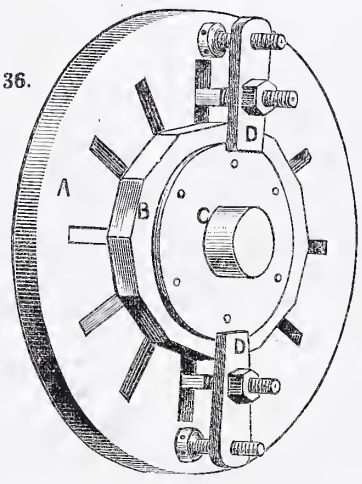



Fig. 36.

Fig. 31.—Section through Centre of Boring-Bar, showing Cutter and Wedge. Fig. 32.—End View of Bar. Fig. 33.—Cylinder Casting fixed ready for boring with Bar. Fig. 34.—End View. Fig. 36.—Cylinder Cover chucked for Turning.

Taking in hand now the cylinder covers, begin with the bottom cover. An American universal chuck will hold it by the outer edge, or it may be driven into a recess in a piece of hard wood turned out to receive it. Face up the inside surface of the cover flat and true, and make the shallow projection fit exactly into the back end of the cylinder, trying this on to it as it is fixed in the chuck; then with a point tool strike a fine circle 3 in. diameter, to indicate the centres of the six screw holes; mark the positions of these with the centre-punch, not omitting to notice that, whilst four holes equally divide the circle into sixths, one pair are placed further apart by ⅜ in., to avoid clashing with the ports. Lay aside the bottom cover, and take the top, or lid, which has the stuffing-box cast on it; turn up the inside in the same way as the other, fitting it to the other end of the cylinder—that is, the front end; and, after striking the 3 in. circle for the screw holes, bore a ⅜ in. hole truly through the centre of the boss for the piston-rod to pass through. By boring this hole carefully *at the same chucking* as the cylinder fitting, you ensure that the piston-rod shall be exactly in the centre of the bore of the cylinder. Next bore the six holes in the two covers with a drill $\frac{3}{16}$ in. full. To turn the other side of the covers and their rims true with the part already finished, a recess must be made in a hard wood chuck, into which the cylinder fitting on each lid can exactly fit; in making this recess, try each cover in, and begin with whichever has the smallest fitting, because then the recess can be slightly enlarged for the other. Having fitted one cover into the chuck of hard wood (which is supposed to be screwed to the front of a face-plate), place two or three dogs to clasp it firmly by its edge against the front of the wood chuck. Fig. 36 shows the face-plate, A, and the wood chuck, B, of beech, or some wood equally hard, secured by wood screws passing through from the back of the face-plate. B is carefully faced up level, and then the half-turned casting, C, is pressed into a recess turned in the wood to fit the shallow projection, after which the dogs, D, D, are applied to secure and hold it fast, grasping it by the extreme edge, so as to allow the tools to face up almost all the front surface. In the case of the front cover, the shallow fitting on the outside of the cover (Fig. 5) will be formed, and the stuffing-box will be bored, and screwed about 14 pitch, with the screwing lathe; or a ⅜ in. gas-thread tap might be used, followed by a chaser, by those who do not possess a self-acting lathe. Finish both covers nicely, and polish with emery-cloth, and, before removing either from the chuck, turn up and

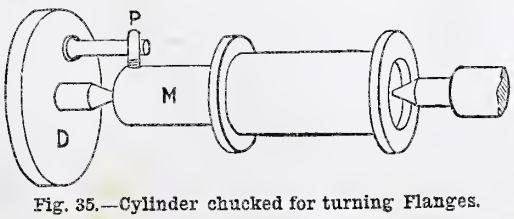



Fig. 35.—Cylinder chucked for turning Flanges.

polish their edges to exactly the size of the flanges on the cylinder. To do this, we must remove the dogs, and secure the cover to the chuck by two or three wood screws, passed through the screw holes in the covers into the wood chuck; this method of holding will also allow of finishing the edge of the face of the covers, which could not be touched while the dogs were in position. To complete the cover, take the brass casting for the gland, bore it with a $\frac{3}{8}$ in. hole while chucked in the lathe, mount it on a small mandrel, turn up and screw it with a point tool in the screwing lathe, finishing with a chaser to fit the internal thread in the cover. The screwing lathe will ensure a true thread, but the screw might be marked out by the $\frac{3}{4}$ in. gas stock and dies corresponding to the tap which might have been used to start the thread in the cover, when the chaser would be used afterwards to finish: thus both these screws can be accomplished without a screwing lathe, even by an amateur, who cannot cut them with the chaser alone; but it is not likely they would be very true or correct. All screws of this kind should be cut first in the screwing lathe, and then they may be finished to size and shape by the chaser or the stock and dies. The top of the gland is formed into eight equal sides, that it may be grasped by a spanner. The best way to do this would be by means of a division-plate on the lathe pulley, but, failing this, a template or pattern may be made by drawing the required octagon on tin or sheet metal, and after cutting away the inside and filing to the lines, the template can be used to test the sides of the gland as they are gradually filed to shape. The same template will serve for filing up the pump gland, as that is the same size, to suit the same spanner. Another equally good method would be to file up a little octagon in tin, and use that to file out the spanner (shown with another in Fig. 5); the jaws of this largest spanner being thus correctly shaped, it can itself be used to test the octagons on the piston-rod and pump glands: the smaller end of the same spanner is for use on the six-sided valve-rod gland, union on pump delivery, and cap on pump valve-box.

## PICTURE-FRAME GILDING.

BY H. E. MAXTED.

INTRODUCTION—GILDER'S CUSHION, KNIFE, TIP, ETC.—GILDER'S MATERIALS—COMPO.—PARCHMENT SIZE—THIN WHITE—THICK WHITE—CLAY—CLEAR-COAT—MATT GOLD-SIZE—BURNISH GOLD-SIZE—OIL GOLD-SIZE—GILDER'S ORMOLU—MATCHING MOULDINGS—OIL GILDING — BURNISHING — BURNISHERS — GILDING FLATS—RUBBING DOWN MITRES—RE-GILDING.

THE art of gilding, as applied to picture-frames and numerous other articles of interior decoration, requires not a little care and skill to be exercised by the operator, professional or non-professional. The latter presumably possesses a good stock of patience and liking for the work in hand, which should go a great way to balance the experience of the former.

In a back number of WORK, under the title of "Plain and Decorative House Painting," the gilder's cushion, knife, tip, etc., were illustrated and explained; it is therefore quite unnecessary to comment upon them again. In addition to these, some tools are requisite, but they are inexpensive and few. A badger, two or three small sash tools, camel's-hair pencils, and stone jars or pots are all that are absolutely necessary at present.

Before going further into detail, it will be advisable to describe in full the numerous preparations used in picture-frame gilding, so that reference can be made to them in their order as we proceed. First of all, the reader must be impressed with the importance of using clean pots and brushes, keeping all free from dust or dirt of any kind, and not using size when it begins to turn bad. This is scrupulously carried out by the practical man, and materially assists in the production of successful work.

Gilder's materials can be procured from Brodie and Middleton, Long Acre, Rowney, Rathbone Place, or any artists' colourman, and will require to be mixed in the following manner:—

*Compo.*—Boil seven pounds best glue in seven half-pints of water; melt three pounds of white resin in three pints of raw linseed oil. When well boiled, mix together in a large saucepan, and boil for about half an hour. When done, pour into a boxful of well sifted and rolled whiting. Mix all together, and knead up like dough till it will hold no more whiting. To keep it moist, wrap up in a damp cloth, or bury it in whiting.

*Parchment Size.*—Wash a handful of fine parchment cuttings in a clean saucepan or other suitable vessel, cover with water, and simmer for two or three hours until the water has evaporated to one-third or one-fourth of its original volume. To test if it is strong enough, the hand should be wetted with the size, the other hand being pressed closely to it. If it is found to be sticky, strain the solution off into a clean jar to cool, and save the parchment to be boiled up again.

This size is used to mix nearly all the preparations required by the gilder, and should, when cold, be a firm jelly; the stronger it is, of course, the firmer it will set, and consequently will require water to be added in some of the preparations.

*Thin White.*—Parchment size, moderately strong, mixed with rolled whiting and strained through muslin. This must not be too thick.

*Thick White.*—The same as preceding, with enough whiting to make it thick like cream.

*Clay.*—When unmixed is very stiff. Place a small quantity of size in a clean stone pot, add a little water, melt, and add a small portion of clay; stir till dissolved, and add more clay till it is of the consistency of cream.

*Clear-Coat.*—Take a tallow candle, light, and drop two drops in a pot of moderately strong size. The grease will keep it from working up.

*Matt Gold-Size.*—This is mixed in the same way as clay, but slightly weaker, and is of a reddish tinge.

*Burnish Gold-Size.*—Mixed the same as clay, but weaker, and is of a bluish tinge.

*Oil Gold-Size.*—This is bought ready for use or unmixed; if the latter, it must be thinned out with boiled linseed oil and fat oil. A little patent driers will hasten its drying qualities, which should take place in about twelve hours.

*Gilder's Ormolu.*—There are many recipes for this preparation, but equal parts of white lacquer and methylated spirits (mixed and kept in a bottle) are often used, a few drops being put into the finish size, which is applied after the gold is laid.

Now that we are acquainted with the preparations that will be used, I propose to gild a frame, compo.-faced, Alhambra pattern, with compo. corners, and flat inside.

The practical man has sometimes to match certain mouldings not easily procured, and consequently has to prepare them from the wood; but this is seldom done now, as they can be bought in the white, or compo.-faced and whitened up ready to prepare for gilding, at much less cost than he could make them in small quantities. So if the reader will follow, I will endeavour to explain concisely the art of frame gilding, which of course will embrace furniture gilding, such as chairs, tables, cabinets, or other interior work.

There are two methods of gilding—namely, oil for ornamental work, water for flat or burnished work.

To gild a frame in oil with bead and prominent parts burnished, first wash the ornaments, such as corners or top and bottom ornaments, to free them from grease or dust that will adhere in getting them from the mould. Cold water and a brush must be used—with not too much friction, or the sharpness of the lines may be destroyed. After this is dry, lay a coat of thin white evenly on the frame, applied hot, taking care not to float it or put too much on, but only to cover every part. When dry, take some powdered whiting and hot size, and mix a little of each with a gilding knife or modelling tool; the predominance of whiting will make putty. Then thoroughly overhaul the frame and stop up every defect in the moulding, nail-holes, and corners that are damaged. When this is hard, it must be glass-papered—the flats, hollows, and beads with fine glass-paper, taking care that no defect is overlooked, for the success of our work depends upon the absolute perfection of each smoothing down.

After dusting, it is ready for a coat of clay; but, before this is applied, the parts to be burnished must be determined, and three coats of thick white laid evenly on and glass-papered. Clay should be applied hot, in the same way as thin white, not forgetting to cover every part of the frame, dabbing the brush down into all ornamental parts, and getting well into the bottoms.

When this is dry it is again ready for smoothing with fine emery-paper, which should produce a smooth, even surface, for the frame will not be papered again.

Now attention must be paid to the burnishes. Matt gold-size is mixed and applied three or four times evenly with camel's-hair pencil. When dry, paper with fine emery, and brush off with a damp sponge.

After well dusting, give the frame two coats of clear-coat, moderately strong, touching every portion carefully, as it is intended to keep the next preparation from sinking into the frame, but do not put it on too abundantly. A good way is to squeeze the brush out every time between the fingers before applying it, and the frame will receive a thin level coat all over, without running. When this is dry the work is ready for oil. Take a piece of clean linen rag, and squeeze a small quantity of oil gold-size on to a piece of glass; then with a suitable-sized sash tool (bound round with string if the hairs are long) lay a coat of oil thinly over the surface: the thinner it is spread the better it will be for gilding; in fact, it must not be too thick, or the work will turn out dull when gilded, but cover the frame equally, thinly, and completely, touching every part and missing nothing. This operation is usually performed in the evening, so that it will be in a fit state to gild the next morning. When it is ready will be known by the dry tackiness of the oil.

There must not be the slightest suspicion of greasiness about it, nor yet must we allow it to get too dry, but take it in the humour and at the time. If it is not dry enough, leave it till it is, but do not leave it too long.

Before it is put up to dry (being in oil) over-night, take a piece of damp calico rag, and wipe off with care the grease from the burnishes.

In the morning our frame is examined and found to be ready for gilding. The leaf is blown from the book into the cushion, and cut up to the size and shape suitable to the part under operation. Take up the piece with the tip (which should be brushed across the head to make the gold adhere), place it lightly on the frame, and repeat till every part is covered. The gold is then carefully pressed into the ornament with a dabber of cotton-wool, and skewed or brushed over and over the frame in order to make the gold-dust that rises remedy all defects or parts by accident left uncovered. When the frame is perfect as far as it can be, brush off all superfluous dust, and the frame will shine like the surface of solid gold.

Now give the burnishes (if any gold has adhered to these take it off at once) two coats of burnish gold-size evenly laid. When dry, procure a glass of cold water and a camel's-hair pencil, and proceed to gild by floating the bead to be burnished with water, and quickly applying the strip of gold, which must be ready, on the tip. Should any defects show themselves, they must be remedied at once by another application of gold to the already wetted surface. This will be repeated until all the burnishes are covered, care being taken not to run too much water on the gilded portions of the frame.

This completes gilding in oil and burnish, and the flat inside must be seen to after the parts already gilt have been burnished.

The burnisher is made of agate stone in numerous sizes and shapes, the most convenient being curved, with a point that will fit into hollows and curves that require burnishing. A little practice will be better than a volume of description as to the method of using them; however, a few words will not be out of place on this subject.

Hold the handle firmly in the right hand, and with the left put slight pressure on the burnisher, and apply the curved part to the bead or the point to the hollow; keep it steadily upon the work, and draw backwards and forwards until a brilliant burnish is produced.

Now carefully overhaul the frame, and if any faults occur, be sure to remedy them before going any further. Then finish sizing, or ormolu size the frame all over except the burnishes, which must be religiously excluded from this operation.

The inside flat may consist of flat and hollow or flat and bevel, and may be burnished in the hollow or matt, according to taste.

Flats are double gilt, unless economy is the object. Double gilding gives solidity to the work in hand, and at the same time does away with any appearance of inequality where the leaves join.

The mitres may require rubbing down with glass-paper, the hollows or bevels stopping with putty if badly joined or damaged. When smooth, apply a coat of clay, emery-paper when dry, and apply four coats of matt gold-size; again emery-paper, and wash down with a sponge and clean water. When very nearly dry, use a piece of cloth, and briskly rub the surface until it assumes a brilliant polish. Upon this lay two coats of weak size (when cold it must not be strong enough to set), and allow to dry. Prepare to gild as before with camel's-hair mop and glass of water, keeping the gold from the hollow if it is to be burnished. When dry, wipe off the superfluous gold with a piece of soft wool. The faults will now probably be enormous, but the next coat will remedy that. Lay one coat of weak size over the gold, and two coats of burnish size in the hollow. This, when dry, must be again covered with gold, laying flat and hollow together. Again rub off with wool. Should any faults be visible, wet the place with mop, and put a small piece of gold over till all defects are made good. Burnish the hollow without slipping over the flat, and finish sizing the flat without the hollow. The frame will now be complete.

*Re-gilding.*—Old frames that require re-gilding undergo the same preparations as new work, with the exception of one or two little details.

If the frame is in good condition, make a bath of soda-water, and with a brush wash every part of the frame free from dust and grease, and wherever possible strip off the old gold without undermining the composition or whiting. When dry, stop up every crack, and proceed as with a new frame.

Should the ornament be broken away, it will have to be replaced. If small pieces only are missing, use a piece of glue, putty, or compo. applied and modelled as near to the shape as possible; if large pieces, a "squeeze" must be taken. Place a piece of compo. over the steam from a saucepan to soften, knead it up like dough with whiting, and proceed to take a squeeze from a perfect portion of the frame. First grease the part to be reproduced, then place the compo. over it, squeezing it into every part of the ornament; take it off, and put away till dry and hard. To take the required impression, grease the mould and press soft composition into it, wet the back, cover it with a piece of board, and apply pressure to force the compo. into every part; then loosen it from the mould, and it will come away with the board. When partly set, cut away the required ornament with a knife, place it on to the frame in its proper position, and back up with compo., smoothing all down in a workman-like manner.

Oak, if well selected, will make a good gilding surface to show the grain. After well glass-papering, give it two coats of methylated French polish and put in oil as described above. After gilding, finish sizing.

## MASONS' WORK.

BY MUNIO.

DAMP COURSE — FOOTINGS — VARIOUS KINDS OF WALLING — RUBBLE, BLOCKING, AND ASHLAR WALLING — POINTING — DRESSING STONES: PLAIN, CIRCULAR, SUNK, MOULDED, CIRCULAR MOULDED, AND SUNK AND MOULDED WORK.

*Damp Course.*—As soon as walls are brought up to the surface of the ground, a damp-proof course should be laid on, to prevent damp arising in the walls; this may be of asphalte, about ½ in. thick, laid on hot, or it may be a course of slates bedded in Portland cement, with the joints overlapping each other. A damp-proof course of glazed stoneware is also sometimes used; this is made about 3 in. thick, with perforations through it, and also acts as a ventilator under wooden floors; the damp course should be thoroughly set before being built upon.

*Footings.*—Footings are large stones laid in the foundations of walls. They should, when possible, be in one stone, and should be at least 3 in. wider on each side than the wall which comes upon them; they are from 3 in. to 6 in. thick, and are pick- or hammer-dressed. They should be bedded down perfectly solid; sometimes two courses of footings are used, the lower course projecting at least 3 in. on each side beyond the upper course. When they cannot be got the full width in one stone, they may be laid as shown in Fig. 30; when they are laid in two courses, they may be bonded as shown in Fig. 31.

*Various Kinds of Walling.*—There are many different kinds of walling, but they may be briefly summed under three heads—viz., Rubble or Random Walling; Blocking, or Block and Course; and Ashlar Walling.

*Rubble Walling.*—In this walling the stones are not made to any particular size, but are roughly bedded, and the sharp angles knocked off with the hammer in walling; a thin stone is laid under the tail of the stone, called a "pinner," and the stone hammered down on the mortar; the pinner gives the beds of the stones a slight inclination outwards, which prevents the wet running into the wall. In the Lake District, where rag walling is used, this inclination is made much greater, and the stones are said to be "watershot;" this is to prevent the heavy rains from beating through the wall; for the same reason the mortar in these walls is kept back from the face of the wall, giving it the appearance of being built without mortar, as, if built in the ordinary way, the mortar would be washed out.

A sufficient number of throughs or bond-stones should be inserted in the wall—about one in every 6 ft. of area; and those in one course should be laid between those in the course below. The bond-stones should not be left projecting out of the walls, as they are liable to be broken in cutting off the ends. Fig. 32 shows rubble walling; the large stones at the angles are called "quoins," and are generally hammer-dressed. Fence walls for fields are built in dry rubble, or without mortar, except a row of bond-stones laid in mortar in the centre of the wall; and the coping, formed of stones set on edge, is laid in mortar. These walls are built with a batter or slope on each side.

*Blocking.*—Blocking is formed of stones reduced to parallel courses. The faces are hammer-dressed, pitch-faced, or drafted and broached, the quoins being dressed in the same manner. They are walled, and throughs inserted, in the same manner as rubble walling; the inside of the wall is generally rubble work. Fig. 33 represents blocking walling. Sometimes the blockers are walled in varying courses, called "sneck walling," as shown in Fig. 34.

Some excellent blockers are obtained from the Yorkshire and Durham flag quarries; they are from 2 in. to 6 in. thick, with parallel beds; the faces are pitched; they are called "flag blockers" or "parpoints."

*Ashlar Work.*—This is formed of stones about 12 in. thick. The faces are pitched, drafted and broached, tooled, or polished; the inside of the wall is faced with rubble work or brickwork; the beds and joints are dressed with the mallet and chisel, and they are set with fine putty; bond-stones or throughs should be inserted as before named, and when openings for windows, etc., occur, every alternate stone should go through the wall; the facing-stones should also be of

varying widths, a narrow-bedded course being set on a wider-bedded course to give a better bond to the backing of the wall; the joints should be made square for at least 2 in. from the face, after which they may gradually widen out. The stones should always be set on their natural or quarry bed. Fig. 35 shows ashlar work.

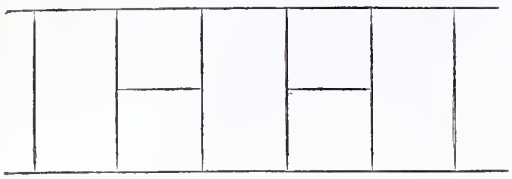


Fig. 30.

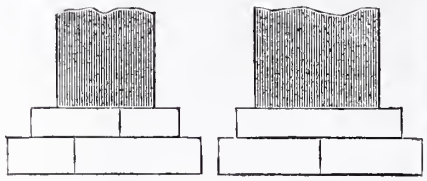


Fig. 31.

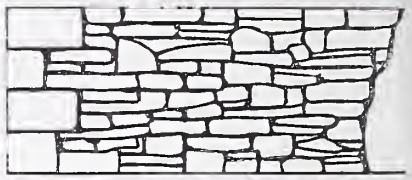


Fig. 32.

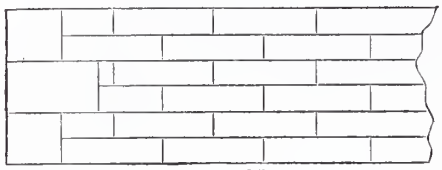


Fig. 33.

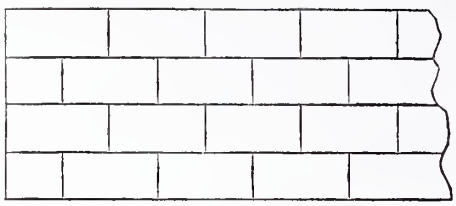


Fig. 35.

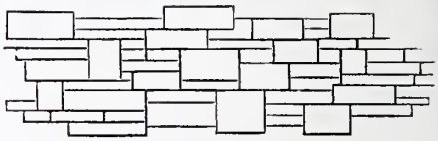


Fig. 34.

Sometimes the edges of the stones have a small chamfer formed round them, as shown in Fig. 36. This is called "Rustic" or "Rusticated Work." Sometimes the quoins only are rusticated.

Another method of finishing the face of ashlar work is called "Rock Work." This consists in sinking the face of the stone (after it has been dressed level) into various irregular forms, with a narrow flat margin between them, the sunk portion being about $\frac{3}{4}$ in. deep.

*Pointing.*—Pointing consists of filling up the joints of walling with fine mortar, to prevent rain from injuring the wall. The simplest method is called "raking off" or "dashing." In this the joints are filled with mortar, and raked level with the edge of the trowel. Sometimes a stiff brush is rubbed over it, to level the work; this is used on rubble walls.

*Lean Pointing.*—In this the joints are filled with mortar, and the trowel is drawn along to smooth it, slightly pressing the top edge inwards; the lower edge is sometimes cut off to a rule, and sometimes with the trowel-edge only. This pointing is used in blocking and rubble. Rock or pitch-faced work is pointed with a jointer with round edge; the joint is filled with mortar, and the jointer drawn along the edge of a rule. *Tuck pointing* is also used in blocking. In this the joints are filled with mortar made to the colour of the stones; this is smoothed over, and when sufficiently stiff a joint of white putty is laid on with a flat jointer by means of a rule. The filling may be made the colour of the stones by mixing it with sifted smith's ashes and stone dust till of the required colour. The putty must be well beaten, to get all the water out of it, and mixed with silver-sand and oil; the joints must be gauged to keep them parallel, and the edge of the rule is rebated to allow the putty to fall down as it is cut off; a knife with the end slightly turned up is used for cutting off the putty joint; the cross-joints are cut off with a piece of wood shaped into a set square, and a handle fixed on the face. The joints are made from $\frac{3}{16}$ in. to $\frac{1}{4}$ in. wide.

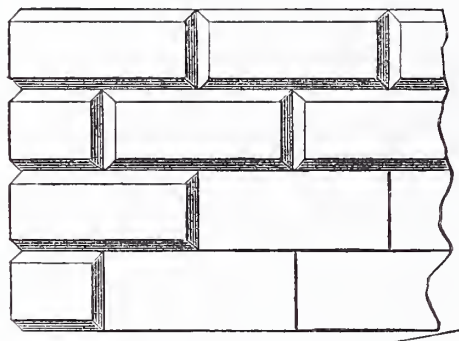


Fig. 36.

Before commencing to point a wall, the joints should be well raked out, the dust brushed off, and the wall damped, as the pointing will crack if laid on a dry, dusty wall.

Ashlar is pointed with fine putty mixed with stone dust; the joint is filled level, and the edge of the trowel drawn down the centre of the joint with a rule. Ashlar work should be washed, and the lime-stains scraped off before it is pointed.

*Dressing Stones.*—Dressing stones is the art of cutting the stones into the various forms required in building. It is designated as Plain, Circular, Sunk, Moulded, Circular Moulded, and Sunk and Moulded Work.

*Plain Work.*—Plain work consists of forming the surfaces into planes. To level the surface of a stone, a draft is run along one side and across one end with a 1 in. chisel; a rule is fixed on the cross-draft, and a draft is run across the opposite end, which must be cut so that when a second rule is laid upon it, the under edges of the two rules are

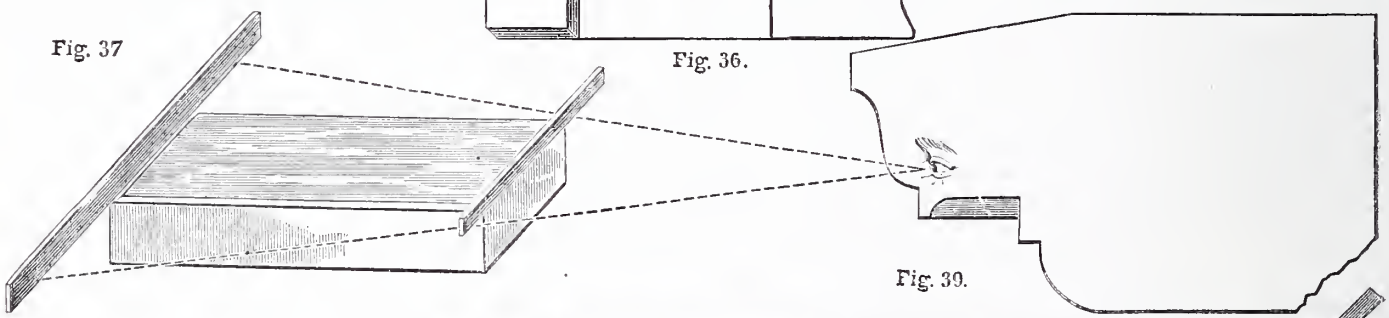


Fig. 37

Fig. 39.

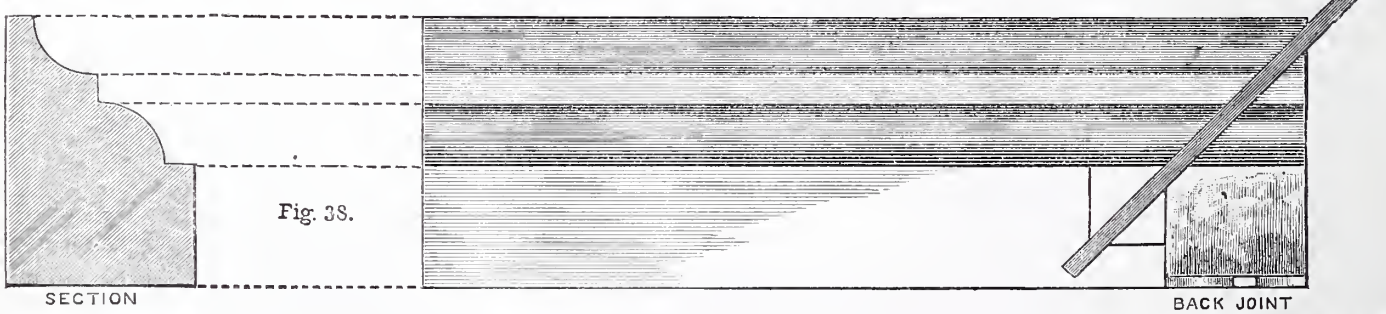


Fig. 38.

SECTION

BACK JOINT

**Fig. 30.—Footings in one Course. Fig. 31.—Footings in two Courses. Fig. 32.—Rubble Walling. Fig. 33.—Blocking Walling. Fig. 34.—Sneck Walling. Fig. 35.—Ashlar Walling. Fig. 36.—Rustic or Rusticated Work. Fig. 37.—Taking Surface of Stone out of winding. Fig. 38.—Mode of Mitring Moulded Stone. Fig. 39.—Moulded Stone with undercut Portion left unworked.**

out of "winding." (See Fig. 37.) Then divide the whole surface of the stone by drafts into spaces 10 in. square, making each draft perfectly straight; the rough stone between these drafts is levelled down with the point, and then straightened with the inch chisel; the surface is then ready for finishing. The remaining sides and ends are squared from the face already dressed. There are various methods of finishing the surfaces of stonework—Boasting, called also "Swin Chiselling" and "Droving" in Scotland. This consists in going over the whole surface of the stone with the boaster, keeping the tool-marks all one width, the sizes varying according to circumstances; but on a coarse-grained stone they are generally wider than on a fine-grained stone. Tooling consists in forming the surface into parallel lines or flutes, which are at right angles to the edge of the stone; a tool 3½ in. or 4 in. wide is used, and the strokes are commenced at the side farthest from the workman, and brought right across the stone towards him. In order to keep the tool straight, square lines are drawn at intervals across the stone. Polishing consists in rubbing the surface with a level stone, fed by sharp sand and water; the stone is rubbed with a circular movement, and care must be taken not to rub the surface into hollows: the rubbing is continued till all the tool-marks are obliterated.

Drafting and broaching consist in putting a draft round the edge of the stone, which is gauged about 1 in. wide, and struck in; the centre portion is levelled down by the point, and dotted over till perfectly level by the stone-pick or diamond-hammer.

Rock or pitch-faced work is struck off round the edges, and left with the natural face of the stone; sometimes a draft is run round the edges of the stone, and struck in parallel.

*Circular Work.*—In circular work the face or bed, as the case may be, is first reduced to a plane surface; the mould is then laid on this surface, and cut in; the remaining beds or joints are then squared from this surface. In applying the square to the joint of a circular stone, it should be held at right angles to the line of the joint.

*Sunk Work.*—In sunk work the margin of the sinking is first reduced to a plane surface; the sinking is then marked on, and cut in at each angle, using a gauge for the depth; drafts are then run between each point thus cut in, and the surface levelled to these drafts.

*Moulded Work.*—In moulded work the beds, joints, and as much of the face as is not moulded, are first reduced to plane surfaces; the mould is then marked on each joint, and cut in, and the intervening stone is then cut away, using the straight-edge for testing the work. When a return or quoin occurs in a moulded stone, it must be mitred in the following manner:—The mould is formed on one face, as already described; then work a back joint on the head end of the stone, and cut in the mould, and draw square lines from the top and bottom member, intersecting the mould already worked; and at the angle of intersection draw a square, the sides of which are 4 in. long; also draw a diagonal across the square, and lay a rule on the diagonal line, projecting to the outside of the stone; then, sighting the edge of the rule with the outside angle of the moulding, draw a line across the moulding coinciding with the edge of the rule, which will be the line of the mitre (Fig. 38); this line can also be checked by gauging. Should any part of the moulding be undercut, it must not be worked till after the return portion of the moulding has been worked, but is worked afterwards to a reverse mould; in Fig. 39 the shaded part is left till the return end is worked.

*Circular Moulded Work.*—In circular moulded work the stone is first worked to a circular form, as already described; the mould is then marked on the joints, and cut in, and the moulding is worked to circular rules, one being required for each member of the moulding.

*Sunk and Moulded Work.*—In sunk and moulded work the plain sinking is first worked at the inside of the moulding; a reverse mould is then applied, and the moulding cut in at each side, and worked by means of a rule; the mitres are formed by drawing lines, intersecting each other at the angles, from the portion already worked, and the working tested by a rule cut to an angle of 45° at the end.

## MANTEL-BOARDS: HOW TO MAKE AND FIX THEM.

BY H. HINGE.

WOOD, ETC.—WORKING AND SHAPING—DOVETAIL KEYS—COVERING, FRINGES, FANCY NAILS, ETC.—FIXING, ETC.

THESE very desirable additions to our chimney-pieces can be easily made and

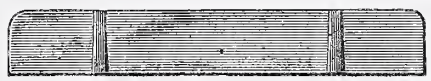


Fig. 1.

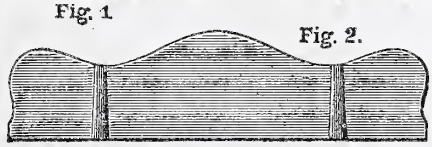


Fig. 2.

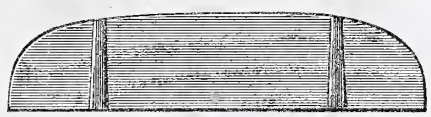


Fig. 3.

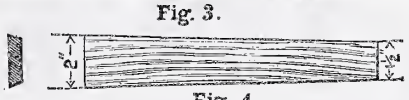


Fig. 5. Fig. 4

Fig. 1.—Plain Mantel-Board, showing Underside, for Bedroom. Fig. 2.—Shaped Mantel-Board for Sitting-Room. Fig. 3.—Alternative Mantel-Board for Sitting-Room. Fig. 4.—Enlarged View of Dovetail Key. Fig. 5.—Section of Ditto.

fixed by anyone who has a few tools and a desire to use them. The size, of course, must be ruled by the width of the chimney breast, size of room, etc., but generally, almost all chimney-pieces will admit of a mantel-board 3 in. or 4 in. longer and wider than the existing one.

*Wood, etc.*—The wood for the purpose should be good and dry. It will be easily understood that if it is not fairly dry, the heat of the fire and general dryness of the situation will cause it to split and twist, and spoil the looks of it.

*Working and Shaping.*—Procure a fair piece of deal the length and breadth required, and not less than 1 in. thick. Plane up true and straight on both sides, and then determine what shape to make it. Fig. 1 shows a board with only the corners rounded, suitable for a bedroom. Fig. 2 is the best shape for drawing- or sitting-room, and looks very well. Fig. 3, another shape, not so much used as Fig. 2. Having decided what shape to make it, measure to the centre of the board, and make a square mark across it, and then begin, and with a pencil sketch the shape you want, putting on a little or taking off (after the outline is got) until the desired shape is attained. Now cut it out with a bow saw and mark it on a paper; cut this out, and lay it on the other half, and mark it and cut it out; you will then get both sides true.

*Dovetail Keys.*—We must now put in some dovetail keys to keep the board flat and true. These are made of ⅞ in. oak or mahogany, or other hard wood, about 2 in. longer than the board is wide, 6 in. from the end. They should be about 2 in. wide at one end, and taper down to 1½ in. at the other end. Besides being tapered in the length, the edges are bevelled to form a dovetail. Fig. 4 shows a dovetail key, and Fig. 5 section of the end of key. These are to be fitted tight into the mantel-board. The best way to fit these will be to get and place them the narrow end and narrowest side down in the place we want them to come, and then mark with a sharp pencil along the edges of the key. These should be cut with a sharp saw on the bevel to match the shape of the key to a depth of ½ in., and cut out with a chisel, care being taken that the groove is of a uniform depth right through. Now see how the key fits, and if it has been done right, it will just drive in tight. If it is too tight, plane a little off the edges of the key; but be sure it fills nicely, or it is of no use. When both keys are fitted, they should be marked about ¼ in. shorter at each end than the board is wide, carefully driven out again, and then cut off to the marks with a saw. They should only be glued about 1½ in. at the narrow end (which comes to the front of the shelf). The glue is best put in the groove, so that when the key is put in no other part will get glued except the end. These are now planed off level with the board, and, if done right, will admit of the board shrinking without splitting or becoming unlevel. In a long board put in three keys, one at each end and one in the centre. Take off all sharp edges after the shaping is finished.

*Covering, Fringes, Fancy Nails, etc.*—Cover with crimson or green cloth, or any other colour harmonising with the surroundings. This is easily done by tacking the material to the back edge of the board first, and bringing it over the top side, and just pointing in a few tacks to keep it in position, and slitting the cloth anywhere out of sight to facilitate it fitting the shaping, and pulling it down, taking out the tacks that were pointed in as we go along, and pulling it tight and tacking it on the underside of the board. If carefully done, it will present a nice level surface, and fit the shaping, and leave no wrinkles anywhere. If a fringe is going on to the front edge, it should be backed by a piece of the same material as the shelf is covered with, about 2 in. narrower than the fringe. This is tacked along the front edge, not pulling it tight anywhere. If we do, it will be pinched at the corners, and not fall nicely. The fringe is put on in the same way, turning a little under at the ends to prevent it roving. It must now be finished along the front edge with fancy brass nails put in at equal distances of about 2 in. or 3 in. This is best done by setting out with a pair of compasses. It will be found that the brass nails all require boring for with a fine sprig-bit, as they will bend and be disfigured if they require much driving in. Macramé work makes very good and durable fringes.

*Fixing, etc.*—Our mantel-board is now

finished in itself, and only requires fixing. If the chimney-piece it is going on is wood, there is no difficulty; it simply wants screwing down from the underside. If it is iron or marble, we shall want two rebated pieces of wood to clip the underside of mantel-shelf, and screw to the underside of the board. These can be made by screwing two pieces of wood together, one the thickness of the shelf, and allowing the other piece to stand over about ¾ in., and then screwing right through both pieces into the shelf at the right distance from each end, so as to clip the bottom shelf. If fixed in this manner, it can be taken off at any time to clean, etc., by simply sliding it off.

## A USEFUL HAT OR CLOTHES STAND.

BY T. S.

Many readers of Work have changed their residence some time or another, and, on changing, have doubtless found that the old cornice poles, which had been well suited to the old house, were either too large or too small for the windows of the new residence, and thus have been led to put them away in the loft, and buy new poles. It occurred to me that a good stand could be made from one. This I have made, and hope the description will be useful to others. I had a piece of a good mahogany pole cut off a long one when I last moved, with the knobs at end, and I made a three-legged stand for it, screwed on some brass hooks that were also the result of a "move," and I find it

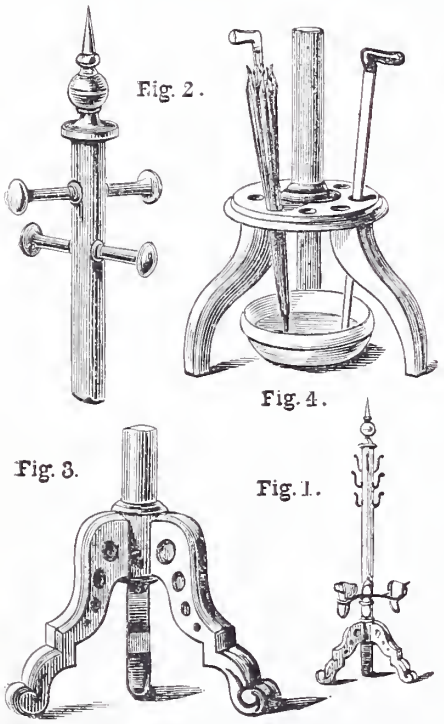



**Fig. 1.—Sketch of Hat or Clothes Stand complete. Fig. 2.—Enlarged View of Top with Pegs. Fig. 3.—Enlarged View of Bottom or Foot. Fig. 4.—Adaptation of Bottom for Sticks, Umbrellas, etc.**

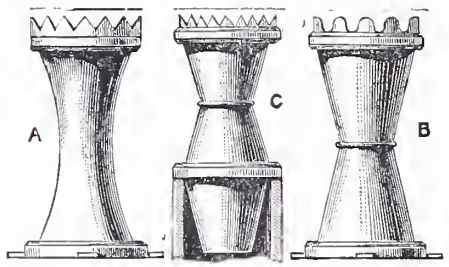
most useful. It stands in a corner, and my clothes hang on it when I am in bed, instead of across the foot of the bed. Thus they get nicely aired, and are put on with pleasure in the morning. This stand also avoids disfiguring the door of bedroom with hooks, and could be made to stand in the corner of a landing or hall, where any other stand could not be placed. Mine is 4 ft. 6 in. high, and has a foot like a three-claw table or music-stool; but if a rather longer pole is used, the three claws could be screwed to side of pole, and the lower end of pole stand on the ground, or be finished with a knob, like the top. The claws could be cut and shaped out of stuff from 1 in. to 2 in. thick, taking for a pattern any table or music-stool you can get at. A reed or moulding could be scratched on the edges, holes sunk in the sides by a large centre-bit, etc. Fix to the pole by one screw through the top part of leg, and one through the pole between two opposite legs. If you have a lathe, you may turn the pins and the base; but if not, brass hooks, or even black iron hooks, would do. The feet should be about 18 in. apart to get a good base, or the stand will be top-heavy. The lower part could be made with holes to take boots or slippers. The top knob takes the hat.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

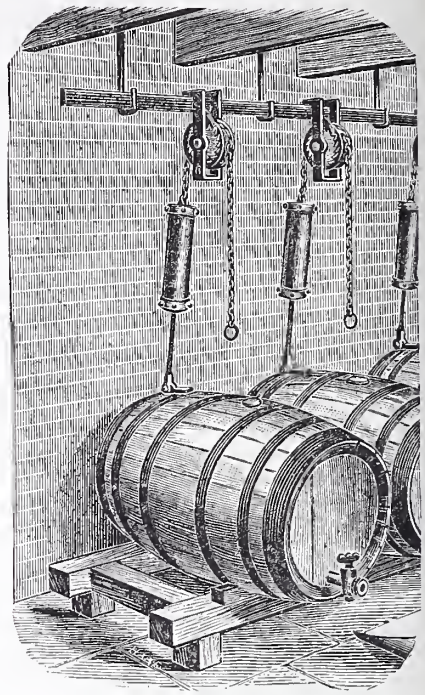
### 41.—Mitchell & Hare's Improved Pot or Cowl.

In the summer, when the fires are over and the chimneys swept, and ready for the winter when it




**Mitchell & Hare's Improved Pot or Cowl—A, B, Ordinary Cowls; C, Cowl for Stove.**

comes round again, persons who are troubled with chimneys that smoke will be taking the necessary precautions to prevent, if possible, a recurrence of the nuisance. In the next number of Work an expert, who writes under the *nom de plume* of "Excelsior," will show us how he manages to do this by judicious alterations of the throat of the chimney just above the grate or fireplace; and in this number, Messrs. Mitchell & Hare, Bedale, Yorkshire, or 10, Chesson Road, West Kensington, show us how it may be prevented by placing a suitable pot or cowl at the chimney top. The form of "The Comfort," the improved pot or cowl by which this desirable result is attained, is shown in the accompanying illustration, in which three shapes are shown, of which two, A and B, are intended for placing on ordinary chimneys; and C, for stoves. The principle of the invention consists, as may be seen, in making the pot narrower in the middle, either concave, as in A, or tapering, as in B and C, and wider at both top and bottom. This, Messrs. Mitchell & Hare say, tends to prevent down draught and the ill-effects arising from it, as the contracted or narrow part acts as means whereby the force of the downward draught becomes broken and gradually expended, and the up draught improved. The manufacturers consider B to be the best shape. They send me a copy of a letter from Messrs. Garlick & Horton, Limited, Builders and Decorators, 43, Sloane Street, London, S.W., to this effect:—"We have much pleasure in informing you that we have fixed your 'Patent Comfort Cowls' to a number of houses in this neighbourhood, and found them a success in preventing down draughts in some very bad flues, and shall be glad to recommend them." The price of "The Comfort" Cowl in galvanised iron is 21s.; and in earthenware or pot, 15s. and 10s. 6d.



**Thomas's Patent Cask Tilter.**

### 42.—Thomas & Sons' Patent Cask Tilter.

When a cask of ale or beer is getting low, it often happens that the liquid remaining in the cask is seriously impaired and rendered "muddy" by shaking up the dregs in tilting it. To obviate this, Messrs. Thomas & Sons, Acme Hoist Works, Cardiff, make and supply a patent cask tilter, known as "Walker's Patent Cask Tilting Apparatus," which appears to form an improved and handy appliance for automatically tilting barrels and casks without disturbing or shaking up their contents. It is said to be light, portable, and simple in construction, and such as can be easily and quickly fixed. Its principle is apparent from the accompanying illustration, in which it is shown attached to the first, second, and third of a goodly row of barrels in a capacious cellar. First of all, hooks are attached to the joists, in order to give support to a rod of iron, on which as many cask tilters are hooked as there may be barrels. The portion of the apparatus hooked on to the bar consists of an iron frame carrying a ratchet wheel and a pawl, which engages in the teeth of the wheel as it revolves, and prevents its return in the opposite direction. Over the wheel passes a chain, free at one end, and attached at the other to a cylindrical case, in which is a spring. At the lower end of the case is a hook of special form, by means of which a firm and instantaneous grip is obtained on the rim of the cask when the hook is attached to it. To set the Cask Tilter, the hook is fixed to the rim of the barrel, and the chain is pulled until the spring inside the Cask Tilter, as the cylindrical case is called, is compressed flat. The apparatus is then ready for work. As the liquid is withdrawn, the spring gradually returns to its normal position, and, in doing so, tilts up the end of the barrel without the slightest shock until it is empty. When empty, the pawl is released by pulling a string attached to it, and the cask immediately runs back to its original position. The price of the Cask Tilter, which is said to be suitable for barrels and casks containing any quantity up to a hundred gallons, is 17s.

The Editor.

# SHOP:

## A Corner for Those who Want to Talk It.

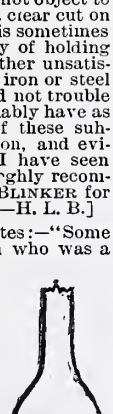
*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Gilding on Glass.** — Blinker writes:—"I fear that Young Signwriter will not find H. L. B.'s instructions (No. 112, present Vol.) in every point satisfactory. By his use of the terms 'inside' and 'outside,' H. L. B. would seem to have a *window* in his mind (an excellent thing, by-the-bye, facilitating enlightenment). Now it is obvious that our young friend will never be able to paint a clear, sharp letter on a vertical surface (rather a mixed expression that; but never mind) with a size so thin and fluid as is used in this process. Even were his glass laid flat, its evenness would offer irresistible temptations to the size to indulge in frisky little excursions on all sides. I have never seen the thing attempted in this way, and, having a horror of bad language, I never want to. Let Young Signwriter lay on his size—which is not expensive, for the spirits of wine may he dispensed with—liherally, and when it has drained to a thin film, cover all that part of his glass wbere lettering occurs with leaves of gold neatly laid to overlap each other the 'laste taste in life.' This must now drain and dry, dryness being indicated hy the disappearance of the minute irregularities which make the gold look 'mat' and the reappearance of burnish. While this process is going forward, Young Signwriter cuts a stencil or stencils (hints have appeared in Work), which will cover the gold that is to *remain* on the glass, and expose the *superfluous* to the action of a stiff but not harsh brush, as a nail-brush. The stencils may be made in stout paper of hard texture (continuous roll preferred), and as they are not to be roughly used, they will serve a number of times, though thin stencil metal will be better. Young Signwriter need not be told that it is practically impossible to *paint* a letter so clear, sharp, and altogether lovely, as can be produced by stencilling of this kind, even though he used a much more workable size than this, which is hardly more than water; and if he has a number of tablets to be lettered, or any kind of repeating to do, the advantage of stencilling—not to say the absurdity of using any other method—will at once be apparent. If he is engaged on plain lettering which lies between two (imaginary) right lines, *one* stencil, to remove gold from *between* letters, will be sufficient, and superfluous gold from tops and bottoms can be cut away with—a match-stick, for instance; care being taken to lay the straight-edge across slips of wood, to prevent contact with gold-film, which is easily damaged. Shading may now be painted in, if required, and the whole backed up any colour. I should have mentioned that stencils are not laid upon a board during the process of cutting, but upon a piece of glass—*not* the piece heing decorated, of course, but a waste piece which does not object to being scratched. You cannot ohtain a clear cut on any yielding or uneven surface. Lead is sometimes used for this purpose, but it has a way of holding the point of your knife, and is altogether unsatisfactory. Zinc is better, and polished iron or steel is almost as good as glass; hut I need not trouble to say so, as our young friend will probably have as easy access to the latter as to any of these substitutes."—[This is valuable information, and evidently written by a practical man. I have seen work done in this way, and can thoroughly recommend the process. I am obliged to Blinker for kindly supplementing my instructions.—H. L. B.]

**Spanner.** — W. E. (*Liverpool*) writes:—"Some time ago I was working with a man who was a good engineer. He came to put some 1 in. steam piping, and had forgotten to fetch his pipe tongs. He said he was not much concerned about them, he could screw up round piping with a square spanner, which he did, and made a good job of it. He got a spanner a little bigger than the pipe, and inserted a bit of a rat-tail file between the pipe and jaw of the spanner, which held the pipe, I think, better than tongs would. I enclose a rough sketch—A is a bit of rat-tail file; B shows the pipe."



Spanner.

**Bicycle Parts.**—Messrs. W. A. Lloyd & Co. (*Birmingham*) write:—"We have been inundated recently with applications from amateurs for our price list, and we find it is largely owing to the article appearing in your journal of May 30th, on 'The Construction of the Safety Bicycle,' in which our name is mentioned as one of the firms where parts, etc., may he obtained. We shall be very glad if you can find space in the next issuc of your valuahle paper to say that we can only supply the *actual 'cycle trade'* with fittings; and if any of your readers require our goods, they can he obtained from any cycle agent in the country. We may say it is evident your paper must have an enormous circulation, as the applications have heen very numerous indeed, and have come from all parts of the kingdom."

### II.—Questions Answered by Editor and Staff.

**Celluloid on Piano Keys.**—Leicester.—Take the keys off the frame. Now get a level board to lay your keys on, then glue two strips of hrown paper on the two top edges of the hoard; then put a spot of glue on the underside of the key hack and front, and glue to the strips of paper, placing them in their natural position, leaving the sharps out. Having taken the old ivory off, tooth the tops of the keys. Now tooth your celluloid well, and saturate the side you have toothed with methylated spirits. This softens it. When the spirit has evaporated, you are ready to glue with ordinary glue. I should advise you to lay it in four pieces. You will require a caul made hot. Now glue carefully, and press with handscrews and leave to dry. You will find that you can easily separate it from the paper; then turn over, and cut apart with a fine saw. Where the sharps fit in, cut with saw across, then with a knife from underside cut the piece out, finish with file, and polish with bath-hrick and paraffin or spirits and whiting, and plenty of friction.—T. E.

**Sticker Action.**—Repairer. —The action you speak of is what is known as the "Sticker Action." Remove the stickers from the levers, and take the hinges from the butts; number with pencil each one, so that they go baek in the same place. Pull the old hinges out of groove with a pair of pliers. To re-hinge, ohtain fawn-skin sticker hinge (it is 1 in. wide), bend in middle, and strike with a hammer, holding it on a piece of iron, and form a hinge smooth side out. Cut into lengths sufficient for six, glue the groove, and press leather in with a piece of thin steel; a stay-husk makes a usc-ful tool for this purpose. You may re-cover levers with fawn-skin cut to the width you require, and glue on top first and allow to dry; then pull tight round and glue on the underside, and hold in position with hammer springs. Now slack the screws in the hammer rail, and take out the centre wire with the butts on. Take off the butts, and remove old bushing. Ohtain a set of bushing eloth and point the ends, and glue and allow to dry. This makes a point to thread with. Now thread the cloth in the butt, leaving a small portion hanging out. Glue this, or use shoemakers' paste, and draw level with side of butt, and cut with knife; when dry, broach for centre wire. If you now put the centre wire in, and fix the hammers in the rail, you can re-cover them. Remove the felt by cutting across the front of the hammer with a sharp knife (only cutting the outer covering), and tear off. Ohtain a strip of felt, and after tapering the edges down with a knife, cut the felt across a shade wider than the hammer-head. Glue the top side first, and put a spring on each, and allow to dry; then pull felt firmly over, and glue underside; fasten with spring and allow to dry, when you can trim the sides. Do not glue the front of the hammer. Use a shoemaker's knife, and sharpen on emery-cloth. If you do not cut the sides of hammers very nice at first, press between two warm flat-irons. Obtain a strip of damper felt, and cut to the width you require, and glue on, holding with a spring until dry. To put new vellum in levers or dampers, saw slightly across just behind hinge, and open with a knife; take out old vellum, and having prepared your vellum by gluing hoth sides and allowing to dry, place in the groove, damp the wood, and hold a warm iron on it. This will soften the glue on the vellum. Now put spring on, and allow to dry. You may now put your stickers in their place. Lay the action down on your bench, and glue the bottom of sticker and hinge at one time. Put the bottom on the lever, and hinge on the hutt, and with a sticker hook press the leather on the hutt front and back. After stickers are dry, ease them backwards and forwards—not too much, only what is necessary when in the piano. The materials for repairing action you can ohtain from Hallpike, 213A, Mare Street, Hackney, London; the tools from G. Buck, 242, Tottenham Court Road. Ask for pianoforte maker's spccial price list.—T. E.

**Cost of Copper Sheets.**—Anxious.—I find that a sheet of copper ¼ in. in thickness, and 4 ft. long hy 2 ft. wide, weighs ahout 36 lbs. As there are eight square feet in a sheet of this size, it therefore follows that the weight per foot super. is 4½ lhs. The retail price of copper, varying, according to the market, from 1s. to 1s. 3d. per lb., you would find very expensive to use, a sheet of the size stated above costing ahout 35s.; though, if you are in the metal trade, or could get anyone in the trade to get it for you, there would, of course, be a good discount off retail price.—R. A.

**Tinners' Mixture.**—F. H. (*Birmingham*).—I am not aware of the existence of the mixture you ask about for darkening the colour of tin. If, as you say, it is a tinners' secret, you may depend upon it that it is only to bc got by paying for. As you appear to have the opportunity of seeing it used, could you not get hold of a little, and submit it to analysis? or if it is of value to you, as I suppose it is, ask the users of the mixture their terms for imparting the secret.—R. A.

**Scenic Artist.**—Work.—Consult the *Era*, theatrical newspaper. You will find scenic artists and assistants are advertised for weekly. Also study my instructions in Work.—W. C.

**Plating Safeties.**—F. C. (*Manchester*). — The materials required to nickel-plate two safeties are a floating bath, a battery, nickel, ammonia, hi-sulphite of soda, and the practieal experience of a nickel-plater. The process of plating, you will see, is entirely different from painting black enamel. It is not a painting process, hut a dipping and depositing operation hy the action of an electric battery. Nickel-plating may, however, be done without a hattery, hut it would not be advisahle for a novice to try even it. The process is as follows:—A porcelain or copper vessel, large enough to dip a handle-har, is required. Into the vessel is placed a concentrated solution of zinc chloride, diluted with one and a half its volume of water, and heated to hoiling. As much powdered zinc as will lie on a shilling is then thrown in, which will coat the interior of the vessel with zinc. The nickel salt, which may he the chloride or sulphate of nickel, is now added until the bath appears green. Now put in some zinc fragments and the articles to be plated, and hoil for fifteen minutes. When taken out, wash with clean water, and clean with chalk or jeweller's rouge. If you want a thicker coating, repeat the process.—A. S. P.

**Plating.**—J. C. (*Wraxall*).—You seem to imagine that nickel-plating is put on with a brush, like paint, whereas it is a process of dipping in a bath charged with nickel, ammonia, etc., under the action of a hattery, so that an outfit for nickel-plating one's bicycle is out of the question. Send it out to a professional plater, who will do it for about 10s.—A. S. P.

**Size.**—Hawk.—I have never used Cognet's patent powdered size, therefore do not know its properties. If you cannot get the ordinary jelly size, and you find the results not satisfactory, get 1 lb. of hest treacle, ½ lh. hest yellow soap, and, say, 1 lh. of your powdered size; bring it all to a boil, but do not let it hoil. These ingredients should be put into 3 quarts of water before placing on the fire. When all is ready, pour this into your soaked whiting, well mixing it. Let it get cold. When cold, it is ready for application. The room being cold and damp would not make much difference, hut, I should say, rather depressing for any artistic work.—W. C.

**Cost.**—Working Man.—I should roughly estimate the cost of such a building as you have described to be worth ahout 5½d. a foot cube to huild. The way you can arrive at the amount is as follows:—Multiply the extreme length of building by the extreme width, and the total by the height half-way up the roof, thus:

| | | |
|---|---|---|
| Length of building ... ... | 36 ft. | |
| Width of building ... ... | 38 ft. | |
| | 288 | |
| | 108 | |
| Superficial arca of building ... | 1,368 ft. | |
| Height of building ... ... | 12 ft. | |
| Cuhical contents of building ... | 16,416 ft. | |
| Price per foot cube ... ... | 5½d. | |
| | 82,080 | |
| | 8,208 | |
| | 12)90,288 | |
| | 20)7,524 | |
| Cost of building ... ... ... | £376 4s. | |

You omit to state the proposed height of building, so I have taken it at 12 ft.—that is, half-way up the roof. In addition to the ahove, it would cost about 1⅘s. a yard to have the hall tiled. You must distinctly understand that this is, as you suggest, only a rough guess, as you have furnished me with no particulars heyond saying that the situation proposed is four miles from a hrick-field, and the little omission I have mentioned above.—E. D.

**Transfers, etc.**—Engineer. —You can ohtain gold transfers from Mr. H. M. Stevenson, 6, Edmund Street, Birmingham, or Mr. W. Gay, 115, Holloway Head, Birmingham. To draw water from the river that runs by your works by means of a lathe seems to me a rather curious proceeding; hut if you wish to do it, get a small rotary action pump from Messrs. Warner & Co., Creseent Foundry, Cripplegate, London, and work it from the slow motion of your lathe hy means of a gut-line or shaft. The third question on your paper—How to utilise the river for driving purposes—could only he satisfactorily answered hy an experienced millwright or engineer viewing the place, and taking all the circumstances of the case into consideration. The data that you give—that the stream is ahout 10 ft. wide, and runs very swiftly—is not sufficient to form any idea of the place, and space in "Shop" is too valuable to waste in mere conjecture. I should think, from the general tone of your letter, that a perusal of some elementary works on mechanics and hydraulics would he beneficial to you.—R. A.

**Marbling.** — A Plasterer. — Your letter and drawing give me no idea of the purpose you propose utilising the pedestal for. If it is to be used as a stand in a living room, then it will look best

finished in one plain general colour. It would certainly be a mistake to paint it in imitation of many kinds of marble; the finished effect, especially in the hands of a novice at marbling, would be common and poor in the extreme. I would not, personally, advocate trying to imitate any one kind of marble, save those of a quite general colour. With such an object, wherein the structural ornamentation is a special feature of its value, the veining of marble would detract from the effect of the enrichment, and would destroy much of its delicate form. Assuming it to be a room pedestal, I should paint and enamel it either alabaster colour or as black marble, and enrich it by gilding the caps and cornice blocks solid with gold-leaf. This would look good and rich, and not "cheap and painty." —DECORATOR.

**Greenhouse Wash.**—B. A. W. (*Croydon*).—Prepare a mixture of white lead paint, made from white lead 1 lb., patent driers 1 oz., and thinned to desired consistency with four parts turpentine to not more than one part raw linseed oil. This must be barely and evenly painted with an ordinary paint-brush upon the outside of glass, and then finished to look like obscured or ground glass by stippling—dabbing—evenly over with either a pad of flannel, soft carpet, or the tips of a larger new dry paint-brush. This paint will not wash off with rain, but you will find that by the time the heat of a summer's sun has been spent on it that it can be removed without much labour, by damping it over and rubbing with a piece of soda, taking care not to have sufficient moisture on the glass to run down and "eat off" the paint from the woodwork. —F. P.

**Varnish.**—J. T. (*Nottingham*).—Copal oil varnishes are of a more durable nature than polish or varnish prepared from lac and spirits. In the former case, the oil combines with the copal gum to make a film which gets harder with age, whilst the lac has not such aid in spirit varnishes from the vehicle in which it is dissolved. Notwithstanding the foregoing, *any* copal varnish would not suit your purpose, since warmth from handling the rods would probably make them slightly sticky. The most durable and quick hardening covering I could suggest is a white enamel varnish or Bath varnish. Such a preparation is rather expensive, but it has all the advantages of durability given by copal varnish, combined with the quick hardening nature of a spirit and lac mixture. You could not profitably make this. Mander Bros., of Wolverhampton, is the firm you should apply to.—F. P.

**Graining Tools.**—DECORATOR.—If you want to purchase in any quantities for retailing, etc., write either Messrs. Crowden & Garrod, 62, Southwark Street, London, S.E.; T. Pavitt & Sons, 70, Southampton Row, London, W.C.; or J. Hill, 230, Pentonville Road, London, N. In buying brushes, be willing to pay a fair price; "cheap and good" seldom go together in this respect. If you require a book of practical value to supplement the series of papers on sign writing which appeared in WORK, Vol. I., get the "Art and Craft of Sign Writing," from 15, St. Ann Street, Manchester. It is the most complete work published, containing everything appertaining to the subject, coloured and gilded samples, etc. The price is 21s.—F. P.

**Patent Leather Boot Varnish.**—OLD SUBSCRIBER.—When patent leather is first taken into wear, its brightness may be preserved by well dusting and rubbing with a soft cloth, and then applying a little white of egg with the finger. This being such a fine transparent layer, it seldom wants washing off; but should the leather want cleaning to receive any other preparation, it can be easily removed with a little warm water. A good varnish that will wash off can be made by boiling ½ oz. of logwood chips in ½ pint of soft water, and adding a piece of copperas about the size of a filbert nut. Strain off the chips, and add to the liquid 1 oz. of gelatine, ½ oz. of isinglass, 1 oz. of sugar, ½ oz. of glycerine, and 1 gill of common port (ale will do). Boil gently, and well stir till all are dissolved; strain again through fine muslin, and when cold it is ready for use. It should be about the thickness of double cream. Another good and simple dressing for patent leather is—one of linseed oil to two of best cream. Just warm it on a slow fire while you mix it well together. Apply with a piece of sponge, and when dry, rub with a soft cloth till you get a brilliant polish.—W. G.

**Lithographing.** — LITHO. — There is no paper published which is devoted exclusively to lithography, but there are several which deal with lithography in connection with printing, publishing, and other branches of the trade; such as the *Lithographer*, the *Printing Times and Lithographer*, the *British and Colonial Printer and Stationer*, the *British Printer*, etc. I should recommend the *Printing Times and Lithographer* (published at 73, Ludgate Hill, E.C.) and the *British and Colonial Printer and Stationer* (published at 58, Shoe Lane, E.C.); the former being a monthly paper, and the latter a weekly one.—A. J. A.

**Cooking Stove.**—T. P. (*Weston-super-Mare*).—I have not any information on the subject of the curious cooking stove described in your cutting from *Cassell's Saturday Journal*. I scarcely think (ingenious though the device is) that it will, as the writer says, revolutionise the art of cooking. With regard to a good paraffin cooking stove, Rippingille's will bear favourable comparison with any other maker. I have used them myself, and frequently have to overhaul and repair them, so can speak from experience. For cleanliness and convenience, especially in summer time, these stoves are very useful indeed. I think your friend must have neglected his stove for it to have worn so badly; with proper care, they will last for two or three years without repairing. The following directions may perhaps be of service to users of oil stoves. Fill the tank up every day of using, whether there is any oil left in or not. Carefully wipe all spilt oil off the tank before lighting; avoid, if possible, the boiling over of saucepans, etc., placed on the top. If they do happen to boil over, see that the stove is wiped dry after it is done with. If put away out of use for a time, empty the oil, take out the wicks, and keep in a dry place. By these means the stove will last as long again.—R. A.

**Spangled Tin Goods.**—A. H. K. (*Birmingham*).—I am unable to give you the process by which this is done, as I do not think it is generally known. You would most likely be able to obtain the material from the Tin-Plate Decorative Co., Neath. —R. A.

**Moderator Lamps.**—W. M. (*Market Drayton*).—You can get your lamp repaired at Benham & Froud's, Chandos Street, London, W.C., or Gardner's, Charing Cross; and there used to be some years ago a shop in Gerrard Street, Soho, W.C., whose proprietor dealt specially in lamps of this kind, but I cannot say if it is still in existence. Your lamp, when in good condition, and if it is a full-size one, ought to run at least four hours with once winding. —R. A.

**Dead Black.** — BRASSWORK. — The best thing that I can recommend you for a dead black is something that I have been using lately myself for my camera and lens tubes. It is called "Enameloid," sold in shilling bottles by the Frederick Crane Chemical Company, 22, Newhall Hill, Birmingham. It is a perfect dead black, absolutely non-reflective, and will bear any handling. Berlin black is also a very good black, but not so dead a surface as enameloid.—R. A.

**Piano Sound-Board.** — PERSEVERANCE. — The sound-board must be planed all over, not merely at the edges. You can obtain a sound-board (ready to put in, with the exception of the bars and bridges) from R. Peace, Blackstock Road, Finsbury Park, London.—T. E.

**Rust on Wrest-Pins.**—F. S. M. (*Huddersfield*). —Having cleaned the rust off, get some good Brunswick black, and with a camel-hair brush paint each pin and allow to dry. You can clean the bolts with emery-cloth, but you will probably take the blue off. If you wish to blue again, take one out at a time, and hold in the flame of a gas-jet near the head until it turns blue, or you may black them.—T. E.

**Cox's Glue.**—G. A. (*Liverpool*).—Write to the agents, Fordham & Co., York Road, King's Cross, London, N.W., when they will probably inform you where to obtain it in your town, or send you the quantity you require.—T. E.

**Piano Matters.**—AMBI-DEXTER.—I should make your bracings 4 × 3. From your letter I judge you would succeed. With regard to your other question, £6 would cover cost.—T. E.

**Tuning Hammer.**—The hole is drilled in before it is tempered, the top of the shank is square where it is inserted in the handle, and a washer riveted on the top; the handle is simply turned out of hard wood. You can purchase one for 5s. 6d. from Buck, Tottenham Court Road, London.—T. E.

**Piano Matters.** — PUZZLED. — I presume you have made the strings too wide apart for the hammer-head to strike them. With a flat punch knock the pin a little closer, and if there is a deep impression, re-cover. As you have put more strain on your piano, you will have to strengthen it by gluing some half-inch hard wood up each side of the bracings as far as wrest-plank.—T. E.

**Fretwork Patterns for Piano.**—F. S (*London, W.*).—Write to H. J. Fletcher, 161, City Road, London, E.C.—T. E.

**Piano Keys.**—LOWERBY.—If your keys are made of ivory, rub with No. 1 glass-paper, then polish with a flannel pad damped with methylated spirits and whiting.—T. E.

**Fairy Bells to Piano.**—J. H. C. (*Edmonton*).—You must tune to the natural notes of a piano if you can get access to one. It is a simple matter to tune them to each note. Make the shortest string to the pitch or middle C on the piano, then follow each white key towards the bass, and tune each one following, when your longest string will be two octaves below pitch C. You can purchase a few wrest-pins or pegs at any pianoforte dealer's.—T. E.

**Piano Wrest-Plank.**—J. C. (*Bolton*).—To take out piano wrest-plank, lay the piano on its back, and take a slip of wood and fit in at the bottom edge of the plank, and mark very carefully with a pencil where every string crosses. This makes a scale, as your hammers must all strike the strings when your new plank is in. Now take a sheet of paper the size of the plank, and with a piece of heelball rub over the paper when laid on the bridge, so that you get your bridge in the right place. Now take off your strings, and bolts out, then take off the wood on top and chop out; make the new one exactly the same, and, if possible, take the bridge off whole to use again.—T. E.

**Looking-Glass Frame.**—BARRA.—If the frame is a plain moulded one, without enrichments or carvings, you would have little difficulty in staining and polishing it black, as you wish. If perfectly plain, the gilt surface could be easily removed, or at least reduced, by rubbing with some fine glass-paper, taking care in so doing not to round off all square members or sharp edges; if there are carvings, you might use a little methylated spirits with a rather stiff brush, such as a sash tool, but do not use water unless you allow it to thoroughly dry, as polish or varnish will not take kindly to anything damp. Having prepared the groundwork, mix some vegetable black in one part polish, or varnish, and three parts methylated spirits; give several applications till you have a dull, even surface; then polish, using white polish and a little gas, or Frankfort black, in your rubber, or mixed with your polish, and finish with glaze, or varnish, or spirit-ing out, as may suit you best. Failing your ability to French polish, I am afraid you will have to fall back on the process you seem to object to, and use some black enamel; but of this there are several brands in the market, one of which, known as "Foo-chow," being made of spirit instead of oil varnish, ought to suit your purpose capitally. It does not give that thick bright surface you object to, and it can, by thinning down with methylated spirits, be made to give an almost dull appearance. You will not, of course, without using extreme care, be able to save untouched all the parts you require gilt; it will be better to do all over as suggested, then cut in the parts or any design you may require gilt with a little oil gold-size, procurable at most oil and colour merchants, to which, when nearly dry, you can apply gold-leaf, Dutch metal, or bronze. You will find full directions for gilding in Vol. II., pages 718 and 750. As regards the treatment of plain wood, instead of that faced with whiting, you do not say what kind of wood it is—whether polished or not; if the former, and a black ground is required, the foregoing treatment will suit; if the latter, the wood will require staining first: this can be done by means of a logwood stain, though it is cheaper and more cleanly to use French black stain, procurable at most places where veneers are sold, and colour merchants; or you might use the Improved Ebony French Polish, as sold by T. Jackson, 199, Borough High Street, London, S.E. This is a stain and polish combined. Should you require other colours than black, and wish to show the figure of the wood, you will have to stain by means of one of the many recipes to be found in "Shop," and finish by polishing.—LIFE-BOAT.

**Iron Lasts.**—A. T. H. (*Acton Green*).—You say "pack"—but of course you mean fit up—"iron lasts for pegged and rivcted boots." Well, for the former an iron last is of no use, but a wood last must be used, for, in making pegged work, the peg-awl must go through the whole of the materials, and a little way into the last. This is that the peg may go just through, that it may be rubbed down inside; hence the use of the peg-rasp and peg-knife. Were you to use an iron last, you would blunt the peg-awl each time you made a hole, and the peg would not go through, and solidity could not be the result. Iron lasts are just the thing for the latter, as the rivets are clenched as they reach the last. They are fitted up according to their particular construction. If they are ordinary block lasts, and you want to fix a joint or long-leather on them, it can easily be done by fixing these with a waxend to the block before putting the block on the last. Of course they must be fitted and blocked to their shape on the last first. Or another, and the best, way, is to take the last to an iron-foundry, and have holes drilled where you want fittings to be put on. You can fill the holes up with gutta-percha or wood, and then nail the fittings on the lasts. The way to sharpen a shoemaker's buff-knife is to run it through a piece of tallow, and lay it flat on a board with the edge you want to sharpen flush with the edge of the board on the right-hand side; hold the knife on firmly with the left hand, by pressing all four fingers upon it, and with the stem of a sewing-awl, stiletto, or steel burnisher, rub down the edge backwards and forwards; this will throw a fine burr right across the edge. Turn it over, and repeat this process on the other side. This done, hold the knife, edge upwards, in the left hand; place the right thumb against one of the side edges, and draw the awl from the centre to the corner, letting the awl run on both the burrs at the same time, and keep stroking it till the edge is flat. This will throw the burrs over on to the sides again, but they will have a keen and even edge, for each time it is sharpened, it throws over a little more steel. This second process has to be repeated on the other half. Do not let other tools come in contact with it; keep it by itself.—W. G.

**Crayon Drawing.**—W. W. C. (*Kelso*).—A rapid and showy method of shading is by first "stumping" in the shadows, and then hatching over them with the chalk point. The stump, I may explain, is a little roll of wash-leather, cut to a conical point, which is dipped in powdered chalk and worked over the paper. "Hatching" is drawing a series of lines which cross each other, but they ought not to cross at right angles. This, however, is not the method in favour in the Government Schools of Art, or in the Antique School of the Royal Academy. In these schools it is the practice first to go over the shadows with very rough hatching —scribbling it might rather be called—and then to work and "stipple" over and between the lines with the chalk point, taking out any harsh line or touch with bread-crumb. This plan gives greater delicacy, and enables the student to render such shadows as he sees before him far more accurately and conscientiously than the first-named

method. For serious study, its advantages can scarcely be questioned. W. W. C. should, if he can, see a School of Art, or get a lesson or two from one of the students. He would thus learn much more about the matter than from columns of description. As to tools, all that he needs will be his port-crayon, a few French chalks, and a penny loaf.—S. W.

**Piano Repairs.**—W. R. W. (*Poplar*).—You can obtain new hammers for your piano from Hallpike, 213A, Mare Street, Hackney, London (probable cost, 10s.), and wire from Hughes, 37, Drury Lane (probable cost, 25s.). Apply to Rudd & Co., 74, Dean Street, Soho Square, for an estimate.—T. E.

**Piano Wood.**—MUSICUS.—Formerly oak was used for piano wrest-plank, and if you veneer it well to prevent splitting, I see no objection to your using it.—T. E.

**Square Piano.**—H. A. C. (*Plaistow*).—Any stationer will give you the information about binding WORK. There are only sixty notes on your piano, but you have confused notes with strings. There are two strings to each note, except perhaps at the extreme bass, where there are a few single strings. When you string your piano, count notes, not strings.—T. E.

**Piano Label.**—S. H. B. (*Barnstaple*).—It is a very simple matter to put label or name on fall of piano. You can either use polish or glaze. Scrape the old label off with a chisel carefully, then level with glass-paper, rub a little glaze or polish on the back of label, and put it in its place. See that the air is pressed out with a soft rag, and leave to dry. Then give it a rubber of polish in the ordinary way.—T. E.

**Piano Making.**—CRESCENDO.—Yellow pine will not make a good sound-board, as it is too soft, and makes the tone without ring in it. A better substitute for Swiss pine would be good quality spruce, free from knots. You could obtain a sound-board ready jointed from R. Peace, Blaekstock Road, Finsbury Park, London (cost about 5s., carriage and packing extra). The bottom plate is made of iron ⅛ in. thick, and is bolted on the bottom of piano; the holes are drilled in the top edge and pins placed in. I should advise you to buy one ready made. Covered strings, 11s. to 12s.; steel wire, 1s. 9d. per lb.; wrest-pins, 2s.; bridge-pins, 1s.; bent side and bottom plate, 3s. 6d.; keys and action, £3.—T. E.

**Felt on Piano Hammers.**—NOVICE.—Kindly see reply to G. T. (*Chatham*) on page 61, No. 108, Vol. III., of WORK. Felt may be obtained from Hallpike, 213a, Mare Street, Haekney, London.—T. E.

**Fairy Bells.**—F. (*Preston*).—I thought I had made the instructions clear. It says distinctly: "Over the bridges you will find sizes of wire and number of notes in brackets. There are four strings of No. 8, four strings of No. 9, four strings of No. 10, and three strings of No. 11, all steel music wire."—T. E.

**Fretwork.**—H. S. C. (*Manchester*).—Get the Indexes to Vols. I. and II. of WORK, and you will find fretwork hints and designs and cupboards by the score.

**Bicycle Parts.**—SUBSCRIBER.—All parts for cycle making are obtainable of—Brown Bros., 7, Great Eastern Street, London; W. A. Lloyd, Lionel Street, Birmingham; Thomas Smith & Sons, Saltley, Birmingham.—A. S. P.

**Ticket Writing.**—WUERDLE.—For materials, paints, brushes, etc., apply to Messrs. Brodie & Middleton, Long Acre, London, W.C.

**Worm and Wheel.**—LETTER CUTTER.—I do not think you can buy a worm and wheel such as you require, and will have to get them made. You did not say what pitch the teeth would have to be, but as the spindle of the worm-whool is only ⅜ in., I may suppose they will be fine, and the worm only of the ordinary ¾ in. Whitworth screw rate. There must be many a workman in Aberdeen who could make you a worm and wheel such as you describe, and I think 15s. should cover the cost.—F. A. M.

**Water Motor.**—A. J. (*No Address*).—You ask what pressure is required in the mains to give you one horse-power. That depends on how much you use. You might as well ask what pressure you must have in a steam boiler to give you 10 h.-p. You might have a pressure of 5 lbs. and get 10 h.-p. in one engine; or you might have 100 lbs. per square in. in another, and yet get no more. In some mains you may have one or two hundred lbs. per square inch, and a small quantity of water at that pressure will give you considerable power; so, too, you may have a slow stream of water, having only a few inches of fall, and yet, if there be plenty of water, you may get the same power. See my remarks on page 23, middle column, of the present volume, and do not think of drawing one horse-power from the town mains; it may cost you five shillings per hour. It is all very well for those who have a natural fall of water.—F. A. M.

**Piano Defects.**—L. C. (*London*).—I should judge that the depreciation in the tone is not caused by the small cracks (which denote that the wood has not been dry), but by the sound-board having sunk, so that the strings do not bear sufficiently on the bridges. Take out the back, and wedge three or four bottle-corks tightly between the upright bracings and the sound-board. This may improve it if the sound-board is firm. The action you have sent a sketch of is known as the "Costa." Probably the felt on the hammer rest is hard; if so, place a piece of flannel over it, and try. Does the hammer-head touch the wire that raises the damper? Noises can only be detected by patient listening to find the cause. If the hammer does not strike with sufficient force, turn the wire which is under the arm that is prominent to the left; if it does not free itself from the string, turn to the right.—T. E.

**Blow-Lamp.**—WATER-PIPE and E. D. (*No Address.*)—A very good lamp for the uses you wish to employ it for is the French methylated spirit blow-lamp, Fig. 1. If you really wish to try and make one, you cannot do better than get an old police lantern; this will give you a start with the body if you take the glass out, and cut front to the shape shown in the sketch; the lamp also could be brought in with a little alteration. The top chamber, C, is the part that you would have most trouble with; it is, as shown in sketch, spherical in form, with a screw on the top for filling; there is usually a valve in this screw, but I will tell you how to dispense with that. The simplest way to get over the difficulty is to make a vessel as near the shape as you can, and this you can easily do (see Fig. 2, which illustrates the following description):—Take a strip

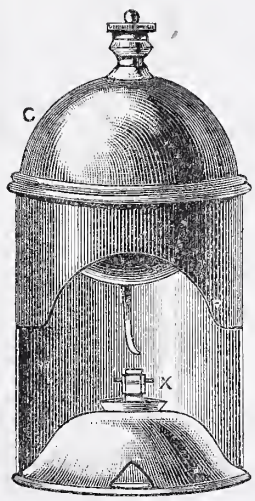



Fig. 1.

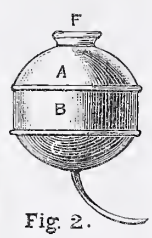



Fig. 2.

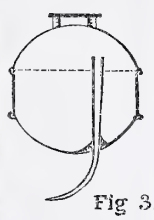


Fig 3.

**Fig. 1.—Blow-Lamp. Fig. 2.—Home-Made Reservoir, equivalent to C, Fig. 1. Fig. 3.—Section of Reservoir, showing Position of Blow-Pipe.**

of copper or brass, whichever you please, ¾ in. in width, and long enough to go round the inside of the lamp body; let it fit fairly tight, and give a ½ in. lap and soldor it; this will form the centre piece B. Next cut a circular piece, ⅝ in. larger in diameter than the piece just made, hollow this up, slip it *inside* the piece B, then cut another circular piece for the top A; as this ought to be hollowed up more, cut a little larger than the piece C, and this piece must he "capped" on to the piece B, as it will then form a ledge, and prevent its slipping down the lamp body. Before soldering, a hole must be punched in the A piece for the filling screw F, which should be a good one, and have either a leather washer or a ground in stopper, such as is used in the best class hot-water bottles. A small hole must also be made in the C piece for the blow-pipe to pass through. Fig. 3, which is a sketch of the reservoir, shows how the pipe is situated; it must be some distance out of the centre, and should come up inside to within ⅛ in. of the top, so as to allow the reservoir to be somewhat over half full to start with. Solder this pipe round well inside, fix the filling screw, and then solder the top and bottom. The blow-pipe may be the end of one of the ordinary gas-fitter's brass blow-pipes, costing about 6d. The lamp itself should have a single tube ⅛ in. or 3/16 in. in diameter; the wick should be the same as used in ordinary bull's-eye lanterns, viz., that sold in large balls; it is a soft, loose, twisted wiek, and should not he packed in too tightly. The flame may be regulated to some extent by the same means that was adopted in the benzoline lamps when they first came up—that is, by an outside tube made to slip firmly, yet easily, over the wick tube (see X, Fig. 1). To use the lamp, fill the vessol C, Fig. 1, about three parts full, or, in other words, not quite up to the level of the inner tube (see dotted line, Fig. 3), with methylated spirit, and the lamp with the same; light the lamp, and as the spirit in the top vessel gets hot, it throws off a gas, or vapour of spirit, which, blowing on the flame of the lamp, forces a strong jet of flame of intense heat outward. Should the lamp not commence to blow in a minute or two after lighting, blow it out, and run a small wire up the blow-pipe to clear it; by being careful about this a valve on the top may be dispensed with. I think that for most purposes that a blow-lamp is required this home-made affair will answer well, but, of course, you cannot expect to do brazing with it. I have not made any experiments to try if this lamp will work with benzoline in place of methylated spirit, but I should think that very likely it would.—R. A.

**Dampness.**—W. N. B. (*Glasgow*).—The only remedy is a dry area, a description of which you will find on page 461, No. 29, Vol. I. Do not, under any consideration, waste your money in rendering the inside of the walls with Portland cement, for although it is very good in some instances, it would be of no service in yours. The ground being so very much higher at the back of house than the front, it is most probably above the damp-proof course; and if it is so, you will find it impossible to keep out the damp whilst the ground touches the wall above the floor and the damp course, and your only remedy is as above. We will now take it for granted that you have constructed a dry area wide enough for a man to work in comfortably right round the external walls of the room you complain of, and still the room is damp (after having allowed a sufficient time for the room to dry—say, three months); and from the fact of the ground under the floor having been asphalted, I should not be very much surprised. You can take it for granted that the damp course is defective, or that the stone facing of the wall is very porous, and absorbs the driving rain and other moisture. You should now from the dry area carefully inspect the damp course (if one exists), and see if you notice anything wrong with it; and, if so, remedy it. If there is not one, and you still wish your room to be drier than it is after constructing a dry area, you must put one; but this job requires rather a lengthy description. If, as far as you can see, the damp course is all right, insert three or four air-bricks along each wall. If you consider the external stone-work to he porous, you had better render it with Portland cement and clean-washed sand, in the proportions of three of cement to one of sand, 1 in. thick, and trowel the face down very fine and smooth, and do not leave it from the float. A very good plan would be to cover the external faces with slates or other waterproof material, hut whatever you do must be done from the outside, for that is where the defect is.—E. D.

**Green Stain.**—A. H. W. (*Newcastle*).—The usual medium for staining green the fancy artistic furniture to which you refer is made by mixing verdigris with hot vinegar; but I find the aniline dyes known as Tomlinson's, sold in one penny and threepenny packets, equally as good; in fact, I prefer the latter, owing to the facilities for getting various shades. For instance, if the green is too bright, it is easy to add a little of the blue or black dye. Both can be finished by the usual process of French polishing, using white or transparent polish and varnish. If "filling in" is used, it is, of course, coloured to match by adding some green pigment, such as emerald or Brunswick green.—LIFEBOAT.

**Stencils.**—J. W. (*Shobdon*).—Your experience with regard to the suitability of "bought" stencils for any special purpose is a common one. The rubbing of stencil border you enclosed is a *motif* not original to myself. The combination of rose, shamroek, and thistle worked into an acanthus scroll, is carved as a frieze to a wing of Buckingham Palace, built by one of the "Georges," and I have repeatedly soen it worked as a steneil scroll border. The one you send is fairly well drawn, and does credit to your experienee, showing that you have grasped the idea of practical fitness in the arrangement of the ornament for stencil cutting.—LONDON DECORATOR.

**Lantern Slides.**—T. A. G. (*Stratford, E.*).—Transparent black lines or shadows, and clear glass in the high lights, such as you ask how to produce, are signs of a perfect lantern slide, and most amateurs find this their greatest difficulty. First, as to the best process. There is no doubt that the finest results can be obtained by the old wet-plate process. This is used by some of the largest and best makers, and has the additional advantage, where a quantity is wanted, of being the cheapest; but if you are an amateur, making only a few for your own use, the dry-plate method or the carbon would be far better. The latter is not very often employed, but when successfully done, very beautiful effects can be obtained; directions for this, unless asked for, would be too long for the columns of "Shop." This leaves the dry-plate process the one most favoured by general workers. The plates are best bought ready prepared, and there is little to choose between those of the best makers. They are all slower than ordinary plates, and I would advise you to use those made by the same firm as you patronise for negatives, except you wish for warm tones, and the only ones in the market I know of which will give these are the Ilford "Alpha" lantern plates. I eannot make sure, from your letter, if you ask for best devoloper and exposure for various subjects, or only for making slides of hymns; there would be a difference, the latter having no half-tones, only black and white. For this work use a slow plato, rieh in silver, for the negative, and do not over-expose it: if anything, the other way; and if you are familiar with the quinol developer, use that; if not, a pretty strong pyro. Develop well out, getting plenty of density. For the lantern slide about the same treatment, and either quinol or iron developer (not pyro. for this).—W. E. D., JR.

**Coloured Picture.**—F. C. (*Clacton-on-Sea*).—The specimen you send is a coloured print mounted in contact with the glass, made transparent, and backed with plaster of Paris to give it greater brilliancy. You would not find the process difficult. To obtain like results, get a print (the one sent is printed in colours, not coloured afterwards), then make some good strong starch, such as is used for mounting

photographs; coat the print with this, and rub down upon the glass. Scrape out as much paste as you can by going over the back with a piece of hard wood cut thin at the edge, something like a turning chisel or the end of a paper-knife, working from the middle to the edges. The more carefully this part is done, the better the article will look when finished. Let it dry, then sand-paper as much of the paper back off as possible, taking care not to make a hole; brush over with paraffin wax to make it transparent, and if a concave glass, like specimen, fill up with plaster of Paris, or you can back with white paper. You would, I think, find photographs mounted in the same way look much better than prints, and for local views would be easier to obtain. Use those that are printed rather deeply; they could then be coloured on the back with oil colours after being made transparent, and finished off with white paper backing; or if not coloured, they need only be cemented to the glass.—W. E. D., JR.

**Banjo Vellum.**—C. E. (*London*).—There is no necessity to sew your vellum when putting it on. If your band is a piece of thin brass, I should advise you to take it off and fit a new one. Banjos having only a thin piece of brass for a band are never a success. When the top of band is pulled down level with the vellum, the points of brackets are almost sure to cut into it, and, of course, break it. Get a piece of brass long enough to go round hoop, ½ in. wide and about ⅛ in. thick, bend it round to shape, halve ends for lapping over one another, then braze them together, or drill two holes and rivet them. Put the band on hoop, and mark exactly where each bracket comes, then file out notches to sink the nose of brackets in, so that they are clear of vellum. Use a piece of brass or galvanised wire to go inside of vellum and under band. In putting on vellum, have it at least 2 in. larger in diameter than size of hoop; or, better still, have it 3 in.—it will be all the easier to put on. With a bradawl make a series of holes round the edge of vellum, keeping them about ¼ in. from the extreme edge, and about 1½ in. apart. Take a piece of banjo string, second or third, and long enough to go round edge of vellum, and thread it through the holes, taking care that both ends of the string come out on the underside. Put the vellum in water to make it pliable; do not let it stop in too long—say, about one minute. Let the water drain off. Lay the vellum on hoop, put on the brass wire ring, and pull the ends of string, turning up edge of vellum all round. Pull the string tight, and see the edge of vellum lays well over; tie the string, and then put on the band that pulls the vellum tight. Put on six or eight brackets at equal distances apart, then pull down band evenly all round. It will be better to use longer screws, made specially for the purpose. Let the band stand up above the level of hoop, say, about ¼ in., until the vellum is thoroughly dry before pulling down further; if you let it stand a couple of days you will be on the safe side, the part of vellum under band taking longer to dry than the exposed part. Put on all the brackets, then cut off edge of vellum near top of band, so that there will be no fear of its slipping when pulled down. When dry, it must be pulled down evenly and gradually, a little at a time, until the band is level with the edge of hoop. Your vellum ought then to be very tight; if it is not, keep on pulling down until it is. Of course, the string is taken off vellum after the band is on.—J. G. W.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Chair Seats.**—W. J. B. (*Deptford*) writes:—"I want some chair seats. I have tried those that are sold at oil-shops, but I find they don't last long, being composed of three pieces of very thin wood pressed together. What I want is something similar, but all in one piece—say, ¼ in. thick. Please say what kind of wood would be most suitable."

**Battery.**—T. R. (*Ashton-le-Willows*) writes:—"Will some reader inform me if there is a battery that will work for six months without being attended to? It is wanted to make contact every second—half-second in contact and half-second off. Current from two Leclanché cells will be as strong as would be required."

**Fret-Wood.**—B. C. E. (*Birmingham*) writes:—"Would any reader kindly tell me the best place in Birmingham to get fret-wood, and what is the price per foot?"

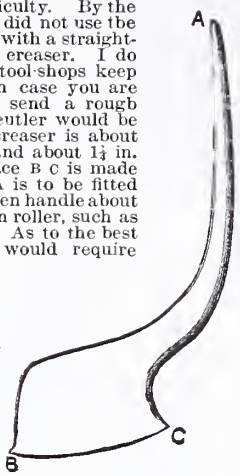
**Riddle.**—W. H. (*Pendleton*) writes:—"Will any reader kindly give me a design for a riddle for a chaff-cutter? Also information as to how it is worked?"

**Melting Brass.**—H. B. (*East Hartlepool*) writes:—"Will any reader kindly give me a design, dimensions, and instructions how to make a small furnace to melt about 12 lbs. of brass in a crucible? I want the furnace to be made on the portable principle, so that I can take it to pieces or put it together in a very short time. I want the same to be kept in the back yard, to be used to make brass ornaments."

**Compasses.**—J. W. E. (*South Darenth*) will be obliged to any reader who will furnish him with a design for a pair of 6 in. steel compasses, with a short note as to making the same.

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Checkering.**—A. T. B. (*No Address*) writes, in reply to CHECKERED (see page 142, Vol. III.):—"To begin with, the tools you will require are—(1) a checkering-board, which should be made of dry wood, planed up true and square, and of any convenient size, say, 24 in. long by 14 in. wide by ½ in. thick. A piece of millboard glued on to each side will give a harder surface to work upon, and prevents warping, but the side used for checkering must be quite flat and smooth. (2) A checkering-rule. This is simply a parallel rule on a large scale, which should be at least as long as the board, and a little narrower. One of the long arms of the rule is fixed to the board near the edge, leaving the other arm to work freely. A cabinet-maker would make the board and rule. I do not know the cost, as I never bought one, but have made my own. I should think you might do the same without much difficulty. By the way, the old checkerers did not use the parallel rule, but worked with a straight-edge instead. (3) Steel creaser. I do not know whether the tool-shops keep this tool in stock, but in case you are not able to get one, I send a rough sketch, from which a cutler would be able to make it. The creaser is about 6 in. long from C to A, and about 1¾ in. long from C to B; the face B C is made very smooth; the end A is to be fitted firmly into a strong wooden handle about 10 in. long. (4) A wooden roller, such as an ordinary rolling-pin. As to the best means to checker, it would require considerable space to describe the process fully, and it varies somewhat with different workers. A short time with a checkerer would probably do more than pages of letterpress, but perhaps the following hints may be of some use. Before being checkered, the leather is damped with clean water, stretched more or less, rolled (on a piece of polished marble or other suitable substance), and left till nearly dry. Place the checkering-board on a bench or table of convenient height, raising the board slightly, so that it may slant towards the worker; draw out the rule as far as it will go, and place under it the leather, so that a small corner extends beyond the rule and at the required angle; then the creaser, which has been previously heated (the degree of heat is learnt by experience), is held in the right hand at the lower end of the handle, while the upper end rests against the right shoulder. At the same time, the rule is held firmly by the thumb and the first and second fingers of the left hand, the third and fourth fingers resting on the board. To make the stroke, the creaser is placed close to the rule, the face B C on the edge of the leather nearest the worker, and the right shoulder is moved rapidly forwards and backwards, driving the creaser across the leather. As soon as the stroke is made, the rule is moved the required distance without raising the left hand from the board; another stroke is made in the same way, and so on till the leather is covered. It is then turned to the opposite corner, so as to form a check, and the operation is repeated. I strongly advise you not to make your maiden attempt at checkering with anything valuable, but procure instead some waste pieces of leather, and work upon them until some confidence is acquired in the use of the tools."



Steel Creaser.

**Cotton Belting.**—A. R. (*Scorrier*) writes, in reply to S. A. & Co. (*Stockport*) (see page 158, Vol. III.):—"To prevent injury to the edges of your cotton belts, sew strips of leather the whole length of your belts, letting the leather project a little beyond the edges of the belt, so as to take the friction. Cotton belts can be had with strips of leather fastened with copper wire by means of a machine."

**Camera.**—M. (*Bishop Auckland*) writes, in reply to BOY SORTER (see page 206, Vol. III.):—"(1) You can buy a ½-plate camera, lens, and stand, from Messrs. Lancaster & Son, Colmore Row, Birmingham, for 21s.; and having had a little experience as an amateur photographer, I would not recommend you to get one at a lower price. If you make any progress, you will soon want a larger camera. You had better send for Messrs. Lancaster's catalogue (price 4d.), which gives prices and descriptions of a great many different kinds. If you find any difficulty in selecting what you want, if you write again I shall be glad to give any other information. (2) 'Photography for Amateurs,' price 1s., Cassell & Co. (3) The Ilford dry-plates are very good."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. L. (*Risecholm*); ROUND O; H. B. (*Sheffield*); T. W. P. (*Ilkley*); TROOPER; LITTLE JIM; G. W. O. (*Durham*); NEVER-SAY-DIE; S. C. T. (*Knutton*); A NEW SUBSCRIBER; W. L. (*Brunteliffe*); J. H. (*Bacup*); W. W. (*London, E.*); G. F. C. (*Southampton*); J. J. B. (*Stockton-on-Tees*); LONG VALLEY; R. S. D. (*Edinburgh*); W. E. H. (*Leeds*); D. B. (*Middlesbrough*); DARKSLIDE; S. C. T. (*Knutton*); G. E. L. (*Battersea*); ANXIOUS; J. H. (*Ballina*); W. O'N. (*Athlone*); SKIBO INOÉ; W. J. C. (*Tavistock*); DROWSERS; S. N. (*Dalston*); J. W. A. W. (*Wednesbury*); W. T. C. (*New Normanton*); IDEAS; JACK; W. H. N. (*Birmingham*); W. G. C. (*Bowham*); CONSTANT READER; T. J. G. (*London, E.C.*); A. T. S. (*Hackney*); W. C. (*London, E.*); E. G. (*Nottingham*); T. W. (*Loughborough*); BRUSHER; THE GUILD AND SCHOOL OF HANDICRAFT; F. B. (*Manchester*); WELL WISHER; RIVET BILSTON; W. R. (*Mile End*); CONSTANT SUBSCRIBER; QUEEN'S ISLAND; H. B. M. (*Spalding*).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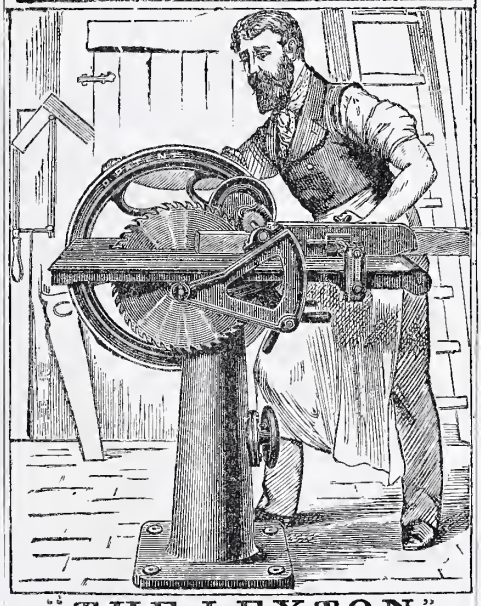

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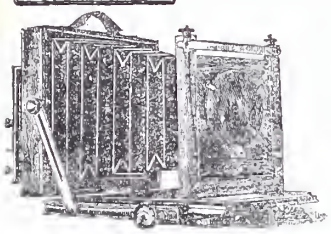

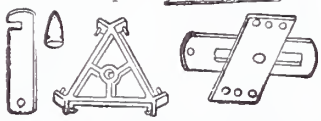

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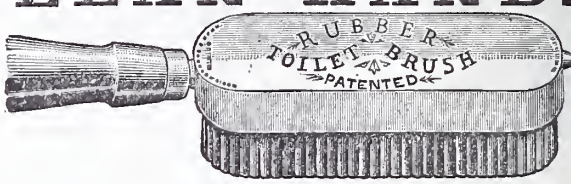


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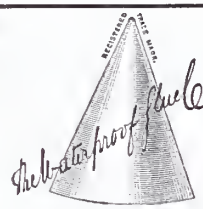


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# WORK

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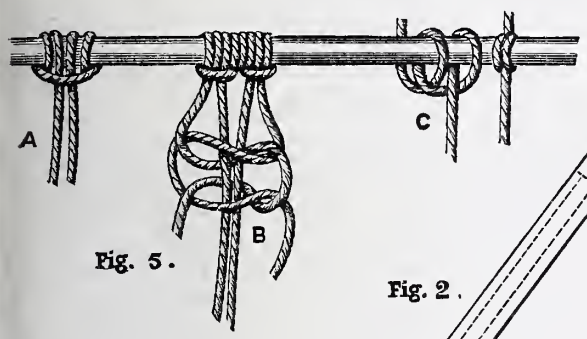



Fig. 5.

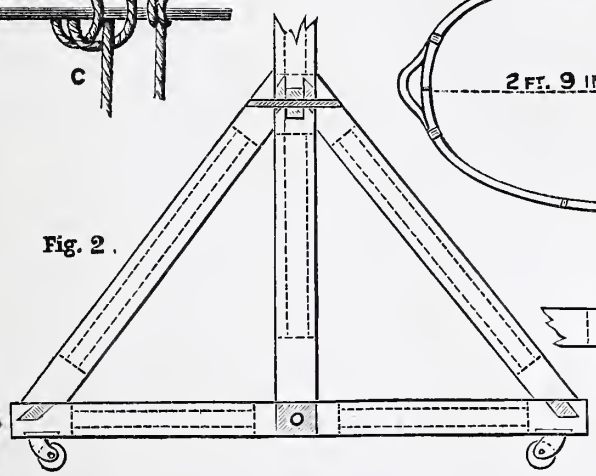


Fig. 2.




Fig. 4

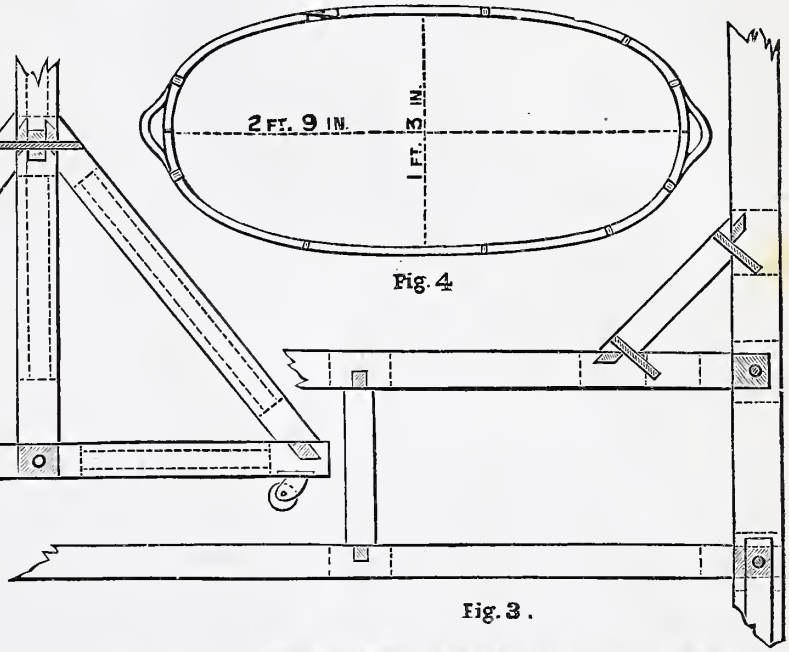


Fig. 3.

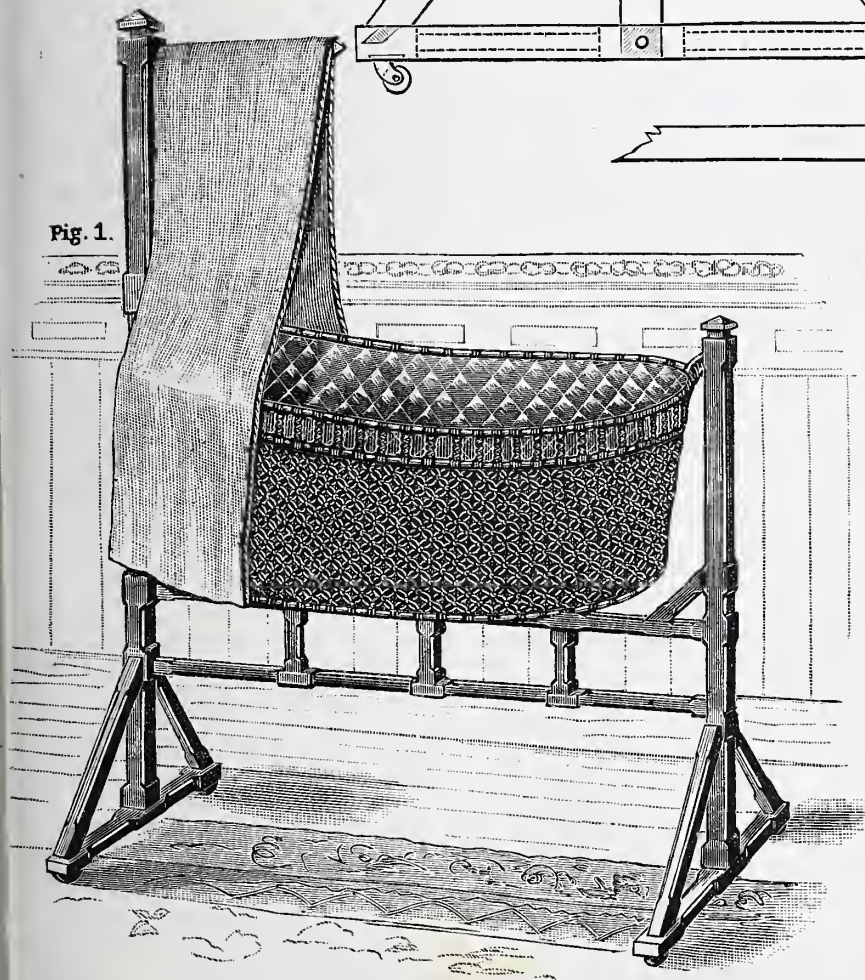


Fig. 1.

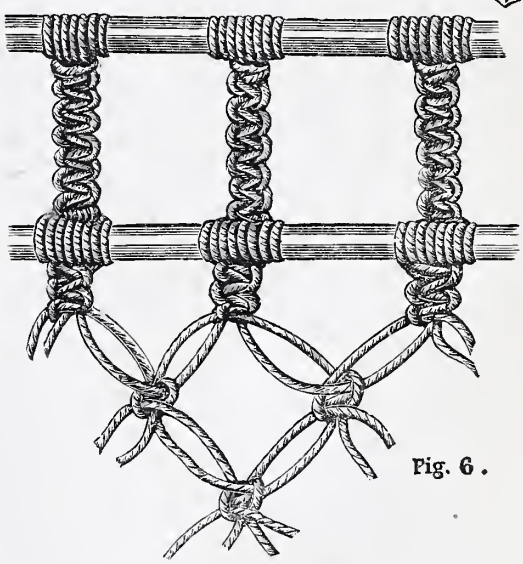


Fig. 6.

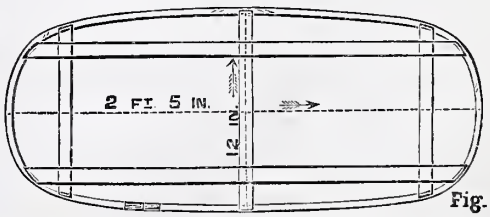



Fig. 7.

Fig. 1.—Perspective View of Swing-Bassinette. Fig. 2.—Showing insertion of Uprights and Spurs, and Method of securing Spurs and Connecting-Bars with Pin. Fig. 3.—Section of Connecting-Bars. Fig. 4.—Shape for Canes of Cot. Fig. 5.—Laying on Cords (A); a Solomon's Knot (B); a Macramè Knot-Stitch (C). Fig. 6.—Solomon's Knotted Bars and Network below Second Cane. Fig. 7.—Bars fastened to Cane to form Bottom of Cot.

## HOW TO MAKE A SWING-BASSINETTE.

BY CHARLES E. DODSLEY.

ADVANTAGES OF SWING-BASSINETTE—PRINCIPAL POINTS IN FRAMEWORK—PIECES AND THEIR DIMENSIONS—STYLE OF OUTLINE—JOINTS—MORTISES—TENONS—PUTTING FRAME TOGETHER—CASTORS—HOOKS—CANES FOR FRAMEWORK OF COT—MATERIAL FOR COT—ITS COLOUR—MACRAMÈ CORD FOR NETTING—SOLOMON'S KNOTS AND KNOTTED BAR—ATTACHMENT OF CORDS TO CANES—FORMATION OF BOTTOM OF BASSINETTE.

FOR the benefit of those who read this paper having present or prospective requirement for an article of domestic furniture such as is herein described, I will, before directing how a swing-bassinette may be made, give what I consider the great advantages it possesses over the old-style cradle. One dictionary meaning of cradle is, a bed which may be rocked. A short experience of the same unpleasant rolling motion would develop in many the nauseating sensations attendant upon an attack of *mal-de-mer*, yet the poor helpless babe is made to undergo daily experiences of this kind—a mild form of churning. How different the soothing movement of a hammock! Who that has enjoyed it can forget the pleasant swaying to and fro beneath the leafy branches, the sunlight glinting between the leaves, and the faintest south wind stirring them to a whisper, lulling gently into a happy state of *dolce far niente?*

Such advantages as the following will be evident on glancing at the illustration (Fig. 1). The cot is raised to a convenient height above the floor, thus keeping the little occupant out of draughts; and if other children are about they cannot get to baby without leave, and so many a cry may be saved, consequent upon excessive loving. There is no chance of tumbling over it. It is much more handy for the mother, requiring no stooping to attend to baby during the day, and stands conveniently at the bedside at night. It is supported on castors, and so may be easily moved wherever desired. Lastly, our swing-bassinette is superior to a metal one, being strong, but light, warmer, and much less in cost. It may be elaborately finished, according as the worker's taste may dictate and pocket allow. You will notice two distinct kinds of work are entailed in the making: the supporting frame, in wood, and the bassinette, or cot, of knotted macramè thread upon a cane foundation, lined and padded, forming as comfortably easy a snuggery for the "cannie wee bairnie" as the fondest parent could desire.

The two principal points requiring thought in designing the framework are (1) that it shall with ease bear all the strain of leverage upon the posts, and so obviate all fear of collapse; (2) that it cannot be easily overturned. As the whole weight of the cot and occupant depends from the top of one post, and at an equal height from the other, there is considerable inward pressure of the posts. This inward leverage is modified by means of the short spurs, the weight being thrown more into the centre of connecting-bars, relieving the joints from over-strain, and so danger of collapse is avoided. The possibility of being overturned is secured against by the length of the foot-rests or steps, and position of spurs.

Now, to work. I do not think anything will look better for the wooden frame than oak, either polished or plain. Pieces of the following dimensions will be required:—

Head-post—4 ft. 5 in. by 1½ in. by 1½ in.
Foot-post—3 ft. by 1½ in. by 1½ in.
Two connecting-bars—each 3 ft. 2½ in. by 1 in. by 1 in.
Three rails—each 6 in. by 1 in. by 1 in.
Four spurs—each 1 ft. 2½ in. by 1 in. by 1 in.
Two spurs—each 6½ in. by 1 in. by 1 in.
Two foot-rests—each 1 ft. 7½ in. by 1½ in. by 1 in.
Curtain-rail—1 ft. 1 in. by 1 in. by 1 in.

It will be seen that the style of outline is square and octagonal. This, however, may be varied at the will and ability of the worker, the posts, etc., being turned or carved to any design; but I think the method of fitting and jointing I have adopted is as reliable as any way. All the joints are mortise-and-tenon glued, and secured with a pin about $\frac{3}{16}$ in. thickness. The tenons are cut the full width of the wood, except the spurs and rails; the tenons at the bottom of the upright posts measure 1½ in. by 1 in. by $\frac{5}{8}$ in., a mortise being cut through the centre of each step to correspond; the tenons at the ends of connecting-bars, 1 in. by 1¼ in. by $\frac{5}{8}$ in., with mortises in the uprights to correspond, the lower bar being inserted 9 in. from the bottom of posts, above the step, the top one 5 in. above it. The rails are fixed into connecting-bars at equal distances apart—*i.e.*, 8¼ in. space between each. Cut the tenon at each end of rails ½ in. by ½ in. by ¼ in., and so leave rails 5 in. long. The spurs are fixed as shown in Fig. 2, being permanently secured by a long pin passing through the top, the upright connecting-bar, and the spur at the other side. The tenons of the spurs will be cut at an angle; if the uprights be fixed into the step, and the piece of wood to form the spur placed in position at the side, the angles at which the tenons are to be cut will be easily marked off. Fig. 3 explains itself. The short spurs are fixed at an angle of 45 degrees. The curtain-rail is 1 ft. in length, and may be round or octagonal, a knob being left at the end to prevent the curtain slipping over. This rail will only require to be glued in.

All the separate pieces being finished and ready for uniting, we may put the wooden frame together. I have simply given measurements and working outline, leaving details to the worker; for I guess no one would make a commencement who mistrusted his own ability to complete it. First, glue the rails into connecting-bars, clamp firmly into position, and set aside. Place the step flat, and the upright with spurs on either side above it, all being ready glued; with a mallet drive together, and secure with a pin through the steps. Allow time for the glue to set, and then unite the posts with connecting-bars and short spurs. Fix on the castors last; these should be small, and placed at the ends of the steps, so that the weight rests well between them. The hook in the foot-post is 2¾ in. from the top, that in the head-post being an inch higher. On the top bar, above the middle rail, fasten a narrow thong of leather or a macramè band, to act as a stop strap, leaving 5½ in. on either side, with dress-hooks at the ends. This is to prevent the cot swinging, unless desired.

So far, all has been plain work. The cot will be to many a new departure, but when finished it will fully repay for the time and patience spent over it. First will be wanted three canes, each 7½ ft. or 8 ft. long, which may be had from dealers in basket or wickerware. Bend these into shape, as shown in Fig. 4, two of them being equal in size—length 2 ft. 9 in., breadth 15 in.—and the other one of a smaller circumference, being 2 ft. 5 in. by 12 in. broad. To join the canes, taper off the ends so that they fit closely together, unite with marine glue, and rivet with two or three small wire nails, boring a hole first to prevent the cane splitting; then bind with thin twine. For the handles, two pieces of cane, each 8 in. long, will be needed. Taper off the ends and fix on to the top cane, uniting and securing the same way as above. As the elaboration of design in the woodwork is left to the worker's taste, so the choice of colour and material for the cot must be. Fawn-coloured cord, with lining of peacock-blue sateen, padded and quilted with pink sateen on the inside, and curtain to match, has an exceedingly pretty effect, and has been much admired: this by the way. Two balls of macramè cord will be required. Cut off into lengths of 10 ft. each. There will be few who are altogether unacquainted with macramè work, but for any who may not know how to set about it, I will do my best to initiate, and, with reference to the illustrations, I think any difficulty will soon disappear. Take the top cane and one of the 10 ft. cords; pass the ends under the cane inwards, draw over the top, and pass through the loop formed; under, over, through the loop again, as Fig. 5, A, and draw tight on to the cane. We have now two threads to work with. Place a second cord in the same manner, and draw close up to the first one. Leave a space ¾ in., and place two more cords, and so on all the way round. All the cords being placed in pairs at equal distances, a Solomon's knotted bar, of six double Solomon's knots, is to be made, four threads going to form one bar. I find the easiest way of working these knots throughout is to loop the two middle cords into a button-hole of the vest, and so leave both hands free to pass the outer cords from side to side. Fig. 5, B, shows a Solomon's knot before it is drawn tight. In Fig. 6 is shown a finished Solomon's knot and netting below second cane. Five minutes' practice will teach how this is done, whereas detailed directions would probably fail to make it any clearer. Having finished the round of Solomon's knotted bars, fasten on to the second cane by the macramè knot-stitch (Fig. 5, C). Remember, in doing this, that the first knot must always be drawn tight before the second is made, two knots with each cord forming one stitch. When the second cane is fixed, make two Solomon's knots beneath each of the above bars, and then proceed with the network. Fig. 6 will readily illustrate this. Take the two left cords of one knot and the two right cords of the next, and with them make two Solomon's knots, but drawing the first loosely in each instance; four fresh cords are taken each time. Work round and round in this manner until the depth of netting reaches 9 in. or 10 in.; then four or five more rows, gradually narrowing, by drawing the first knot higher up in each round. Fasten the cords on to the bottom cane in the same way as the one above—*i.e.*, with macramè knot-stitch. Cut all the cords to one uniform length of 5 in. or 6 in.; tie each pair together, forming half the number of loops. Now, from a piece of light strong wood ¼ in. thick, cut three bars 12 in. by ¾ in., and two bars 2 ft. 5 in. by ¾ in. Groove the ends for the cane to fit into, and fix as shown in Fig. 7, by lacing a length of cord through the loops previously formed, from side to side and from end to end, and draw up as tight as possible before fastening off. A

piece of stout ticking must be fastened underneath, and two eyelets to receive the hooks at ends of stop-strap.

Our part of the work towards supplying a swing-bassinette for baby is now completed. What remains to be done—draping, etc.—will be more deftly and nattily done by the willing hands of those whose pleasure it is to make babyhood a comfortable and happy time.

## CONSTRUCTIVE STRENGTH IN METAL WORK.

BY J. WHITFIELD HARLAND.

OBTAINING STRENGTH FROM PUTTING SEPARATE PIECES OF METAL TOGETHER TO FORM FRAMING—INVISIBLE FORCES IN ACTIVITY—ATTRIBUTES OF FORCES—VELOCITY—WEIGHT—TO DESCRIBE A PARALLELOGRAM OF TWO FORCES AND TO FIND THE DIAGONAL OR MEAN—THE IMAGINATIVE FACULTY—LIGHTNING CONDUCTOR—LATTICE GIRDER—ARCHED LATTICE GIRDER OF NEW CONSTRUCTION—BARS DECREASING IN STRENGTH PROPORTIONATELY TO LENGTH—IDEAL ARCH—CONDUCTORS—STRUTS—SECONDARY FRAMING—BOLTING THROUGH OUTER AND MIDDLE WEB-PLATES.

I HAVE endeavoured in two former papers to indicate the main points in achieving strength of construction in metal, and have spoken of the different strains and opposing forces, showing how their directions might be so deviated as to clash and expend themselves in neutralising one another, instead of acting in concert to destroy the construction itself. Fanciful, perhaps, I may have been in seeking to impress an image on the minds of WORK readers of the action of unseen forces in active operation, but this conception, if fanciful, is, in the main, absolutely true, and serves the purpose of stimulating the reasoning powers in the effort to foresee the results of the various expedients one must employ to overcome, by stratagem, as it were, the material obstacles that opposing Nature throws up against man. It is in this connection that I must emphasise the well-known principle of the diagonal of the forces, which we reduce to paper by making two lines square with one another, or at such an angle as represents the direction of each force, of such proportion to one another as shall express the value and activity of any two forces acting at the same time and in different directions. In arriving at this proportion it is evident there must be a unit of comparison, there must be a common denominator. One cannot compare chalk and cheese. All forces have two attributes: (1) velocity or speed, *i.e.*, feet travelled per second, and this involves what we term momentum (which is, after all, a mean between *inertia* and *propulsion*); and (2) weight. Hence, given the speed a certain weight travels per second in one direction, and given also the speed the ascertained weight travels per second in some other direction, and supposing the direction of each to be also ascertained and expressed accurately on paper by two lines drawn indefinitely long, one is now able to decide, by comparison, by simply multiplying the weight by the velocity in each case, to establish a unit of comparison between any two forces; the product of the one multiplication giving the one length of line, the same process giving accurately the length of the other. We have now only to complete the parallelogram by dropping perpendiculars, and draw a diagonal, which *must* be the mean of the two forces. To ascertain still further the complication of more forces than two, we can simplify the operation by the same process of elimination, obtaining the diagonal of any two, and then using the diagonals so obtained as data, and finding their joint diagonal, or mean co-efficient, which is the same thing.

It goes without saying that construction involves thought. As the Scripture saith, "Who by taking thought can add one cubit to his stature?" He cannot; but he has had the power conferred upon him—if he will study the all-wise laws which God has given for the government of the universe, not merely of what we call the earth, but, so far as we can see in our finite sphere of knowledge, of millions of other worlds visible only by our permitted knowledge of science—of manipulating such all-wise laws by his intelligence, and making them subservient to the good ends he has in view. Man cannot create, but he can construct; and whilst he may be defined by Carlyle as a "tool-using" animal, and by Sir H. Lyon-Playfair (in his opening speech at the late WORK Exhibition) as a "fire-using animal," and with all due deference to these high authorities, I prefer to define him as the *only imaginative animal* extant, and it is only by the exercise of this imaginative power that man has ever elevated himself and his kind. Therefore, it is by cultivation of the imaginative faculty alone that mankind can be educated to higher things; for neglected imagination, untrained, or badly trained, leads to the worst crimes; whilst on the other hand, the more thoroughly it is developed, the more it is brought under the control of reason and mathematics, and thus is compelled to act in strict obedience to the will and the conscience. The higher this high faculty becomes the more it will benefit mankind. All invention, all progress, all design—in short, all the influence that man can exercise over others for good or evil—depends wholly and solely upon the way his imagination has been trained. The genius of Shakespeare depended on this faculty; the whole system of jurisprudence, law tempered by equity, depends on the power of imagination, the power of putting one's self in the position of someone else; the power of knowing beforehand what is almost certain to occur in certain circumstances (and the worst of it is, that not in one single isolated case does our national system of education provide one lesson for the culture of imaginative faculties) is the function of imagination.

This digression is in defence of my mode of impressing on the minds of WORK readers the absolute necessity of forming an ideal in the mind of the hidden action of hidden forces which, to use a cant phrase, is "so much more easily imagined than described." Even such every-day phrases as "Fancy that, now!" "What do *you* think?" etc., show there is truth in this contention, for there must be a germ of it in the mind to cause such phrases to obtain currency.

Therefore, good WORK readers, please imagine that in the body of the metal in which you wish to work there are forces fighting against one another, or fighting against you, and that you must find out how to convert their efforts to nullify yours by taking advantage of the known conditions of their weight and their velocity and their natural direction, by pitting the one against the other, so that they may waste their initiative in overcoming, for you, other inimical forces without destroying the strength of your constructive scheme or plan.

To make this clearer still: you know, either by your own or by others' experience, that the electric fluid always seeks the shortest way to its opposite pole. In putting up a lightning conductor you provide the shortest cut to the earth, and thus render its passage harmless. In this case you simply have to contend with one force at one time. If you had two forces to contend with at the same time, the diagonal of the two forces, or three forces or more, ascertained as above indicated, would give you the direction in which the accumulative forces would elect to move; and if you provided in your scheme of construction a piece of metal lying longitudinally in that direction, as a path or channel wherein they might be jointly and severally conducted away, you deprive them of all power to injure your construction, just as the lightning conductor provides for a safe conveyance of the fluid to its other pole, instead of letting it run riot in its course to the destruction and ruin of your building which you thus protect. I say a piece of metal lying longitudinally advisedly, because, partly on account of the compressive resistance being greater than the cohesive resistance, and partly on account of the lengthway of metal being of greater dimension than any other, and therefore stronger, it is better fitted to form a way or channel between two points, without being itself injured, just as a road or street, having no obstructions and being hedged in, forms the best possible channel of progression.

The logical outcome of this theory is what is termed the lattice girder (see Fig. 1), in which what would, in a solid girder, be the two flanges, are two separate members connected together, not by a solid web as in the case cited, but by bars of metal which are riveted together and to the webs of the upper and lower members. Now to construct such a lattice girder properly, the bars which take the place of the solid web should possess the same resistance to strains of all sorts as the web would. If these bars were to be placed perpendicularly there would result an accumulation of force liable to displace them from the perpendicular, and the points of junction with the upper or lower webs would become so many fulcrums of leverage which the varied forces would immediately utilise. But, by ranging the bars in the line of the diagonal of the forces, they would be subject to no preponderance of any one force, and could carry off without effort or injury the whole of the combined forces longitudinally, conducting them to a safe outlet where they would become spent and harmless. Thus constructed, the framing constituting the girder can be made very much stronger than if it were made of the solid plate even of the same thickness as the bars, and this is not only a saving of material, but of a vast amount of weight to be carried, extra, which would increase instead of diminishing the strains of all kinds that would attack it.

I have, hitherto, spoken only of bars in the direction of the diagonal of the forces, viz.: *c*, *c*, *c*, *c*, *d*, *d*, *d*, *d*, in Fig. 1, but these are only the principal supports and the conductors of the forces, and would be incapable of resisting the remainder of the forces, as they could not, from their being at an angle to both top and bottom flanges, keep these two members invariably at one distance apart. We must, therefore, provide cross-braces, fixed to the centre of each diagonal bar or conductor, and to the webs also at each extremity of the bars (see *d*, *d*, *d*, *d*, Fig. 1), which braces or struts would prevent either end of the conductor from

moving on a pivot at its junction with the girders, and thus maintain the rigidity of the framing. In Fig. 1 it will be seen that the diagonal of the forces is shown to vary the further it gets from the centre of the girder it is part of. I ought to say that in the diagram it is only guessed at, the actual diagonal of the forces governing it not having been actually arrived at, as we do not presuppose any given data. It will also be seen that the conductors, as I prefer to call them, and the struts, are *slighter* in the centre than at the ends, *i.e.*, that as they become necessarily longer they require to be of proportionately greater breadth. Logically, this is correct construction, as the weight at the breaking point is reduced, while it increases the nearer it gets to the supports at each end. It will also be noted that the diagonal struts, *a*, *e*, *a*, *e*, *a*, *e*, are not only much lighter than the conductors, but are also proportionately heavier, as they require to be longer, which they become the further away they are from the centre. In short, every construction in the form of a bridge (which may be defined as construction supported at the ends only) depends for strength on its being capable of converting downward thrusts into compressive strains. This is done, as in every arch, by making the length of it greater than a straight line, which, so long as the piers or supports do not give way, can never, by any weight, be compressed or crushed till it only measures the length of a straight line from pier to pier. If the material of which an arch be constructed be such that downward pressure of any weight placed thereon, converted, at a loss of force, as it must be into a compressive strain acting outwardly from the centre, or keystone, in the direction of the piers, is capable of compressing it sufficiently to reduce its normal length to that of the distance between the piers, down it comes. The ideal arch, however, is one where each half or side is entirely self-supporting, irrespective of the other half, like two cantilevers independent of one another, each carrying away to the pier supporting it, and through it thence to the ground, the whole of the inimical forces. The nearer this ideal is approached the stronger the bridge, be it arch or girder, will become, because at the centre, which would be its natural breaking point, there is no strain whatever, and its stability would not be impaired even if it were broken.

In Fig. 1 I give what I consider to be the strongest means of strutting a lattice girder. Here the lower girder is flanged of an L section at bottom, and both conductors and struts are riveted to the opposite sides of the web; the web is double, with a centre web-plate. The top web is flanged at the top, and to this the conductors and struts are riveted—again leaving the flange intact. Instead of the conductors being solid, they consist of two separate pieces, riveted one on the outside of each of the webs, and the strut passes between the two. Instead of straight bars of sufficient strength for the conductors and struts, lighter ones may be used if they are dished under the steam-hammer to the section shown in Fig. 6, except where they require riveting. This would give sufficient strength to allow of them being thinner, not narrower. I am inclined to think that the struts should all be radial to the centre of the circle of which the arch is an arc, as shown, whilst the conductors form diagonals corresponding to the diagonals of the ascertained forces—and thus, denoting the distances apart of the struts, would connect the top of one strut with the foot of the next but one, and so on, always, however, maintaining the true proportion of breadth to length in both. In roofs, all ties and braces should, if possible, be bolted or riveted to the flanges, and not to the web; and in bridges, the flooring, which acts as both bracing and tie in one, should consist of buckled or dished plates bolted or riveted to the top flange of the upper member, not to the web already pierced to the full extent for the bolts and rivets of the framing.

In addition, is the latticing of struts and conductors, which I have shown shaded in the drawing (Fig. 1), so as to more clearly distinguish them from what may be called the secondary construction, which latter consists of the diagonal framing of the pieces *a*, *e*, *a*, *e*, *a*. *e*, which are riveted at top and bottom to the middle web-plates, *m*, *m* (see Figs. 2, 3, and 4), and to both conductors and struts where they cross them. But as, if these diagonals were made straight, being fixed at each extremity to the middle web-plate, they could not touch the outer framing on each side of them, consisting of struts and conductors riveted to the angle-iron portion of the top and bottom girders (the one straight, and the other, the lower member, arched), they must be cranked, so as to meet the outer or primary framing at the various points of intersection.

This construction has a two-fold purpose: it strengthens the whole fabric longitudinally, giving greater rigidity; whilst it also braces the two outer framings firmly to each other and to the middle web-plate, thus strengthening the fabric transversely. In order to connect the left and right angle iron webs with the inner or middle web-plate, these should be bolted right through between the ends of the struts and conductors, washers of the proper thickness being used in the interstices between them, as shown in Fig. 1. The end of the girder next to the abutment of the pier should be of the section shown in Fig. 4, and should not only be rivcted strongly to both top and bottom webs, but should carry also the end of the conductor, *c'*, the strut, *d'*, and the diagonal, *a'*, where they finish and die into it. The lower portion of it should be forged, as shown, to form a shoe at a radial angle to rest upon the springer of the

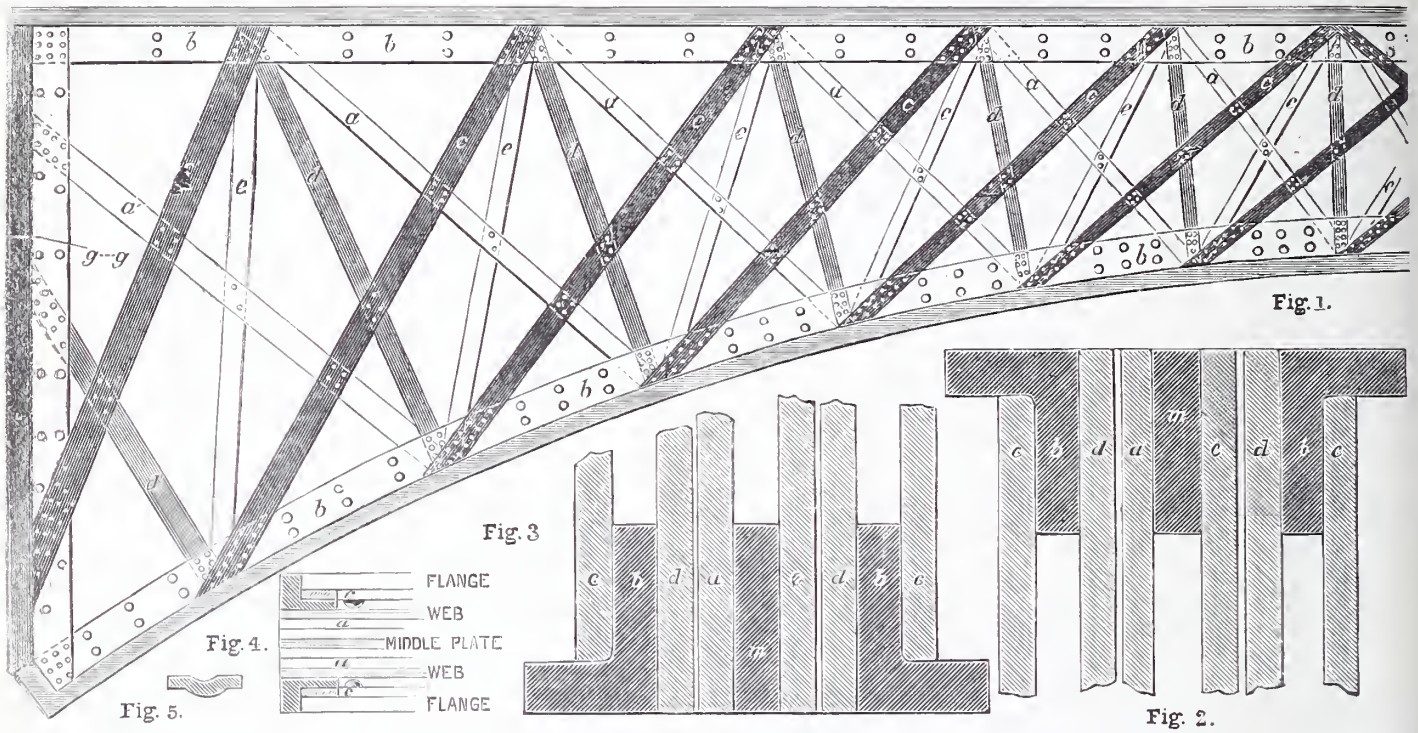



Fig. 1.—Half Elevation of Lattice Arch Girder—*a'*, *a*, *a*, *a*, and *e*, *e*, *e*, *e*, Secondary Diagonal Framing; *b*, *b*, *b*, *b*, etc., Web-Plates; *c'*, *c*, *c*, *e*, Conductors of Strains; *d'*, *d*, *d*, *d*, Radial Struts. Fig. 2.—Enlarged Section of Webs with Angle Flanges and Middle Web-Plate (*m*) of Upper Member. Fig. 3.—Ditto, Lower Member. Fig. 4.—Section at *g g*, Fig. 1. Fig. 5.—Section of Conductor or Strut, dished.

abutment pier. It should be mentioned that the whole construction should be of wrought iron, as cast webs would be too much weakened by bolting or riveting the struts, etc., to them, to stand any strain. Figs. 2, 3, and 4 are three times the size of Fig. 1, but none of them are drawn to scale, as none of the strengths have been calculated, and I do not presuppose any data. They are merely diagrams showing the general principle of construction only as applied to an arch girder.

## SOME ELEMENTS OF PATTERN-MAKING.

BY FRIDAY.

I SUPPOSE many a reader of WORK has had, or at some time or other will require, the iron-founder's aid in the execution of his work, the use of cast iron being so general that it is used in some shape or form in almost every craft represented in this paper.

But an iron casting cannot be obtained without its corresponding pattern is first prepared, and the intention of this paper is to put novices, either amateur or professional, on to the right track in the matter of pattern-making.

The average run of patterns sent to the foundries by amateur and professional workmen, other than those actually engaged in some branch or other of foundry practice, are constructed without any regard to the use for which they are intended. They are neat and well finished in many cases, but, from ignorance of a few elementary rules in pattern-making, are often quite useless as patterns, and have to be cut and altered by the founder before they can be used at all.

The first thing necessary to understand is the process known as "moulding."

Briefly, this is the art of producing, in suitable sand and under proper conditions, an impression of the required casting, which can best be obtained by ramming up in the sand a pattern or model of the article required.

Now, a moment's consideration will convince the would-be pattern-maker that this model must be withdrawn from the sand before the mould can receive the molten metal, and, therefore, the necessity of so making the pattern that it leaves the mould without disturbing the sand about it.

It is the non-appreciation and consequent non-application of this essentially fundamental knowledge that produces so many indifferent patterns from the hands of the amateur pattern-maker.

There will be cases in which a fuller knowledge of the art of moulding is required in order to construct a required pattern, but our paper is too limited in its scope to deal with such cases, our object being an explanation of the principles used in the simplest types, and leaving the reader to apply them to other and further examples.

It is obviously impossible to consider more than a few simple examples in this paper, though we fully expect to please but one in a hundred by our selections; and if this is so, we hope the ninety-nine will do no more than exercise their national privilege and grumble, as is the bounden duty of every aggrieved Englishman. The first thing necessary to pattern-making—given the tools and material, and, by the way, a pair of callipers are almost indispensable in this craft, and should be added to the ordinary joiner's kit if possible—the first thing to remember is that a pattern requires to be tapered, to allow for draft. To illustrate this, I append in Fig. 1 a sketch of a common pillow block, showing the taper on a rather exaggerated scale.

It will be obvious that such a model used upside down in the sand, as it would be, would very readily "draw" or leave the mould.

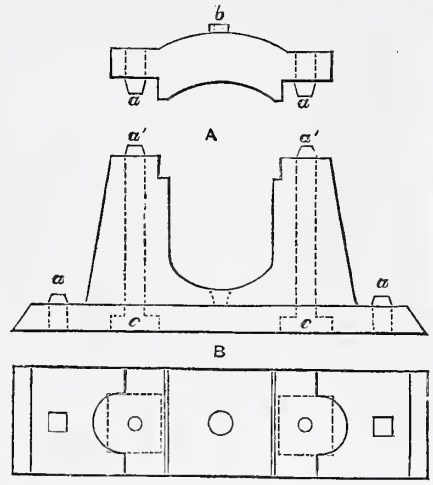



Fig. 1.—Pattern of Pillow Block and Cap, showing Taper in Elevation (A) and Plan (B)—*a*, *a'*, Prints for Cores; *b*, Oil Cup and Hole; *c*, Core Holes for Bolt Heads.

The same diagram illustrates another point—viz., the use of prints in pattern-making. These prints (*a*, $a^1$) are little pieces of wood, the size and shape of any hole that may be required in the casting: in this case for the necessary bolt-holes. It will be easily seen that a long taper core of green sand through $a^1$ would not withstand the metal when it is poured in the mould, but by use of a print an impression of the required hole is made in the mould, and a hard dried core may be stood in such a print hole, which will be strong enough to resist the inrush of metal.

It is not usually necessary to make the prints very prominent—just sufficient to supply a firm seat for the core. In our present example in Fig. 2, which is from a pattern for a 2 in. block, $\frac{5}{8}$ in. is the size, and even less would answer. The actual taper in the same model is $\frac{1}{16}$ in. all over: just enough to render moulding easy, without spoiling the shape of the block

Another simple example will illustrate two other elementary principles. The sketch illustrates a double-flanged cylinder. Here the hole is required right through; hence the prints are tacked on each end, thus providing a double support for the core, such a

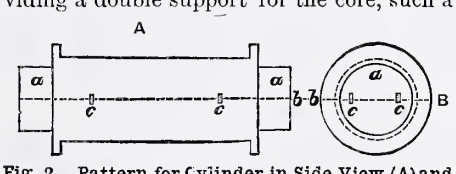



Fig. 2.—Pattern for Cylinder in Side View (A) and End View (B)—*a*, Prints of Cores; *b*, Line showing Cut through Centre; *c*, Pins for dowelling same.

casting being made on its side, as shown. Should the hole be required but partly through, one print will do, but it may be necessary to lengthen that one very considerably, unless there be no objection to the use of a chaplet at the inner end of the core. In either case it will be simply necessary to state the required depth to the moulder. Patterns of this type are much more convenient in use if they are cut in halves through the dotted line, and then dowelled together. They then part when the moulding box is uncovered, half remaining in the upper part and half in the lower part, thereby rendering their removal from the sand more ready and simple.

In the construction of patterns, glue suggests itself as a convenient article to use; but may I make one other addition to a well-known book of manners and morals, and remark that as far as possible in pattern-making, "Don't!"

Glue so frequently gives out when the damp sand comes into contact with it, and a pattern which possibly has taken hours to prepare often comes to pieces almost the first time of using, so that so far as possible the use of joiners' brads, or, better still, fine wood screws, is recommended as more likely to ensure the longevity in use of a pattern.

When, however, glue is necessary, it is well to use the very best; use it thin, and use it fresh. A little quick-drying linseed oil, well stirred in while the flue is quite hot, enhances its resistance to moisture; but even then a coat or two of a good oil paint is necessary to protect the joint from the moisture arising from the sand.

A word about core-boxes. Most founders have core-boxes, both square and round, varying from $\frac{3}{8}$ in. upwards, and the judicious use of the rasp or file will produce almost any plain core; but when the hole required in the casting is irregular, or peculiar in shape or position, a proper core-box will be necessary. Reverting to the "plummer" block, the hole through $a^1$ is required to contain a square head-bolt, as shown by the dotted lines at *c*, and the core will therefore take that shape; and a core-box for the same may be made by cutting away in two pieces of wood one half of the bolt, and then dowelling them together, leaving the ends open, so that the core sand may be well rammed into the space, from which they are subsequently removed, dried, and otherwise finished. In making core-boxes, the taper required for draft is similar, but opposite to that referred to in pattern-making. In making up dowelled patterns or core-boxes, it is very necessary that the joints should fit quite accurately, or the casting will be more or less irregular in shape, and out of truth.

A very important point in pattern-making is the due allowance for shrinkage. Castings in iron vary in shrinkage, according to their mass; for metal 1 in. in thickness, allow $\frac{1}{16}$ in. to the foot in making the pattern, while thinner castings require more, and thicker a shade less allowance.

Brass shrinks rather more, and $\frac{1}{8}$ in. may be substituted for the $\frac{1}{16}$ in. afore-mentioned. For castings under one foot, shrinkage need scarcely be taken into consideration; the rapping of the pattern by the moulder usually suffices. This rapping, which is done to loosen the pattern before drawing, is usually done by boring a hole in the pattern, and inserting a spike in the same, and then rapping the spike on all sides with a hammer. This necessarily tries the strength of the pattern, and if many castings are required off one pattern, it is well to cut a small mortise when the rapping hole is wanted, and insert therein a small iron plate with a hole in it, thereby saving the wood from the actual contact with the spike.

In making patterns of articles which have to be worked up before use, it is well to allow sufficient metal for the process. A file or lathe will easily remove a superfluous $\frac{1}{16}$ in., but no mechanical method can

satisfactorily add the same if it be lacking at the first. The material most used and most readily worked in pattern-making is undoubtedly pine or deal, and on the whole it is the best for most purposes, though a mahogany pattern soon repays its extra cost when a large number of castings are required from one model. In selecting pine, pick out the best-seasoned, but not the very driest and hardest, as these conditions develop into cracks and warps when in actual use.

To finish and preserve your pattern, the readiest and simplest method is a coat of hard-drying paint, which should afterwards be well sand-papered, and finally brushed well with dry blacklead or chalk. This gives it a fine smooth face, and renders it easy of use, and at the same time preserves it from the damp and moisture of the moulding shop.

Another preservative is a shellac varnish, prepared by dissolving one and a half to two parts (by weight) of shellac in twenty parts of methylated spirits. This takes longer to prepare and requires more skill in applying; and, on the whole, the first method is more simple and convenient to the occasional pattern-maker.

I find that, spite my efforts to refrain from the use of foundry phrases and terms, I have been compelled to use several trade terms, and would explain now that green sand is the sand usually found on the shop floor, and forming in use the main part of the sand; while a chaplet or frame is a wrought-iron stud, used to keep a core in its place in the mould. For example, the core of a column is often supported by chaplets, and their ends may often be seen covered by a little button on the columns of public buildings. Ramming up, rapping, draft, and some other words are, I think, sufficiently explained by their context.

In conclusion, the approximate weight of a casting may be arrived at by allowing fourteen pounds of iron to one pound of deal pattern, or eight pounds to one if the pattern be mahogany. Zinc castings are about the same, while copper, brass, and gun-metal are from twenty to twenty-five per cent. heavier.

## A CHAT WITH A FRENCH POLISHER.

BY "AMATEUR WORKER."

PRELIMINARY—REMOVING POLISH FROM HANDS—WORKSHOP HABITS—NAPHTHA POLISH—MAKING POLISH — AMATEUR *v.* PROFESSIONAL POLISHING—STAINING.

LIKE many readers of WORK, my favourite hobby is working in wood, making odds and ends of furniture, and such like. Now, as an amateur, I like to finish my own work, and to do so of course I have to change myself from a cabinet-maker to a polisher when the proper time arrives—that is to say, I do the work of the latter instead of that of the former. As I am supposed to know a good deal about polishing, I am often appealed to by friends of kindred tastes to my own to help them out of their difficulties. Sometimes I am able to do so, sometimes not; for whatever I may or may not know about the work, I do not delude myself with the notion that I know *all* about it. There is always a little more to be learned, and when that has been done, still something further—a kind of "Will-o'-the-Wisp" chase, extending the field of operations, but not getting hold of finality in the particular line of work. I am, however, more fortunate than some, inasmuch as I have many acquaintances among professional workers, and when I am in a difficulty they are generally ready to help me out with it.

Well, to come to the point, I have an old friend, a beardless youth of fifty years of age, or thereabouts, who has been a French polisher all his life; though, strangely enough, even he does not profess to know *everything* in connection with his trade. He is, however, always willing to give any information he can, and is a reader of WORK.

Sitting together one night lately, and a copy of WORK lying near him, some remarks were made about it, to the effect that he saw Mr. Denning was writing on "Polishing," and that this seemed, to judge from the "Shop" columns, to be a subject in which many readers are interested. The conversation became general shop—I mean polishing shop—talk, though I am bound to say it was all one-sided, my friend W—— doing all the speaking, and I the listening. It was a regular lecture on polishing, considered generally, and I said to him after a bit—

"W——, why don't you put all this down on paper, and send it to the Editor of WORK?"

He replied, after a few thoughtful moments, which were apparently occupied solely in filling his pipe—

"Well, you see, there is nothing in what I am saying except what everyone knows, and Mr. Denning will, no doubt, tell anything that is important before he has done."*

I could not agree with the first part of his remark, for there was a good deal in what he was saying which I am sure interested me, and would, no doubt, be equally interesting to others could they have heard him. As for the rest, possibly Mr. Denning may not think it worth while to touch on such general topics in his series of articles on Polishing; and, in any case, I do not think he will object to seeing these remarks regarding polishing viewed from a different side to his own. I am inclined to think he will be very glad to see them published. Finally, I suggested to W—— that if he would not write to WORK, I should. Agreed; and this is the result. I do not pretend to give the words, only the general tenour of what was said.

The opinions are those of an experienced polisher, who served his apprenticeship, worked as journeyman, and for many years has been foreman over a number of others. They are, therefore, worthy of attention; and the writer has the privilege of being the mouth-piece, or rather the pen-holder, which makes them public in WORK.

The observations are made in the first person, my friend W—— being the speaker, and my own remarks are left out, to be read between the lines, if necessary.

"I often wonder why amateurs bother so much about polishing, for it seems dirty work for a gentleman to take up; and though I like it very well as a trade, I don't care about it for amusement; but then, I suppose no one does look on his own business as being a pastime. It's his work, and by way of a change he takes to someone else's when he has done with it. My hobby is photography, and I daresay a photographer would think this anything but an amusement, so that, after all, there is not much wonder that amateurs, when they have made anything, like to finish their work. The dirt—or it's not that so much as hardened polish and other things on one's hands—can easily be washed off with a little (methylated) spirit or soda and water. No, I don't mean spirits and soda-water internally. Yes, it's a fact that some men will drink even methylated spirit if they can't get anything else, though it is horrible stuff: nothing better than poison. They will even suck it out of the spirit-rubber if they get the chance. It is best not to have too much of it about. There is no risk of youngsters learning bad drinking habits from the polish or spirit used; though, of course, if they are in a shop with dissipated men they may get spoiled, but that would be the same in any business. The fumes from the spirit are not strong enough to hurt anyone.

"It was different with naphtha when it was used instead of spirit, for the vapour affects the eyes. Naphtha, anyway, is nasty stuff. It smells horribly, and is not so safe as spirit. Why, in a full, close shop at the end of day one could see the vapour flashing as it came in contact with a light. I should never use naphtha when I could get spirit. I prefer to make my own polish, and, whatever the books may say, there is nothing better than shellac and spirit. Some of the bought polishes are very good, but I like to make my own, for then I know exactly what it is. That is the principal reason why good polishers prefer their own preparations, even if they use something besides shellac and spirit. Opinions differ, and men have their fads in polishing as well as in anything else. Then there is a good deal in a man being accustomed to his materials. I think the chief reason why polishes often contain something besides shellac is on account of price. Take resin, now; it seems to give a better substance and body to the polish, but it is cheap. Polish with much of it in will not stand well, and something is put in to make it more durable and work better. I have never been in a polish manufactory, and do not know what manufacturers use, so I don't want to run them down; but I don't see how a lot of the low-priced polish can be sold, unless it is adulterated. It really does not much matter what kind of polish amateurs use; for, of course, they can't get as good a finish, even with the best, as a regular polisher, though they often seem to think they ought to, and wonder why they can't. They blame the materials, and perhaps something may not be just what it should be, but the chief reason is want of practice. How can an amateur or beginner reasonably expect right off to do what a polisher has to learn during a long apprenticeship, with those over him to show him how to do anything? It is unreasonable for anyone to think that he can know all about polishing at once. Even if he is told, and may have all the ways and methods clearly explained to him, he still wants practice. Even among polishers there are plenty 'not worth their salt' when they have to do anything but plain straightforward work, such as staining, matching-up, and the like. Anyone can do staining—after a fashion—but to do it thoroughly a man must have used his eyes and his brains. He must have studied the different kinds of timber, with their varieties of marking, not only in colour but in configuration. He must enter into the spirit of the different features, so that he can convey the impression of the wood he intends to represent. There is nothing

* I have in my hands papers from Mr. Denning on "Spiriting-off," "Glazing," and "Dry Shining," in connection with French Polishing, and these will appear in due course.

mechanical about this kind of work; simply copying will not do, though for purposes of study useful knowledge is gained by doing so. A man may know all about staining so far as the most useful colours and the preparation of the stains, but may signally fail in using them properly. Anyone can wash them on, and so darken the wood to the same extent all over; but then, if an imitation of a darker wood, except as regards colour, is wanted, this is not sufficient. The characteristic markings are absent, and it is certainly better to let them be so than to perpetrate the hideous libels on the real material which are so often seen. Then, again, even in colour there are minute differences which can be got only by adapting the stain at the time, modifying one with a little of another, and so on. All stains must be used with discretion, and one cannot tell another how to apply them with equal success always, even on the same kind of wood, for in any, great variety will be found. To take one, now very fashionable—viz., mahogany. It varies in texture and colouring very considerably; and supposing we want to stain it a 'Chippendale' colour, even after the exact darkness of this is known or specified, to get several pieces equally matched, the stain must be strengthened or reduced at the discretion of the polisher. How is it possible to explain to anyone else exactly what will suit all the pieces, even in one piece of furniture? It cannot be done. Just the same might be said of oak, or almost of any wood.

"Then amateurs make a lot of fuss about having different fillers and different little preparations for varieties of woods. Of course, each polisher has his favourites, but then he could manage very well with any of those generally used; and it is almost nonsense for a beginner to think that he could have managed better if he had used something else to fill or polish with. It is only a man who has been constantly at the work who can appreciate the differences between one material and another for the same purpose. So you see, after all it is principally experience that the amateur or beginner lacks when he cannot do polishing properly."

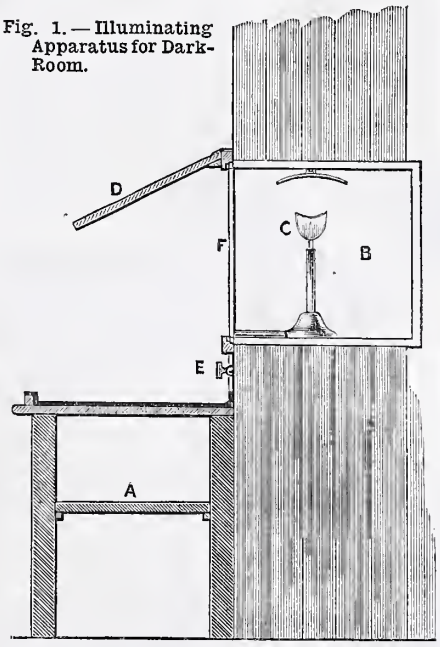
## LIGHT FOR THE PHOTOGRAPHIC DARK-ROOM.

BY WALTER E. WOODBURY.

PRELIMINARY CONSIDERATIONS—UNHEALTHY AND INJURIOUS DARK-ROOMS—REQUIREMENTS OF A PERFECT LIGHT—A SIMPLE ILLUMINATING APPARATUS—NO LIGHT ABSOLUTELY NON-ACTINIC.

BY far too little attention is paid by photographers, either amateur or professional, to the subject of dark-room illumination. Perhaps to the amateur, who practises the art but little, making a photograph but now and then, the subject is one of little interest, as any lamp will do, provided it be perfectly non-actinic, and give sufficient illumination for his purpose. But there are many, however, who remain for considerable lengths of time shut up in a room lighted only with a ruby or yellow light. In this case, two important conditions must be studied if the health of the worker is to be considered. First, with regard to proper ventilation; and, second, the injurious effect of the light upon the eyes. It cannot be disputed that remaining in a dark-room, usually of very confined limits, for any length of time with a light burning, and no proper ventilation to carry away the noxious gases formed, can but be extremely detrimental to the health. Again, too few have any idea of the injurious effect constantly looking at a red or ruby light has upon the eyes, producing eventually a form of congestion. Taking these two points into consideration, I have devised a form of dark-room lamp that should, I think, meet with all requirements. These may be briefly stated to be: first, a light that will not produce fog on a sensitive plate on reasonable exposure; second, that shall throw a sufficient quantity of light to work by upon the dish containing the negative where the light is required, and that shall be shaded from the eyes of the worker;

Fig. 1.—Illuminating Apparatus for Dark-Room.



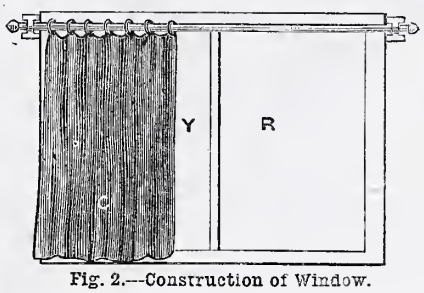




Fig. 2.—Construction of Window.

third, that shall be outside the dark-room, yet capable of being controlled from a convenient part inside; and, fourth, that shall give intensities of illumination varying at will with the necessary requirements.

In Fig. 1 I have endeavoured to give a sketch of an illuminating apparatus that fairly well meets all these requirements. A is a bench with a leaden sink top; B is a box or chamber fitted outside the dark-room, preferably with a special outlet for the vitiated air; C is a gas flame, the size of which can be controlled from the outside by means of the tap E. The light passes through the coloured media at F, and is reflected on to the working table by means of the reflector D, which has also the effect of shading the light from the eyes. Fig. 2 will serve to show the construction of the window through which the light passes. Two pieces of glass are required, one a canary-yellow colour, and the other of a ruby-red. In front is arranged a curtain of black material. With this arrangement, it will not be difficult to see how the strength of the light can be altered at the will of the operator by shifting the position of the opaque curtain. For developing very sensitive plates, the curtain is drawn completely over the yellow glass and half way over the red. For working bromide paper, or with the material of low sensitiveness, the yellow glass will be found suitable. This can also be used for examining the plate during the progress of development.

It should always be remembered that there is no medium which is absolutely non-actinic. The deepest ruby light will fog a plate if it only be allowed sufficient time for action.

Therefore every care should always be taken that it is not exposed to the light more than is absolutely necessary. A cover should always be placed over the dish when it is not required to examine the plate. Another advantage gained with this light is that at any time, if desired, the whole room may be illuminated for convenience in finding articles placed about. For extra convenience in this, the reflector D should be hinged so that it can be lifted out of the way. This is also necessary when examining the progress of the negative.

The window should also be removable, for exposing bromide paper and lantern and transparency plates.

The construction of the whole apparatus is not very difficult or costly; and I claim that those who work for great lengths of time in the dark-room will find it invaluable.

## BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

INVISIBLE PATCHES ON UPPERS—HOW TO BLINDSTAB—THE FINDING OF THE HOLE INSIDE.

THE neatest of patches is what is called an "Invisible Patch." It is stuck on with a solution of gutta-percha. Its solvent has a very unpleasant smell, but as it evaporates very quickly, it is not smelt much by the one using it; but if used in a room with the door shut, it will soon be smelt by whoever opens the door. To do this part of the business, an outhouse is best, or any way, when no one is near.

This solution can be bought at 2d. per bottle, and when not in use it must be kept well corked. Worman's has a scent mixed with it, so it does not smell quite so bad; but I prefer Sand's, not for smell, but for quality.

I will now show how to fit the new patch on the old leather. First, it is of all importance to have a last, boot-stretcher, tree, or something in the boot, that the part you are going to operate on may be quite solid.

But before going further, it will be best to state that during these articles I have, and shall have, often cause to refer to what in the trade is called "skiving." It is a thing that is so essential; therefore, I here advise all who do not know how to do it well, to try their hand at it as much as possible upon any old odd piece of upper leather, with a sharp knife, on a piece of smooth marble or board. Skiving means: to give a tapered edge to the leather, on one side or the other, and skiving is the principal thing in this sort of patch, for it is fitting it to a nicety that makes the patch invisible.

The safest way to get the piece the right size is to cut a piece of paper out, about

¼ in. larger all round than what is really necessary to cover the worn or cracked parts, or than what you would in the ordinary way. This is to admit of the skiving. Then, seeing that this is of good shape, cut the new piece of leather to it. This should also be as described in the last article, "Calf for calf, kid for kid," etc. After the piece has been cut out a nice oval or curved shape (Figs. 1 and 2), proceed to skive the edge. Skive all round, if oval; and round the top only, if curved (Fig. 2). It should be skived from the letters A A A to the edge, B B B, and at this part it should be positively skived to nothing.

The difference between preparing these patches and one to be closed in is that the new piece is fitted first, and after the old leather fitted to it, and that the old piece of leather is not taken away, as for closing in.

It will only be necessary to explain how to put on the oval piece in this instance, for in all other shapes the rule is the same, excepting where the pieces have to be sewn down to the sole; and instructions for this were also given in the preceding article. Now, when the piece is skived, lay it on the worn part of the boot, overlapping the worn part equally all round, as A A (Fig. 3), which is a section of the patch. Now chalk the edge all round, and on the old leather as well, as shown at B, and draw a line right across, as at C C, that you may get the piece back into its proper position.

Then skive the old leather, at D D, just enough to receive the patch, starting at the edge of the chalk mark, and skive towards the centre, all round, being careful to get it regular.

Then nicely rough both the new and old leather with a file, piece of coarse sandpaper, or scrape with a buff-knife. Now lightly brush out all the dust of leather, and apply the solution with the finger; shake the bottle and give one thin coat, both to the patch and old leather; let them dry, and then give another coat, but only thin; let this dry. It should dry white, and if it does not do so, it will need a little more solution. Care should be taken to see that the edge of the patch has taken the solution properly, and that the old leather has it only on the rough part.

It may be considered that it would be best to solution a patch like Fig. 1 all over, but it is not so, as it would make it very stiff, and it would not yield in wear, but only perhaps wrinkle and soon work off. The whole of the solutioned part having dried white, warm both before a very slow fire, and when the whole of the white has changed its colour to a brown, stick the piece on the boot, just as you first fitted it; press it on tight, and, with an iron only just warm, iron on a little soft heelball all over; let it get quite cold, then gently rub off the heelball, smooth with a cloth, and polish with blacking, and it is finished.

Our next system of repairing the tops is "Blindstabbing," so called from having to find the hole inside a boot, where it is impossible to see. Blindstabbing is one of the most important things to learn regarding the repairing of the tops, inasmuch as all repairing to the tops can be done by this means in one form or the other—as patches, rips, toe-caps, new springs, etc., etc.

One thing it is very handy for indeed, and that is when a vamp has (which is very often the case) a small crack in it. You can darn this up in two different ways. First, with using two ends, and setting a zigzag stitch from one side to the other, as at A (Fig. 4); or by setting the stitches with one end only, as at B. This is by far the neatest way of

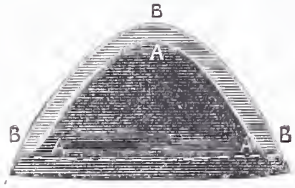



Fig. 2.

Fig. 1.

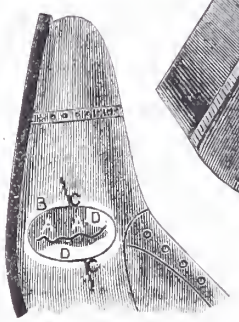



Fig. 3.

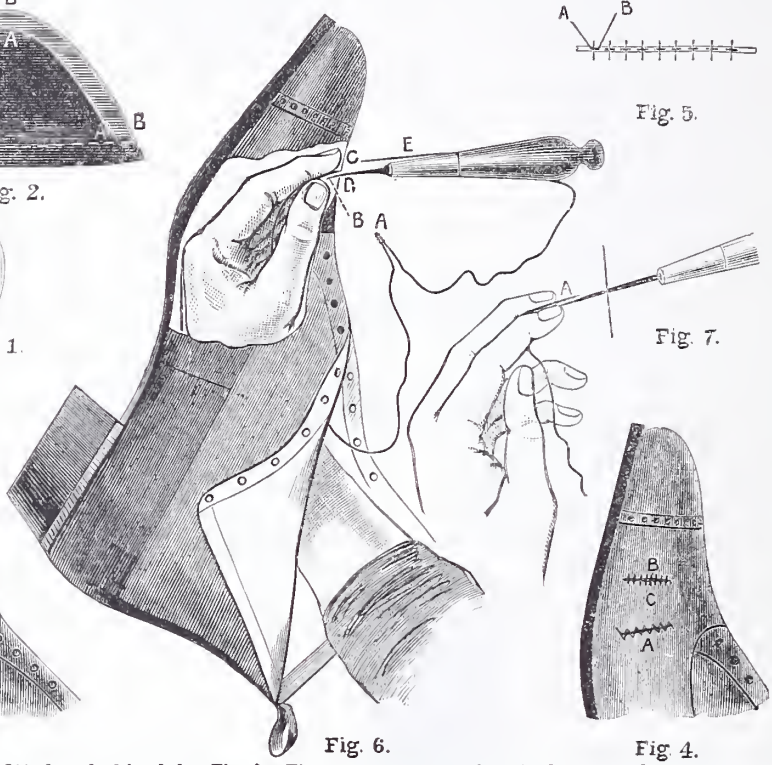



Fig. 6.

Fig. 5.



Fig. 7.




Fig. 4.

**Fig. 1.—Patch fitted and skived for Fig. 3. Fig. 2.—Patch that has to be sewn down to Sole. Fig. 3.—Portion of Boot showing how to fit Old Leather to receive Solution. Fig. 4.—Showing how to mend Crack by Zigzag Stitch and Cross-Stitch. Fig. 5.—Full-size Sketch of Cross-Stitch. Fig. 6.—Boot with Hand inside, showing how to find Hole by using Awl as Leader. Fig. 7.—Another Method for Out-of-the-Way places, and for those whose hands are large and not lissom.**

Fig. 6, it will be seen, is to illustrate the way to do blindstabbing. The left hand must be put inside the boot, with one of the bristles between the thumb and finger, with the point of the bristle about level with the tip of the finger. The stab-awl, which is an awl with a thin, straight blade, is held in the right hand, and at the same time holding the other bristle. It is well to first put the two bristles together, and halve the thread; give it a twist, as at A, so that both ends may be the same length in working.

The awl is then put through about halfway, and its exact position felt with the finger of the left hand, and then lay the bristle parallel with it, as at B; place the finger against the lining of the leather at C to steady the hand; draw out the awl within about a quarter of an inch, pushing up the bristle with it, and letting the bristle lie on the flat side of the awl; and keep moving the awl up and down (not in and out), and the bristle with it, until the point of the bristle finds its way into the hole with the point of the awl. It is quite easy to keep putting the awl up and down if the first finger of the right hand is kept on the leather at C. When you find the bristle in the hole at D, pull the bristle and end through with the right hand; hold it in the hand with the awl, as E; put the left hand in the boot again with the other bristle; make a second hole, and repeat, as shown above, till the bristle is in, and then put the right one through. Take the right one (E) in the left hand, and the left one pull out with the right; pull them both out together the whole length of the thread, pulling somewhat sharply; then give a second pull, just to tighten the stitch. The first stitch is set, and this is continued as far as necessary, putting from twelve to eighteen stitches to the inch.

The position of the boot, as shown in Fig. 6, will give the student the knowledge of how it should be held upon the knees; but while drawing out the thread, it will have to be held fast between the legs, with the toe against the right knee and the heel against the left thigh, and this according to where the repair is being made.

It may be noticed here that all methods of doing anything has been, and will be, explained for a sitting posture, unless specially notified at the time.

When it is wanted to sew up towards the toe, or anywhere out of the way of the position of the hand in Fig. 6, there is another means of doing so. This is by holding the bristle between the first two fingers, as Fig. 7. The bristle is put on the cushion of the second finger, and held there with the nail of the first, as shown at A.

To blindstab like this is more difficult to the two, but, like anything else where an advantage is to be gained, it needs more care and attention to make it so.

In either case it is well to put a piece of leather under the crack. It will want skiving at the edge—in fact, Fig. 1 would do very nicely. It is very easy to get under if it is rolled up and passed through the crack, then levelling by putting an awl through and unrolling it, and then seeing that it is exactly under the crack.

In darning it, set each stitch from B to C (Fig. 4), but taking hold of no more on either side than you can possibly help; and when this is done the whole length of the crack, start stitching backward, setting the stitches from A to B (Fig. 5), which is a full-size sketch of the crack and stitches. This second stitching is to draw down the first row, and make them look small. A fine end or piece of twist should be used, and when it is lightly hammered down, and a piece of soft heelball rubbed in, it can scarcely be seen.

learn, but, it being so very useful afterwards, it well pays for the extra trouble.

Boys can soon learn to blindstab, as their hands are small; and it is a thing that will always be of use to them, and a good first step to industry as a pastime.

## SMOKY CHIMNEYS AND HOW TO CURE THEM.

BY "EXCELSIOR."

WHERE THE FAULT LIES—USUAL MODE OF SETTING RANGE—COURSE TO BE ADOPTED—PROPER FORMATION OF FLUE—REGISTER GRATE—USUAL AND PROPER MODE OF SETTING AND FORMING FLUES—REDUCTION OF CHIMNEY FLUES AT TOP—INSUFFICIENT SUPPLY OF AIR TO GRATE.

Most people, in trying to cure a smoky fireplace, look for the fault at the wrong end of the chimney—viz., at the top.

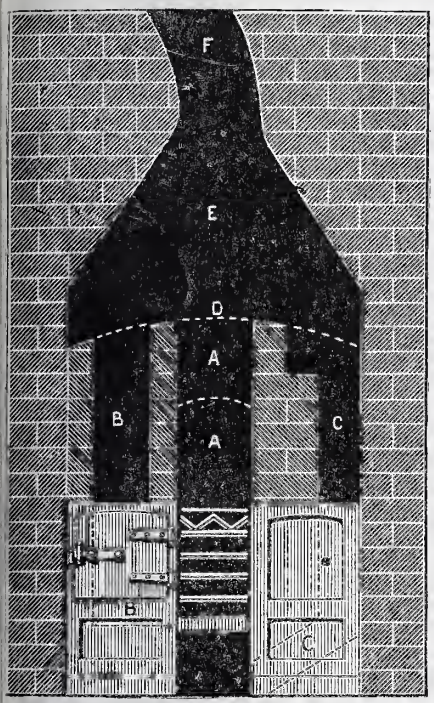



Fig. 1.—Usual but Improper Method of setting Oven Grate or Range. In this Fig. and Fig. 2 the Iron Back and Chimney-Breast are removed to show Construction of Flues. A A, Main Flue from Fire; B B, Flue under and behind Oven; C C, Dust Flue; D, Level of Top of Grate Back; E, Drum or Open Space into which Flues discharge; F, Chimney reduced to proper size.

I venture to assert that, in nine cases out ten, the fault is at the bottom, and rests with the setting of the grate, and I will show that this can be cured by the outlay of a very few shillings.

When building the house, the workman makes the opening to receive the grate the full width, height, and depth of the grate intended to be used; he then gradually tapers off the opening inside till he reduces it to the size of flue required, which is generally about 14 in. by 9 in., which size is reached about 3 ft. above the top of opening left for grate, as shown at E in Fig. 1.

Now for the setting, or fixing, of the grate. We will take, first, the oven grate or range—whichever is intended to be used. This is set up in the opening, and the flue, A, from fire in the centre, and also flues B and C from oven and boiler, are carried up separate to about 6 in. above the top of the

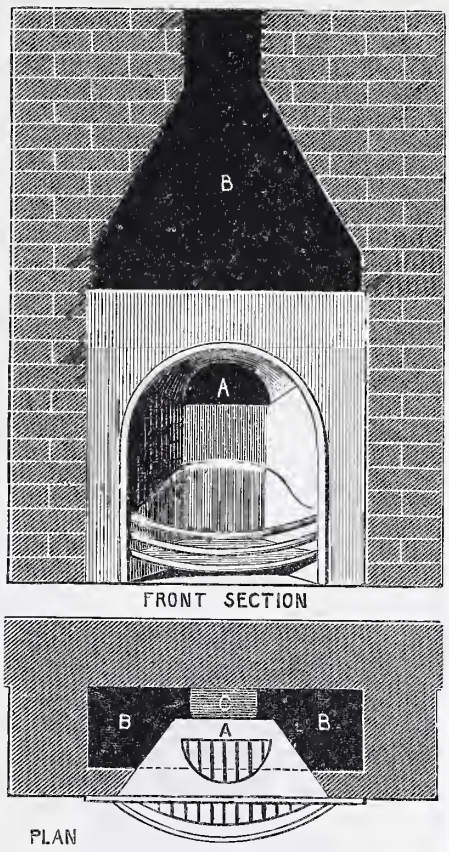



Fig. 3.—Usual Way of setting Register Grate; Chimney-Breast removed—A, Lid of Grate; B, Drum or Open Space round Grate; C, Bricks as Back of Grate.

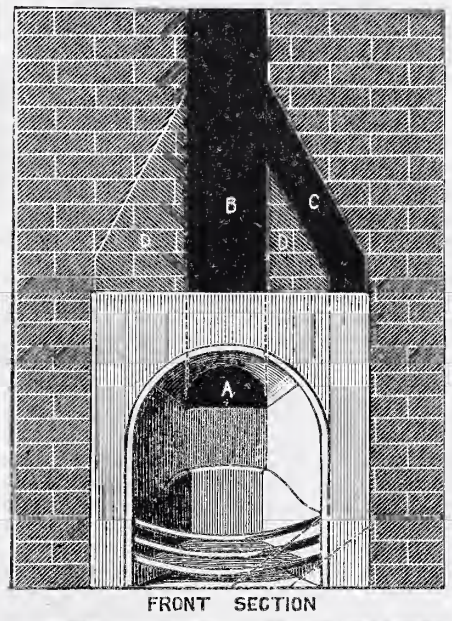



Fig. 4.—Proper Mode of setting Register Grate; Chimney-Breast removed—A, Lid of Grate; B, Flue from Grate; C, Dust Flue; D D, Proposed Brickwork forming Flues.

grate or range, where they all discharge into the gathering, or taper opening, E, between the top of the grate and the flue proper.

Here lies the fault. Here is a large open space or drum, in which the smoke, so to speak, wanders aimlessly about, interfered with by currents of air, instead of making its way at once up the flue and away, at the same time losing much of its heat, thus making it still more difficult for it to ascend quickly. As will be at once seen, this can be easily cured by getting rid of this open space.

To do this, get a bricklayer to start the centre flue from the grate at the same size,

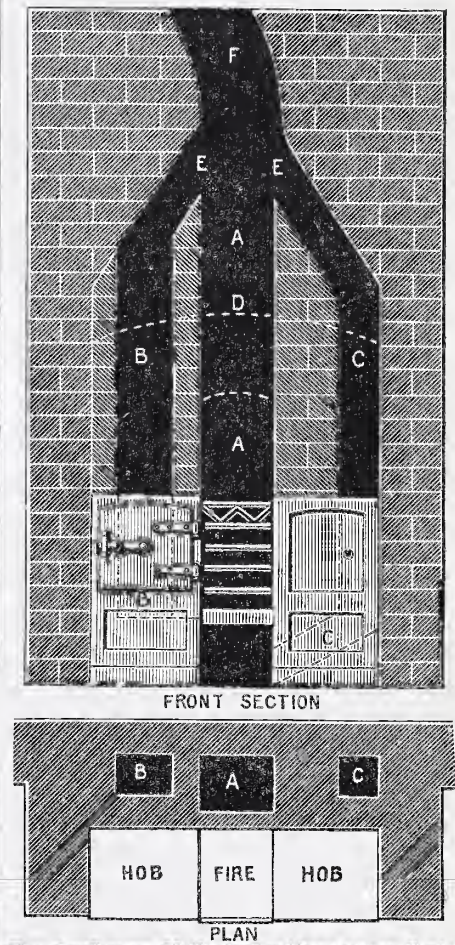



Fig. 2.—Proper Method of setting Oven Grate or Range, shown in Front Section and Plan; Iron Back and Chimney-Breast removed—A A, Main Flue from Fire; B B, Flue under and behind Oven; C C, Dust Flue; D, Level of Top of Grate Back; E E, Diagonal Openings of Side Flue into Main Flue; F, Chimney reduced to proper size.

or, preferably, a little less in size than the flue above, and carry this up until it joins the flue above, at the same time carrying up and bringing nearer, in the same manner, the side flues from ovens, etc., until they join the centre flue through an opening in each side, as shown in Fig. 2.

Carry these side flues up as high as possible before joining the main flue, as this will give a better draught to them. Another advantage of this is that the openings into the centre flue being vertical, falling soot cannot get down them, blocking them at inaccessible places. The truth of this will be seen by looking at E E, in Fig. 2.

Now with respect to that abomination called a register grate, generally used in the

sitting-rooms or parlours of middle-class and the better class of workmen's houses.

These, being constructed so as to be complete in themselves, are oftentimes worse fixed than oven grates, which must of necessity have some brickwork. I have been called to some scores of register grates, to find them just placed in the opening below the chimney, with, perhaps, three bricks behind them to support fire-brick back as shown at C in Fig. 3, and all the remaining space, B B, round and above them being left open.

What else can we expect from a grate set like this but smoke and annoyance?

To cure this, have the whole space at back and sides filled up solid with brickwork, as shown at D D, Fig. 4, of course forming the flue, C, from dust-hole on one side, and then start the smoke-flue, B, at once off top of grate (leaving just room for the lid, A, to lift up), and carry it up to where the chimney is reduced to its proper size, as described before, bringing the dust-flue, C, into it at one side, and having the mouth of it vertical, as in the oven grate or range.

Another advantage of having the grate made solid behind will be that a greater amount of heat will be radiated into the room, which before penetrated through the sides into the space at back, and was lost up the chimney.

Again, pay particular attention to the fact that the smallest place in a flue should be immediately over the grate, as the farther smoke travels the more heat it loses, and consequently the more room it requires in which to get away.

This brings us to the consideration of chimney-tops.

A few months ago my attention was called to a chimney on which pounds had been spent without any improvement. I had the flues carried up as directed, which made an improvement, but not a perfect cure.

I then examined the top, and found the flue—which was a 12 in. circular one up to that point—reduced to 7 in. by a chimney-pot. The removal of this completed the cure.

Yet another failing may be insufficient supply of air: this is readily supplied by piercing a few holes in the hearthstone, immediately in front of the grate, and connecting these with the outside of the building by means of pipes laid in the floor.

If these simple suggestions are carried out, they will cure the majority of smoking chimneys; if they do not, some special cause must be looked for—such as position, whether surrounded by high buildings in such a way that there are gusts of cold air beating down on top of chimneys. Such chimneys would require special treatment—only to be decided by a study of the special causes.

Should the subject be thought of sufficient general interest, I will at an early date give details for constructing a simple, cheap, and most effective grate, in place of the ordinary register.

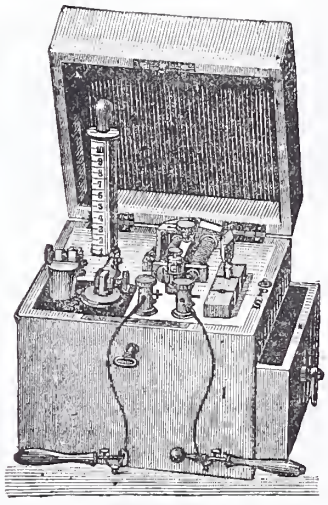
[As the cure of smoky chimneys, and the construction of grates on a simple and efficient plan, are subjects which are interesting to all householders, it is hoped that "Excelsior" will soon redeem the promise made in the last paragraph. The present time is an opportune one for the appearance of papers of this kind, for there is ample time to act upon the advice given and to get the work of reconstruction completed before the time for lighting up fires has come round again.—ED.]

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 43.—SCHALL'S ELECTRO-MEDICAL APPARATUS AND INSTRUMENTS.

I HAVE received from Mr. K. Schall, Medical Instrument Maker, 55, Wigmore Street, London, W., a copy of his new illustrated price list, and a specimen of the medical coils made by him. The neat little coil sent is known as Dr. Spamer's Induction Coil, and is enclosed in a polished mahogany box measuring five inches square. The box contains a small glass cell, fitted with zinc and carbon elements to form the bichromate battery for actuating the coil; a small vertical coil, with movable iron core to regulate the strength of the current, and a drawer containing conducting



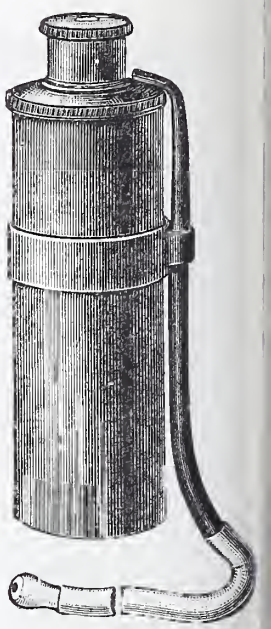
**Dr. Spamer's Induction Coil.**

cords, several rheophores, a pair of polished rheophore handles, and a set of spare zinc plates for the battery. This bijou electro-medical coil is well suited to the requirements of a county practitioner needing a portable means of applying a faradaic current to his patients, since the whole can be sent by parcel post for 9d. This will give some idea of its lightness. It is furnished with a separate quick-acting rheotome of the horizontal form, and very sensitive in action. The faradaic current from the secondary coil is, therefore, of a mild character, easily borne by a child of tender years when the coil is actuated by a current of 1½ volts, even when the core is fully in the coil. Every part of the apparatus shows good workmanship, and is well worth the two guineas charged for it. Mr. Schall has been engaged for several years as a maker of electro-medical apparatus to the London and provincial hospitals. He is now open to supply the medical profession generally with high-class apparatus at a reasonable price. Medical gentlemen interested in this subject should obtain his new illustrated price list of 128 pages, which contains some good information on galvanometers, electrical measurement, the care of galvanic batteries, and a list of books on electro-medical subjects, published in the English, French, and German languages.

### 44.—GLASS-TOPPED SPECIMEN BOXES.

The boxes known by this name have been very recently brought into the market, and will be found useful by a great variety of persons for a number of purposes, which space forbids me to attempt to enumerate at length. They were shown to me for the first time a few days since by Messrs. Moseley & Son, 323, High Holborn, London, W.C., who supply them in the four sizes in which they are made—namely, No. 1, at 2s. per dozen: No. 2, at 2s. 6d. per dozen; No. 3, 3s.; and No. 4, 4s.; all post free at the prices named. The diameter and depth outside measurement of the four sizes respectively are as follows: No. 1, 1½ in., ⅝ in.; No. 2, 1¾ in., ⅝ in.; No. 3, 2¼ in., ⅞ in.; No. 4, 2¾ in., 1 in. The boxes are neatly made, and present a pretty appearance, some being of a dark gold colour and others like frosted silver. The method followed in making them is ingenious. First of all, two pans are made of equal diameter, the upper one having the top edge neatly turned over to take the glass top, which is dropped in on it. A narrow ring of metal, resembling a flat indiarubber band, is then dropped in on the glass, and is held in place by points of metal driven in by pressure from without. A broad ring of bright tin is then put into the lower pan, and projects above it. The cover is then closed down over this ring on to the lower part, and the box is complete. The boxes are made on Jahncke's patent, and presumably come from Germany. Entomologists will find them useful, and so will all who need receptacles for small articles, such as screws, fittings for fretwork, etc.; for, as the contents of the box can be seen without removing the cover, much of the trouble will be saved which invariably ensues when such articles are stowed away in pill-boxes or match-boxes.

### 45.—JONES'S PATENT "MULTUM IN PARVO" SPIRIT LAMP AND BLOWPIPE.



**Jones's Patent "Multum in Parvo" Spirit Lamp and Blowpipe.**

The accompanying engraving shows very clearly the appearance and construction of this useful and appropriately named "Multum in Parvo" Spirit Lamp and Blowpipe, made on Jones's patent, and supplied, post free, by Messrs. Moseley & Son, 323, High Holborn, London, W.C., for 4s. The lamp itself, including the top, is 5 in. in height and 1½ in. in diameter. The cover of the top unscrews, and when put on is screwed down on a washer of yielding material, so as to prevent the escape of the spirit within. The blowpipe, as may be seen, is bent inwards towards the flame at the upper and smaller end, and outwards at the lower end, on which is fitted an indiarubber pipe about 15 in. long, with a bone mouthpiece. It will be found to be a most useful and handy article by gas-fitters, plumbers, etc., and all who are frequently obliged to make use of a blowpipe. The flexible indiarubber tube and mouthpiece with which it is fitted admit of its use in many places where it would be impossible, or, at all events, difficult, to work with an ordinary blowpipe applied to a flame from an ordinary lamp. It can also be used with advantage as a torch or light, when working in dark places, by unscrewing the loose top. The lamp is charged by filling the cylinder with lamp cotton or cotton waste, which must be saturated with methylated spirit for light work, or with benzoline for heavy work. The blowpipe is inserted in a brass band which can be moved up and down at pleasure. Thus the blowpipe can be adjusted at any height up to 2¾ in. above the top. THE EDITOR.

## SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**House Gas.**—E. F. B. (*Liverpool*).—I am not aware that coal-gas has been liquefied. It consists of a mixture of gases, of which the chief are hydrogen, marsh-gas, olefiant-gas, and carbonic oxide, and each gas requires a different amount of pressure to liquefy it. Thus, whilst marsh-gas requires a pressure of 180 atmospheres at 7° centigrade, hydrogen requires 650 atmospheres at −140°C. (One atmosphere is 15 lbs. per square inch.) Very powerful machinery would be required for this, and these gases are only liquefied for chemical research. With regard to your other question, the following gases and vapours will not burn: nitrogen, carbonic acid gas, steam, and, in some senses of the word, chlorine.—F. B. C.

**Ornamental Bookcase.**—BOOKWORM.—Bookcases have had a fair share of the space of WORK. Through Vols. I. and II. you will notice by the indexes there are several, although whether any of them are ornamental it is for you to decide. There are also one or two in the few numbers already issued of Vol. III. Look diligently through "Shop."—J. S.

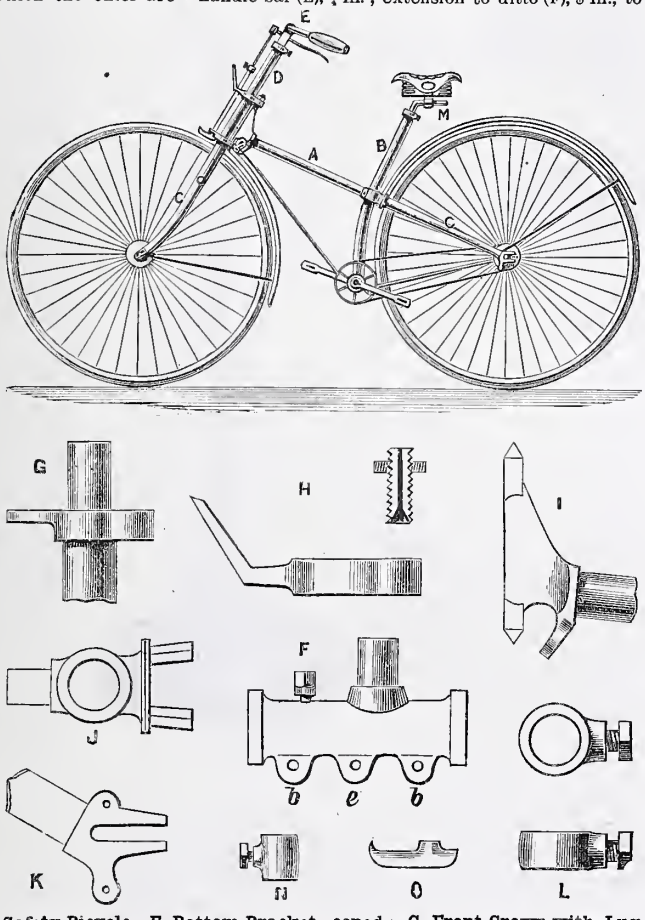
**Home-Made Printing Press.**—AMATEUR PRINTER.—To describe the construction of such a press for amateurs, with the necessary drawings, would take too much space for the columns of "Shop." Wait for a short article.—S. W.

**Gelatine Slab for Copying Writing.**—PATRON.—Gelatine, ½ lb.; glycerine, ½ lb.; a little French chalk or sulphate of baryta to give opacity, and sufficient water, form the composition used for this purpose in the Scriptograph.—S. W.

**Planing Wood.**—R. J. (*Monkland*).—You have in your letter indicated the great difficulty of manual work and the chief defect of printed teaching. I fear "Shop" is too crowded for a long lesson. As a daily teacher, I find that no progress can be made until the critical faculty is awakened. You evidently have that. Now, what is a flat surface? And how can we test a surface to ascertain if it is flat? A flat surface is one which is touched everywhere by a straight line applied to it; no matter in what direction the straight-edge is applied, it should touch the surface throughout—be in contact. I suppose you will try to make a straight-edge? You can have no better lesson. Do it in two ways. (1) Fix together two thin boards by means of three or four screws. Try to plane the edge of the board thus formed as straight as you can; take out the screws, and bring the planed edges into contact. See if they touch throughout; if not, replace screws and try again, noting what fault you discovered, and try to remove it. (2) Plane the edge of a board, and, using it as a ruler, draw a line; turn it over, and bring it up to the line. See if it agrees, knowing, as you do, that two straight lines cannot enclose a space. When you are successful in making a straight-edge, keep it for testing your work, but do not expect to obtain quite accurate work on wood which is thin enough to bend under the pressure of the plane. Thin boards need careful treatment and a flat bench. In the article on Piano Back Making there is embodied an excellent lesson on planing.—B. A. B.

**Indexes of WORK.**—A. F. L. (*Manchester*).—The numbers after each article refer to the *pages* of each volume. Quote the page and the volume to the publishers, Messrs. Cassell & Co., Limited, and you will be able to procure any number you require. Each number consists of 16 pages; therefore the process of division by 16 will give you the number containing any special article: thus, page 34 by 16 will make it clear to you that page 34 will be contained in the *third* number of any volume. But why not subscribe regularly for so small an outlay as one penny per week?

**Safety Bicycle Model.**—J. G. (*Aberdare*).—The parts to make the machine shown in the sketch can be had of Brown Brothers, 7, Great Eastern Street, or St. George's Cycle Company; or in Birmingham of W. A. Lloyd, Lionel Street. All the above will send their price list of materials. To make a cheap machine the bearings would have to be plain or coned, not ball. Cheap lap-welded tubes can be had, but I should recommend weldless steel. In the sketch the wheels are 30 in. by ¾ in., direct No. 10 spokes, forty in the back wheel and 36 in the front. Backbone (A), 14 in. by 1¼ in.; upright seat tube (B), 18 in. by 1¼ in.; two pairs brazed hollow forks (C, C); front steering-tube (D), 12 in. by 1¼ in.; handle-bar (E), ¾ in.; extension to ditto (F), 8 in., to fit inside steering-tube (D). The stampings are: Front crown piece (G); two lugs, with screw for fixing neck (H); neck (I), to be fitted into forward end of backbone (A); centre bracket (J), through which passes the upright seat-tube, and to which are fitted backbone and rear forks; two fork ends (K), one having extension for step; two lugs (L), one to fit on top of steering-post, other on top of seat-pillar; L pin (M), to fix saddle, should fit inside seat-pillar.




**Safety Bicycle—F, Bottom Bracket, coned; G, Front Crown with Lug in one; H, Upper Lug with Lamp Bracket; I, Neck; J, Centre Bracket; K, Fork Ends; L, Lugs for Top of Steering-Post and Seat-Tube; N, Brake-Rod Clutch; O, Brake Spoon.**

**Workman's Clock.**—T. A. (*Old Kent Road*).—Thanks for your ideas on the subject. If you will turn to page 699, No. 95, Vol. II., of WORK, you will find your idea fully described and illustrated. Workmen who may wish for a few ideas on electric time alarums to call them up in the mornings, will find them in plenty on pp. 157, 175, 226, 416, 582, 699, and 723, Vol. II., of WORK.—G. E. B.

**Incubators.**—SUNDERLAND.—Your query being somewhat of a business nature, if you will send me your address under cover of the Editor, I will write you privately.—LEGHORN.

**Framing Engravings.**—J. B. (*Manchester*).—There are many modes of framing good engravings (etchings, mezzotints, and line). I will describe two of the most artistic. (1) Suppose that what you describe as the tinted border (properly called the India paper) measures 17¼ in. by 12¼ in., you should procure a panelled strainer 23½ in. by 18¾ in. You will see that this allows a margin of 3 in. all round. You must then cut down your white outside paper to such a size as to leave two to three inches to overlap the strainer on all sides. Sponge the back of the print, paste (round edges, say, 3 in. only), and lay down on strainer. (2) Strain as above; then get an overlay Whatman mount, either white or French grey. Cut the opening with bevelled edge, to show the engraving itself only if it is without India paper border; if with, show the border, and allow 3 in. to 3½ in. margin of mount on all sides equal. You need not glue mount down, for in fitting up frame it will set all right.—F. B.

**Manganese for Leclanché Cells.**—R. L. (*Ruabon*).—The manganese used in charging the porous pot of a Leclanché battery is the common black ore of manganese, named in some districts "black wad." It has also the names pyrolusite, binoxide of manganese, and peroxide of manganese. It has a black colour, something like rock powder, and must be used in grains of this size, or about the size of peas, for the purpose of charging the cells. If this is the variety found in your locality, use it in charging the cells, but sift it free from dust before putting it in the cells.—G. E. B.

**Standard Ohm.**—J. N. (*York*).—The standard ohm recognised by the Board of Trade is a small instrument for measuring the resistance of electric currents. It consists of a length of German silver or of platinoid wire having a resistance nearly that of 6 ft. of No. 36 pure copper wire. This wire is made into a coil, mounted on a bobbin, and furnished with suitable terminals. I do not suppose you could make one yourself, as you have not the necessary appliance for ascertaining the exact resistance of the wire.—G. E. B.

**Medical Coil.**—G. T. (*Hollinwood*).—I think you have committed a serious error in undertaking to treat patients with doses of electric current from a medical coil before qualifying yourself in electro-therapeutics. I can easily gather this from the contents of your letter. You may be an expert in medical botany, but you know little or nothing about the use of electricity in the relief of pain and cure of disease. If you will take my advice, you will abandon the use of the medical coil until you have studied well how to use it by reading some good books on the subject. Get first "How to Use a Galvanic Battery in Medicine and Surgery," price 4s., published by Messrs. J. and A. Churchill, London. Then read "Electricity in Medicine and Surgery," price 8s. 6d., published by Messrs. Smith, Elder & Co. You will find other useful books in the lists of these publishers. When you have read the first two, you will not need ask anyone the questions put in your letter. Instructions on making medical coils are given in my last paper of the series on Induction Coils. Much harm may be done to your patients by wrongly applying to them the electric current from a medical coil.—G. E. B.

**Faulty Dynamo.**—C. T. B. (*Chapel-en-le-frith*).—I should have been glad had you made your letter long enough to include the sizes of wire used in winding your machine. The cause of failure to light a 5 c.-p. lamp with your machine is evidently due to want of current. This may be caused by an insufficient quantity of wire on the armature, or this driven too slowly. In either case the voltage of the armature current is not high enough to send sufficient current through the F.M. coils to magnetise their cores. You must therefore drive the armature faster. Very little current can be got out of a small machine when driven under 3,000 revolutions per minute. Have you tried shifting the brushes until the best working angle has been obtained? As you have the F.M. coils in shunt with the armature, you will gain nothing by placing a shunt in the main circuit.—G. E. B.

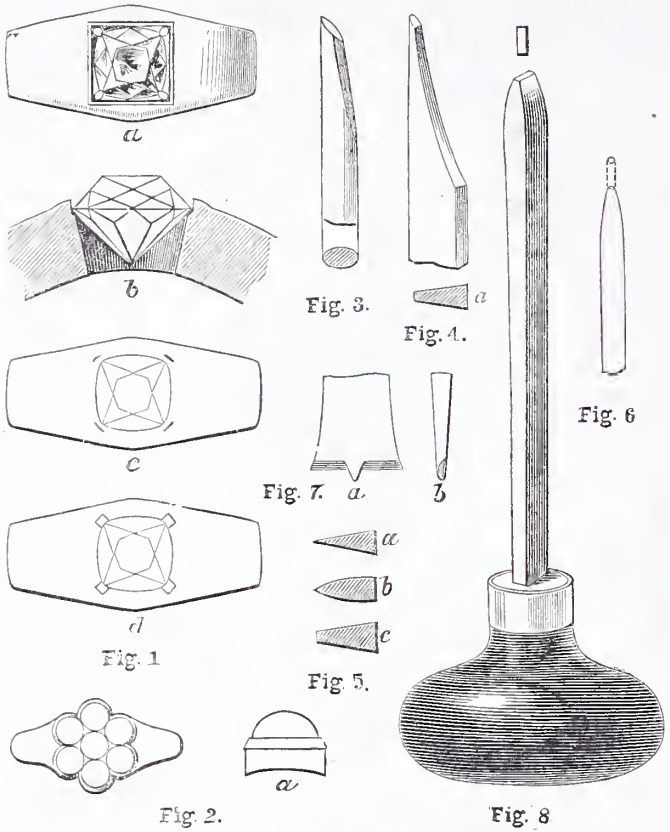
**Repairing Medical Battery.**—J. W. N. (*Gateshead*).—Scrub the zinc block clean, then put it in a saucer or shallow dish, and pour on it a mixture of one wine-glassful of sulphuric acid to four wine-glassfuls of water. Pour on the water first, then the acid, slowly and carefully. The mixture will get scalding hot. Next pour on the zinc about an ounce of quicksilver, and turn the zinc block about in the mixture until well coated with the quicksilver. When it has cooled a little, brush off all surplus quicksilver from the zinc, and put the mixture with the quicksilver not used away in a bottle for future use. This process is called "amalgamating the zinc." You will have to repeat it whenever the zinc gets black and dirty. Charge the cell with 3 oz. chromic acid and a wine-glassful and a half of sulphuric acid in one pint of water. The chromic acid can be obtained by post at a cheap rate from Mr. S. R. Bottone, Wallington, Surrey.—G. E. B.

**Boot Tools.**—A SNOB.—The best shop for kit tools is C. F. Jupp, 78, Wardour Street, Oxford Street, London, W. He will send you anything you need, and I know his kit cutter is one of the best, and each piece is ready for use. His seat wheels are 5s. each, fore-part irons 1s. 3d., double irons 1s. 6d. Should you require further prices, send for list. See WORK, No. 87, Vol. II., page 568. I answered question to M. M., the last of which explains how to cut a fore-part iron. If you do not think you could re-cut the tools you have, it will show some of the essential points to be noticed in buying new.—W. G.

**Making Hinges.**—BUTT.—The substitution of one material for another in manufacture is not the subject matter of a patent. An inventor may

prepare and lodge some papers, and receive a certificate from the Patent Office that he has done so, but this is *not* protecting an invention. An inventor who has no means to pay for having his work done in a proper manner by a duly qualified person must be content to find out by his own exertions whether his invention is new, or what part of it has been forestalled; and then comes the proper preparation of the documents, so that they shall properly explain, define, and cover his rights. This, it is needless to say, cannot be done by one inventor in ten thousand. It seems to us that the section would have to be cut into the lengths required, and then drilled, which, with proper apparatus, there should be no difficulty in doing. We are not quite sure that we have not seen something of the kind proposed before, but cannot speak decidedly off-hand. The only course open to BUTT is to get someone to take an interest or share in his invention and provide the means, so as to be able to have a property created in it. The mere fact of a patent being granted in response to an application no more makes it a property, or proves it to be such, than does an idea of a railway to the moon show how it is to be done, or prove that it can be. If BUTT will refer to No. 41, Vol. I., of WORK, page 694, he will there find some information respecting patents of which he, inventors, and the public have little or any knowledge, but which is of the first importance to all persons desirous of creating a property in inventions.—C. E.

**Diamond and Pearl Setting.**—H. C. (*Norwich*).—This answer will be kept to the particular kinds of setting for which details are asked; but as any attempt at describing the art of setting will probably fail without actual demonstration, I trust that H. C. will write again if he finds some particular point overlooked or not described sufficiently. There are no details of preparation of the work asked for, except on one point, and that is: "Are rings, etc., coloured and scratch-brushed before setting?" No absolute rule can be given for this, but it is well, when we can, to leave the scratch-brushing of all work until the very last, because the surface of coloured gold is so delicate that ever so little rubbing deteriorates it. As these processes can neither be done with stones set with either painted or foiled backs, it follows that the article must therefore be coloured and scratch-brushed before setting; hence we have to do the best we can to protect it with goldbeater's skin. With such stones as pearls, turquoise, corals, etc., no harm should come to them when being scratch-brushed after being set, neither will it harm any stone set with an open back; but do not on any account risk getting water under such things as rose-diamonds by leaving scratch-brushing until the last with them. In short, just think of the particular conditions of each job, and act accordingly. A word as to holding the work during the process of setting. I strongly advise putting all work on a cement-stick, or shellac-stick if the latter be preferred. (Jewellers' cement can be bought at about 6d. per lb. from most tool and material shops.) By this means the article can be held firmly, and does not get out of shape, as many things do when held between clamps, rings particularly. If the work is wrapped round in goldbeater's skin, it must be dried before being put in the warmed cement-stick. It saves trouble if care is taken to keep the cement out of the holes, hall-marks, carvings, etc. This is, of course, done by the "goldbeater" when used, but by paper or whiting in other cases. Another tip to prevent the cement sticking to the work is to pass the very thinnest film of oil over it. This is what would be done with most bright polished work. Now to try and write down all the important steps taken to set (1) a diamond in a ring square-set; (2) a pearl cluster with bright bevelled edges—*i.e.*, glass setting; (3) a pearl cluster with cut down grain setting. No. 1. Fig. 1, *a*, *Square-set Diamond Ring.*—To open the ring for the stone, first drill a hole right through, and let it be a little smaller than the stone. Then open the hole: I mean that the top edge of hole is to be made exactly the size of stone, then file out the hole quite clear to the back, and polish it. See that the ring is polished now before the stone is set, which is the next step. Fig. 3 shows the way a buhl-sticker should be ground and sharpened for use in opening holes or for "letting in" stones. This tool is made to cut round the hole and partly downwards, thus clearing out the hole at the same time that it opens it to the stone. Letting the stone in means that the girdle of the stone is to be made to rest on a bearing, which is to be cut at such a depth that the edge or girdle of the stone is just below the top edge of the gold. This condition depends on the preceding one, for if a stone be correctly "opened to," then merely cutting the gold out below the edge will bring everything right—that is, if the correct depth be obtained. Fig. 1, *b*, indicates this condition in an enlarged section. The next thing to do is to hold the stone in the ring. This will be done by the aid of a medium-sized round scorper ground like Fig. 4. This tool is forced in the gold at four places as marked (Fig. 1, *c*), and the portion of gold between the notch thus made and the stone is pushed forward towards the stone until each piece in turn is over the stone. These pieces, which are rudimentary grains, have to act as points or claws to hold the stone in. That being so, a suitable distance must be chosen for the first hollow that is made by the round scorper, and must, of course, be well within the square we intend to make. Next to "clear away the sides of the grain," a knife-tool (Fig. 5, but sharpened like Fig. 4) is used to make the side cuts, which will leave the work like Fig. 1, *d*. If the grains be not sufficiently over the stone, they can now be pushed up by applying pressure at their bases. The stone now is practically "set," as far as safety is concerned. All that remains is to finish the work, by using the knife-tool to make the grain to the desired size, and then to cut the square with a bright spit-sticker (Fig. 5 *b*), finally finishing it all with a grain tool. The ways to brighten or "gloss" a scorper are many. The one given here is an easy one. It is by making a buff of a piece of very finest emery-cloth glued to a piece of wood, on which the surface that is to be brightened is rubbed until quite smooth, and then the same surface should be rubbed on what is known as a piece of "black-stone." This is to be obtained at tool warehouses as a rule, but failing that, a smooth piece of lump emery, followed by a leather buff charged with putty-powder or rouge, will give a fairly good bright surface. As to the grain tool, it must be of suitable size, of course, and can be made out of a piece of steel rod, like Fig. 6, the end of which does not come to a point, but has a very smooth, rather shallow hollow in it. On the true shape and the surface of this tool the finish of the grain will depend. A most necessary tool for keeping grain tools in order is a fion. This is but a row of different sizes of hard, bright, round steel points, which act as burnishers to the cup-like, or, rather, saucer-like hollow of the grain tool. No. 2. *Glass Setting a Pearl Cluster.*—Fig. 2 is intended to represent a pearl cluster, the gold setting of which is finished in the form of a bright bevel. It is done as follows: The pearls are let in with the utmost care as far as fitting is concerned; and if the mount in which they are to be set be a deep one, then a buhl-sticker can be used as before; but as a rule, pearls and such-like stones are set in a plate of about $\frac{1}{32}$ in. in thickness, so in its place a round scorper is used, ground and sharpened diagonally. This can be used to open the hole from the commencement, but it is better to make a few "pearl" drills, with points the shape of Fig. 7, which, as you see, is not so likely to go through a thin plate as a spear-drill would be; and, besides, it clears the hole out, and if made the exact size, will not only open the work, but almost let the pearls in, if they are quite round in shape. Before fixing the pearls, it is well to put a layer of very fine plaster of Paris all over the bottom of the hole, not to stick the pearls in with, but to give a level surface to rest the pearls on, and to keep dirt away from the backs. To fasten these, a tool shaped like Fig. 8, and made of soft steel roughened on its face by filing, is used. With this "pushing tool" the gold is forced up to and over the edge of the stone. When the gold is close up, then a flat scorper (Fig. 5, *c*) is used to cut a bevel all round it, as shown in Fig. 2, *a*. This bevel is to be bright cut, and to brighten the scorper, the same process is gone through as was done with the bright spit-sticker in the previous job. This setting, from its very simplicity, is a very difficult job, and will take much practice before the settings are properly finished. No. 3. *Setting a similar Cluster with a Cut down Grain Setting.*—The stones are to be "let in" and the gold pushed over, as in the preceding case. Then proceed to mark the places with ink where the grains are to come, and cut away some of the gold in between the grains. Then push up the gold once more, and be sure that all round the stone the gold is quite close. All that remains is to trim the grains into shape, and cut down the parts between them with a similar bright scorper to that used in the second job, finishing off by nicely grain-tooling the tops of grains. The shape and proportion of grains are shown in some of the illustrations on "Ear-Rings," which were printed in preceding numbers of WORK. All the tools here drawn are given merely as types, not especially for the particular size required, although they are sketched from tools actually in use. The art of setting is one that almost teaches itself, as far as its principles are concerned, but practice and experience are the chief factors of one of the sections of jewellery manufacturing in which good wages are still earned by competent men. And I may say, in conclusion, that, like poets, good setters are born, not made.—H. S. G.



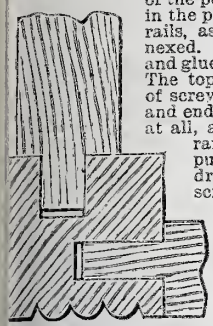

**Diamond- and Pearl-Setting Tools. Fig. 1, *a*.—Drawing of Square-Set Diamond Ring, enlarged. Fig. 1, *b*.—Showing relative Positions of Stone and Top Edge of Ring. Fig. 1, *c*.—Showing First Step in forming Grains. Fig. 1, *d*.—Second Step in forming Grains. Fig. 2.—Pearl Cluster, Glass-Set. Fig. 2, *a*.—Enlarged Drawing of one Pearl and Setting, to show the proportion of bright Bevel. Fig. 3.—Showing the way a Buhl-Sticker is ground and sharpened for opening Holes. Fig. 4.—Example of grinding and sharpening Round Scorper. Fig. 4, *a*.—Section of Tool. Fig. 5, *a*.—Section of Knife-Tool. Fig. 5 *b*.—Section of Spit-Sticker. Fig. 5. *c*.—Section of Flat Scorper. Fig. 6.—Shape of End of Grain Tool. Fig. 7, *a*.—Pearl Drill, back view, enlarged. Fig. 7, *b*.—The same, side view. Fig. 8.—Full-size Sketch of Pushing Tool; this also shows a good length for all the other Scorpers, of which points or sections only are given.**

**Wood Photography.**—J. M. (*Kilmarnock*).—The tools you require may be obtained at Buck's, in Tottenham Court Road, London, or Moseley's, in New Oxford Street, W.C. Photographing in wood may be done in several manners. The chief condition to be borne in mind in adopting any process is that it shall be as much *on the wood* as possible. A thick film of any kind is a fatal objection, as it chips off in cutting. The best plan is a transfer in greasy ink from a collotype cliché. Another plan is to put a thin even coating of salted gelatine mixed with zinc white, sensitised by brushing a strong solution of nitrate of silver on the dried gelatine surface: dry, and print under an ordinary negative to the proper depth, and fix with hyposulphite of soda: wash and dry. This is a process very frequently adopted. Certain precautions must be taken to prevent the wood warping. All the parts of the block not to be printed on should have a coat of some waterproof varnish. In washing, only the printed surface should be moistened with water, the block being held in the hand, and the water applied with a soft brush. This carefulness to avoid excess of moisture applies both to salting and sensitising, strong solutions of each kind being used. Salting solution is made of bromide of ammonium, 20 grains; gelatine, 5 grains; water, 1 oz.; oxide of zinc, 1 drachm. The silver solution is nitrate of silver, 90 grains; distilled water, 1 oz.; citric acid, 5 grains. Fixing solution: hyposulphite of soda, 1 oz.; water, 4 oz. The block must be allowed to dry spontaneously by standing it on its edge in a current of dry air. Artificial heat, such as holding it to the fire, will cause it to warp, and be useless for printing. This process is easily worked, and very good results may be obtained with ordinary care.—D.

**Cameras.**—CAMERA.—Some time may elapse before such a paper as you ask for on camera construction can be presented, so much having already appeared in the body of WORK and in "Shop" upon the subject. If, in the meanwhile,

ou want a thoroughly good camera, you cannot do etter than write to George Hare, 26, Calthorpe treet, London, W.C., who does excellent work.

**A Small Sideboard.**—NEMO.—The gable rails re 1⅛ in. thick, and are set back ⅜ in. from the face of the posts. The mortises are cut in the posts for the front and end rails, as shown in the sketch annexed. These are fitted closely, and glued fast to keep them firm. The top is secured by a number of screws, all from the front, back and end rails—none from the posts at all, as you seem to think. The rails are pocket-holed for this purpose, as shown in the drawing. Perhaps two screws in each end rail and four in front and back rails will be as many as anyone need wish for, and will be quite ample for the purpose. Oak is certainly the better wood for such a job as this is, as

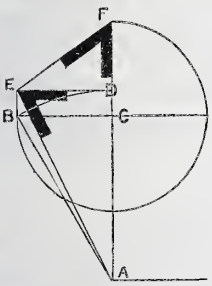


Sideboard Mortises.

ar as appearanee goes; but mahogany decidedly easier to work, as it is less ritty. Good Spanish mahogany is the est to use, though of course it is the earest. I am sorry I cannot recommend ny of the firms you speak of, as perонally I know none of them. You can-ot go far wrong, however, in dealing vith any respectable merchant; and if ou care to do so, you can see and get rices of wood from several before purhasing.—N. M.

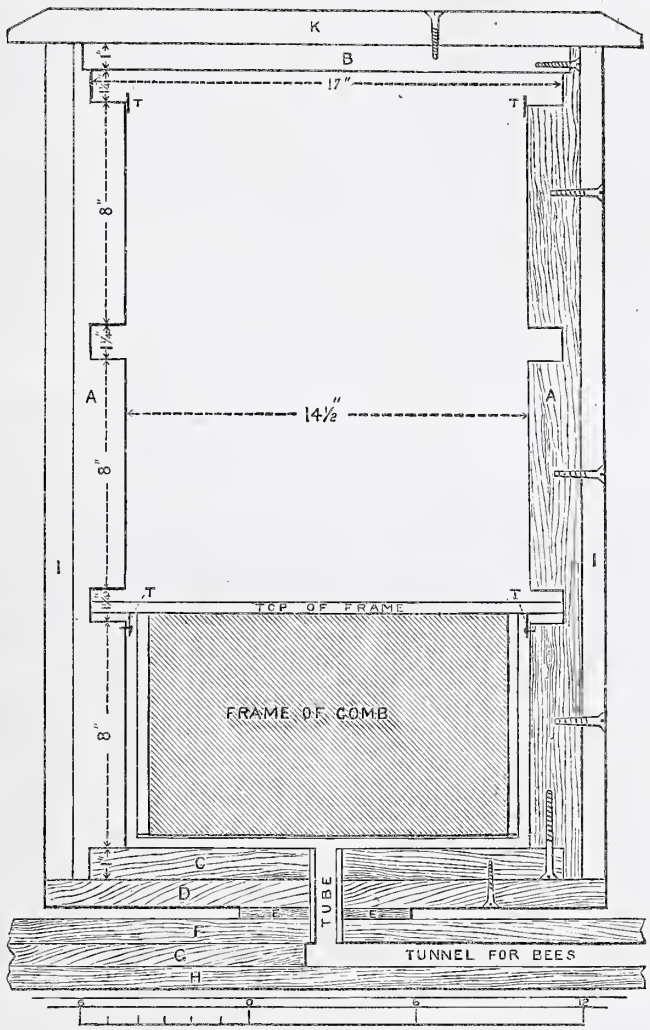
**Stains.**—J. M. (*Fulham*).—I know of o book devoted entirely to stains for vood. Most works on French polishing isually devote a few pages to the subect. Perhaps Mr. Denning may do so n the series of articles on French polishng appearing in the present volume of VORK. To give full particulars of *how* nd from *what* stains are made to imiate the various woods and self-colours -such as black, blue, green, etc.—would ake up more room in "Shop" than I hink the Editor can spare at present. f, bowever, you will write us again, tating any particular stain or colour ou may require, we shall be happy to ssist you.—LIFEBOAT.

**Bevels for Dovetailing.**—SIDEOARD.—Set out angle of sides on a rawing-board. We will call the angle ection angle, said section being at right ngles to base, B C on diaram. Square p from A. utting top line t C, with A as entre and A B s radius, describe are, cutng perpenicular line at . From D, raw D E parliel to B C, raw B E parliel to A D, oin E A, then E D is the ngle of the oards. From as a centre, vith C B as raius, describe rc cutting A D, roduced in F; oin E F; D E F the angle o mitre the oards cut as before directed. QUERIST ight look in back numbers again, however; see lso Vol. I., pages 173, 414, and 731.—B. A. B.




Bevels for Dovetailing—A B C is the Angle of Side Elevation; A E D, Angle to cut the Boards; E F D, Angle to mitre Corners.

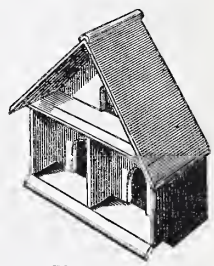
**Observatory Hive.**—J. J. (*Kidderminster*).—f course you know that an observatory hive is one n which the operations of the bees can be watched hrough some transparent medium, usually glass. Ve must, therefore, have glass sides to the hive; utit would not do to have the light always entering, onsequently shutters are provided for darkening p tbe hive, and for preserving the heat which the lass is only too prone to dissipate. It would not do o bave more than one comb in thickness, as, if here were more, the seeret operations of the hive vould be carried on between them beyond the bservation of the owner. The number of combs vhich the hive is to contain is a matter for conideration also. One, three, or six standard frames re usually found in observatory hives. In the igure I give an elevation of a three-comb observaory hive of simple construction, which I designed or my own use. The important parts are the side ieces, A, A, which ought to be very accurately cut o the dimensions shown. They are 2 ft. 5¾ in. long, in. wide, and 1⅝ in. or 1½ in. slaek thick. When hey have been planed true and square, they are to e clamped together, and the reeesses cut out where sbown. Then the pieces B and C should be prepared; they are 1 in. thick, 1⅝ in. wide, and long enough to keep the insides of A, A, 14½ in. apart, and the inside surfaces of the recesses 17 in. apart. To do this, the recesses must be 1½ in. deep, as shown in the figure. These four pieces must now be firmly screwed together out of winding, so that they will be flat and square, and this is the most important part of the work. Both sides of the frame thus constructed will now be found to be flat and uniform; and if not, the plane should be brought to bear until things are right. As the glass will lie against the outside surfaces of this frame, they should be covered either with cloth or wasb-leather glued neatly on. The sides, I, I, and bottom, D, may now be put on. They are 3½ in. wide and about I in. thick, but the thickness does not mueh matter. As, however, they are intended for the outsides of the hive, tbey must be nicely finished. They are attached to the frame already made with brass screws, and if the corners are well done they will be a most important factor in strengthening tbe




Observatory Hive.

entire strueture. The top, K, is 5 in. or 6 in. wide, and long enough to project about an inch over the sides, I, I. It is sloped from the centre towards the front and back like a roof, and the ends are also chamfered. Two sheets of good glass (either plate or flatted crown preferably), 2 ft. 5¾ in. by 1 ft. 6½ in., must now be procured, and tbey can be laid one at each side of the inner frame, and bedding against the cloth or leather, will exclude all draughts from the bees inside. One of the glasses can be fastened permanently in place with small strips of wood tacked on outside; for the other we must put one strip along the bottom, and sink a little button into the thickness of the top to secure it above. A pair of doors must now be made to fit over the glasses. They should be panelled, and the sides next the glasses padded softly with hair or feathers, and covered with cloth. This will check the tendency of the glass to cool the inside. I must not forget to mention that little strips of tin must be tacked at the edges of tbe recesses to support tbe frames, which should be either of Abbot's broad shoulder type, or provided with metal cnds, so that the space at each side will be uniform. With regard to an entrance, if tbe hive is meant to be stationary, a tunnel could easily be cut through one end. These hives, however, are often made to revolve; and when so, far more work is necessary. A vertical tube must be glued to C, D, and revolve on the washer. E, and the base-board, F. If this tube is of metal, the lower end could be slightly opened to prevent the hive from being lifted off by mistake, but I prefer a bit of elder-wood from which the pith has been removed, and in such a case it is necessary to leave the lower end rather thicker than the top, and to insert the tube from the bottom. A tunnel will, in every case, lead from the lower end of the tube to the open air, and a small alighting board should be attached. In ease you wish for a unicomb hive, you may omit the two upper storeys, and if you require one to contain six frames, make it twiee the length. As I said at the beginning, tbe important part is the frame, A B A C, and, if necessary, sheets of glass could be tied to the sides of this with string, and a few bags and tarpaulin tied round the lot to keep in the heat; but I think you are too worthy an apiarist to adopt this method. The movable glass should have its edges slightly smeared with vaseline to prevent propolisation. I shall be most happy to help you any further, and hope you will succeed.—APIS.

**Pigeon House.**—R. V. B. (*Peckham*).—I give a sketch of above suitable for three pairs of birds. It is very simple, and all you require to make it is about 20 ft. of ¾ in. by 9 in. yellow boarding, 12 ft. of ¾ in. yellow matchlining, and a few nails. I should eover the roof with a piece of old linoleum or floor-cloth, which can be painted with the rest. It should be fixed on a sunny wall. You will notice that the floor or bottom of nests is lower than the flying board, for the purpose of keeping the stuff, etc., from getting all over the place. I hope this will meet your requirements.—E. D.



Pigeon House.

**Bending Tubes.**—J. S. (*London*).—I find, on making inquiries, that there is no macbine at present made for bending taper tubes. I fail to see why it does not pay to bend them by hand over a mandrel. Do you mean a taper bick iron? That is what I should use, and turn three at once half-round, and finish singly—the same as we make saucepan handles; and they are made quick enough for anything.—R. A.

**Fixing Old Coins in Frame.**—C. T. (*Boston*).—The coins would probably remain in place if fixed with Le Page's liquid carriage glue, and much might be done in way of supporting them by fitting the frame with a sheet of millboard pierced with holes of the size of the coins, which would thus rest in sockets. As a coin collector, however, I by no means advise C. T. to fasten his coins with cement of any kind. The reverse of a coin is often as interesting as the obverse—sometimes more so—and both sbould be open to inspection. If he is bent on exhibiting his coins in a picture-frame, his more rational plan will be to have a frame constructed as in the diagram—that is, witb a series of narrow sloping wooden shelves, each shelf wide enough for a single row of his largest coins. Along each of these shelves he will glue a strip of millboard pierced with holes to hold the coins, which will thus keep in place witbout any cement. The glass front of the frame will, of course, be made to open and shut, and *lock*.—S. W.

Frame for Coins.

**Pocket Accumulator.**—J. B. (*Bradford*).—Low-priced pocket accumulators are not obtainable. Skilled labour must be employed in making them, and this labour must have its reward. The lowest price is half a guinea. The best in the market are made by Messrs. Cathcart, Peto, & Radford, 57B, Hatton Garden, London, W.C.—G. E. B.

**Brass-Work and Re-silvering.**—T. T. (*York*).—To re-silver your spoons, see the articles by Mr. Bonney on electro-plating in the present volume; and for lacquering your brass-work, you cannot do better than use one of the new substitutes for laequer sold by the Frederick Crane Chemical Co., Newhall Hill, Birmingham. These very useful specialities were noticed in "Our Guide to Good Things," No. 106, and some information as to their

use was given in "Shop," No. 107. The courteous manager of the Company, Mr. Charles Harrop, has intimated that he will send a sample bottle of any of their preparations for 1s., post free, to any reader of WORK.—R. A.

**Bench Lathe.** — B. O. (*Stoke-on-Trent*).—If I understand right, your 2¾ in. pulley works with the 24⅜ in. one. To find the speed ratio, divide 24⅜ in. by 2¾ in.; by putting both into ¼ in., you get 99 divided by 11, which is just 9 to 1: a very proper speed for small work in wood. You can calculate the other sizes yourself, but if the 4 in. pulley on mandrel works with the 5½ in. on the crank shaft, you get quite a slow speed, and can turn iron up to 1 in. or so in diameter, and brass up to 3 in. or more. Now, if you want to reckon the weight of the rim of your fly-wheel without having to weigh it, you must find the number of cubic inches it contains of cast iron, and multiply that by ·26, and that will give you the weight of the iron in lbs., because a cubic inch of cast iron weighs ·26 of a lb. Since part of your rim is of lead, which is nearly twice as heavy as iron—namely, ·41 lb. per cubic inch—you must multiply the cubic inches of lead by ·41 to find the number of lbs. For instance, take the rim of lead, which you say measures 2½ in. by 1⅝ in.; multiplying these together, you get about 4 square in. of sectional area; now, if the mean diameter of the rim is 23 in., the length is 72 in.; multiply 72 by 4, and you get 288 cubic in. in the lead rim, and this multiplied by ·41 gives 118 lbs. as the weight of the lead rim. I think 50 lbs. is heavy enough for the fly-wheel of a 3 in. bench lathe, and that yours is unnecessarily heavy, and would do for a large 6 in. lathe. Now for the treadle, which you say rises too high. The crank has a throw of 2½ in., and therefore, a stroke of 5 in. (2½ in. is a more usual crank); also it is 11 in. from treadle bearing to treadle hook, and 22⅜ in. from treadle bearing to foot-board. In that case the foot-board will have a motion up and down of 10 in.—that is, twice the throw of the crank—because the treadle is a lever having one arm twice as long as the other. Now, if you carry the treadle bearing 11 in. further back, as you propose, then the arms of the lever will be 22 in. to 33 in.: about, say, 2 to 3. To get the movement of the foot-board, divide 5 by 2 and multiply by 3, so: $5 \times \frac{3}{2} = \frac{15}{2} = 7\frac{1}{2}$ in., which is the distance the foot will rise and fall, which I think about right for a small lathe; for a large lathe, where you want more power, I think 9 in. not too much. You could have easily found out what the movement of the foot would be without any figures if you had drawn out the treadle full size. Now for the axle bearings. You can have the axle hung on points, but it might be better to have the bearings fitted with new brasses, as your wheel is so heavy. If you wish to run on points, the pointed screws should be of steel, perfectly hard, and of an angle of about 60°; they may pass through 1½ in. or 2½ in. of cast iron, and be secured with a lock-nut. The iron crank-shaft may be drilled up an inch or so with a ⅜ in. hole at both ends, and a hard steel plug driven into each; these steel plugs to be drilled right through the centre with a ⅛ in. hole, and then deeply countersunk to exactly the same angle as the point of the screws, deep enough to hold nearly all the point, and even then the bearing is small enough; the hole in the plug forms a reservoir for oil. Vol. II. begins with No. 53.—F. A. M.

**Violin Articles.** — J. B. C. (*Liverpool*). — The articles on the Violin commenced in No. 105 of WORK.

**Embossed Letterings** —L. S. (*West Hartlepool*). —If only an odd job, Messrs. Bentley & Sons, Embossers, Norfolk Street, Sheffield, would be a likely firm to address on the subject, sending to them the article to be embossed. On the other hand, if you require a large number of the embossed articles, your best plan will be to write to a die-sinker for an estimate for the die, and the price for stamping a given number, including metal. Mr. Wise, Tenby Street, Birmingham, or Mr. Pashley, Edward Street, Sheffield, will, no doubt, furnish estimates on application, enclosing stamped directed envelope for reply.—N. M.

**Moulds for Carbon Plates.**—S. H. (*Rochdale*). —I cannot think of any easier method than to make patterns of the moulds to the size of carbon plates or rods desired, and have the moulds made in cast iron. Each mould should be made in two halves, with the joints grooved and tongued. The two parts of the mould will be held together by a wrought-iron ring or clamp slipping on over both parts, and tightened with iron wedges. The mould will be in the form of a shallow box, open at one end. At this open end the paste must be pressed in and rammed tight, then a piece of iron must be fitted into the end to form a cover, and this must be secured by a clamp. All joints should be closely fitted, to prevent the syrup from squeezing out, but it is not necessary to attempt making them air-tight. —G. B.

**Combination Bench and Tool Chest.** — W. H. W. (*Great Yarmouth*).—Why not submit particulars of this through Section I. of "Shop"?

**Lithography: Re-transfer and Plate Papers.** —A. R. (*Blackburn*).—These papers are prepared as follows: Make a size by boiling parchment strippings, which when cold should be of the consistency of a *firm* jelly (gelatine is sometimes used instead). Grind flake-white in water, mix it with the size (which must first be warmed), and pass the mixture through a sieve. (*Note:* the proportion of flake-white must vary according to the uses for which the paper is intended; too much will prevent the pen working well upon it if *writing* be wanted.) Coat the paper twice with the size, letting the first coat dry before the second is applied. For this part of the process use a flat brush, and work the size *up* and *down*, but do not cross the strokes. Gamboge or rose-pink is added to the size simply to enable the lithotransferrer to see at a glance which side of the paper is sized. This size is suitable for plate paper, re-transfer paper, and writing transfer paper, the only difference being a variation in the strength of the size, quantity of flake-white, and weight of paper; plate paper is generally 48 lbs., re-transfer 32 lbs., and writing 24 lbs. The two last have to be rolled after sizing, but plate paper is left unrolled. After each coat of size the sheets should be hung across a line to dry. If, as would appear to be the case, A. R. is an amateur lithographer, he might find it to his advantage to get Mr. W. D. Richmond's "Grammar of Lithography," published by Wyman & Sons, Great Queen Street, Lincoln's Inn Fields, W.C. We should add that we very much question whether it can pay A. R., or anyone similarly situated, to prepare his own papers.—S. W.

**Timber.**—G. (*London*).—(1) The following oaks are imported into London: American, Dantzic, Trieste, Stettin, Memel, and Finne. (2) The American logs are the widest, and can be had from 16 in. to 24 in. in size. The others do not run wider than 14 in., usually from 10 in. to 14 in. (3) Any of these oaks can be obtained at most timber-yards, especially in the East End. (4) It is generally sold by the load of 50 cubic feet. (5) The prices are about as follows: American, £7 10s. to £8 10s.; Dantzic, £3 to £5; the others run from £4 to £7, according to size and quality. (6) Sawing would cost about 1d. per foot super. (7) A large quantity of foreign oak is unloaded in the Surrey Commercial Docks. (8) No doubt American would answer your purpose best, but neither of them are equal in "figure" or durability to English oak.—A. J. H.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Upholstery.**—T. C. (*Belfast*) writes:—"I shall be obliged to anyone who will tell me how to cut the cloth to cover a couch or sofa to have it neat and without wrinkles. I am not able to cut it properly."

**Xylonite.**—L. S. (*Beaverstown*) writes:—"Will any reader kindly tell me, through the medium of 'Shop,' where I can procure xylonite in small quantities? I wrote to the British Xylonite Co. for as much as would veneer the front of the cabinet, the design of which was published in No. 1 of WORK. I wanted it in black and white to inlay, but they replied that they do not cut less than a gross of pieces."

**Glacial Decorations.**—J. H. (*Salford*) writes:—"Will any kind reader of WORK kindly oblige by informing me how to remove glacial decorations?"

**Compound Engine.**—PUZZLED writes:—"Would any of you engineers who take in WORK help me? How is the steam exhausted from the high-pressure cylinder so that it does not exert a back pressure equal to the pressure it exerts on the low-pressure piston? I have asked dozens of people, and the only answer you get is, 'Yes, I wonder how it is?' What size ought the receiver to be—that is, the pipe from high-pressure cylinder exhaust to low-pressure cylinder steam-chest? Also, how do you find out what size to make low-pressure cylinder? I am sure a good answer to this would interest many."

**Bread Machines.**—JEAN writes:—"Will anyone kindly tell me, through the pages of 'Shop,' where bread-dough kneading machines are made? Address and prices wanted."

**Door-Mats.**—JEAN writes:—"Will any of your readers kindly tell me how the common brown door-mats are made?"

**Root's Blower or Blast Fan.** — F. W. B. (*Huddersfield*) writes:—"Will anyone kindly give the name and address where I could buy a set of castings for a small Root's rotary blower, or a small blast fan, say, 4 in. to 6 in. diameter, suitable for brazing with small gas blowpipe?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Wax.**—L. S. L. (*No Address*) writes, in reply to CARVER (see page 206, No. 117):—"I find the following recipe recommended, but do not know its value myself: Equal parts of beeswax, lead plaster, olive oil, and yellow resin; add whiting sufficient to form paste; mix well, and roll into sticks. The *exact* proportions will, I fancy, be modified to some extent by the temperature."

**Turned Balusters.**—J. E. P. (*Accrington*) writes, in reply to F. E. H. (*Lancaster*) (see page 158, No. 114):—"You could get stone balusters turned at C. Pollard & Sons, Meadow Tap, Accrington."

**Band-Sawing Machine.** — CHOPSTICK writes, in reply to BON ACCORD (see page 190, No. 116):—"I will describe a machine made of wood which I have used for many months, and have cut heavy wheel timber on it. It is too large a subject for 'Shop,' but if the Editor gives me permission, I will send the paper on at once."—[You may send in the paper on approval.—ED.]

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—AN OLD EDISONIAN; PLUMBER, F. K. B. (*London, E.*); W. B. (*Brunteliffe*); T. G. W. (*Clapham*); W. G. C. (*Bradford*); A. M. (*Liverpool*); G. A. B. (*Normanton*); VULCAN; W. W. (*Hough*); S. S. (*Salford*); R. A. (*Kingston-on-Thames*); CONSTANT READER; W. G.; HUGH; H. H. P.; CURIOUS; T. L. (*Riseholme*); MIKADO; J. G. S. (*Stockton*); W. A. S. (*Bolsterstone*); J. M. D. (*Glasgow*); G. M. (*Reading*); LITHO PRINTER; J. G. L. (*Sheffield*); FRET MACHINE; GANELON; T. W. C. (*Springfield*); W. W. (*Caverton*).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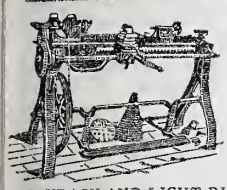

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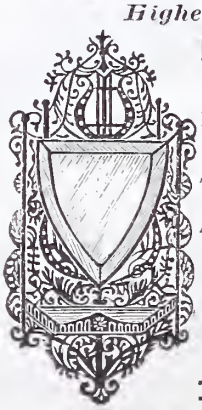

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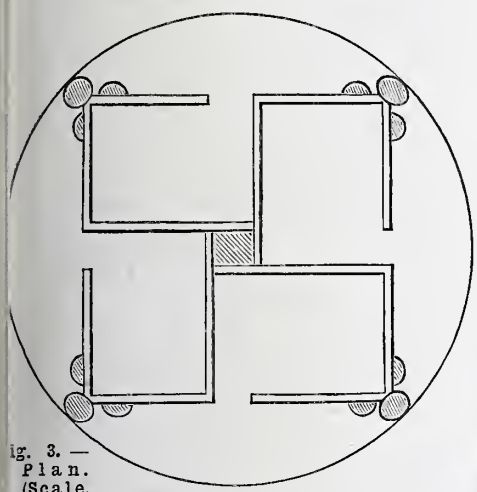
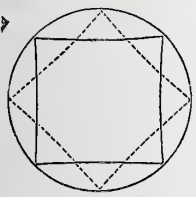
VOL. III.—No. 123.] SATURDAY, JULY 25, 1891. [PRICE ONE PENNY.



ig. 3. — Plan. (Scale, 1½ in. to 1 ft.)



ig. 2.—Section of Pole. (Scale, 2 in. to 1 ft.)

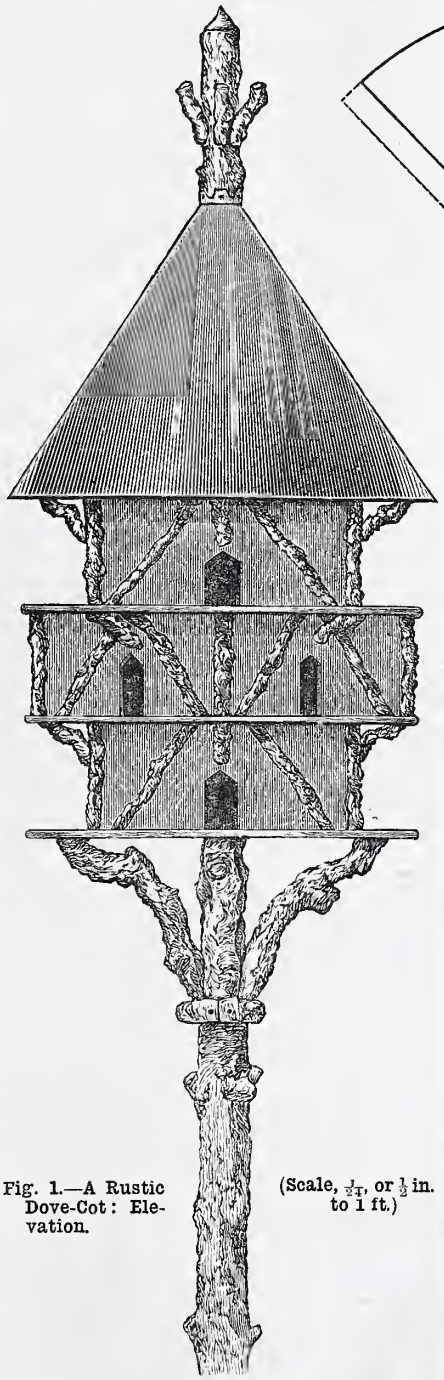


Fig. 1.—A Rustic Dove-Cot: Elevation. (Scale, $\frac{1}{24}$, or $\frac{1}{2}$ in. to 1 ft.)

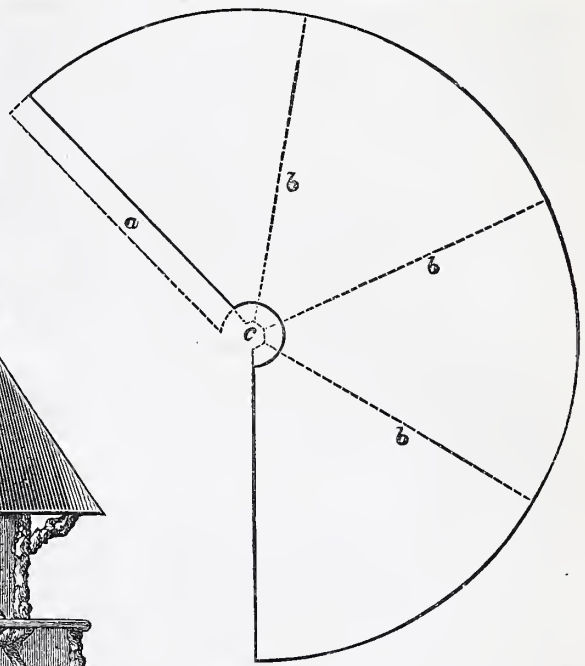



Fig. 4.—Setting out Metal Roof. (Scale, ½ in. to 1 ft.)

## A RUSTIC DOVE-COT FOR THE GARDEN.

BY ARTHUR YORKE.

THE POLE DOVE-COT — THE WOODWORK — THE METAL ROOF.

*The Pole Dove-Cot.*—A pigeon-house of this kind has, it must be owned, its disadvantages: except for the hardier kinds of birds, it is apt to be too cold in winter, and may be too hot in summer. But there are situations in which it alone is available, and to those who keep pigeons, not for "the fancy" nor for profit, but for the pleasure of their company, none other is often so desirable, none other so well admits of being placed before a window, and thus to give the owner the full enjoyment of watching his pets; none other can be made so ornamental; nor, indeed, is any other so safe from the worst enemies of pigeons—cats and rats.

As it is in a garden that a dove-cot of this kind will most frequently be placed, it will be well to keep it in harmony with its surroundings, and unless the garden is very small or very formal, this, perhaps, will best be done by carrying it out to a great extent on rustic lines.

I say to "a great extent," and not altogether, for the actual boxes ought always to be neatly made of planed wood, and painted within and without. Pigeons are subject to parasitical vermin of more kinds than one, and all arrangements for housing them should therefore be made in such a manner as will allow of thorough cleansing.

In the design before us this consideration has been kept in view. It contains twelve boxes—and good roomy ones—each being 18 in. by 12 in., and 13 in. high.

The illustrations are drawn to scale as named in the inscriptions to the diagrams, which see. By working out the design on a smaller scale, it might very well be adapted as a nesting-place for starlings or other wild birds. The starling gladly avails itself of any home provided for it, and no bird wages more inveterate war on grub pests than he. We in England treat him with too scanty courtesy; in some countries, as in Russia, the starling-box is a recognised institution in a garden.

*Woodwork of the Dove-Cot.*—The first and most important matter will be to provide a larch or other fir pole, of which the diameter will average, say, some 6 in. Its length may be varied to taste; some prefer the dove-cot higher, some lower, but few, we presume, will care to have its bottom less than 8 ft. or 10 ft. from the ground; to this must be added 2½ ft. or 3 ft. to be firmly planted in the earth, 6½ ft. for the height of boxes and roof, and 2 ft. for the finial above.

At the point marked off on the pole for the bottom of the cot, we make cuts with the saw on the four sides, and again 15 in. higher, and chip away the wood so as to leave our pole 4 in. square. This is the space for our lowest tier of boxes. To make a space for our middle tier, we treat the pole in the same manner for the next 14 in., only we make the corners of this second space to come opposite to the middles of the sides of the space below. Fig. 2 is a section of the pole illustrating this: the circle marks the original outline of the pole,

the black lines show the space for the lowest tier, and the dotted lines that for the middle one. The upper tier will occupy another 14 in., and this will be a repetition of that prepared for the lowest.

A reference to the plan of one of the tiers (Fig. 4) will show the use made of the squared spaces; one of the partitions which divide the boxes is nailed to each side, whilst the boards which form the outer walls are nailed to the ends of these partitions. For the comfort of the birds, 1 in. stuff should be used for all these pieces: it will be none too thick when planed. For the divisions between the tiers—floors and ceilings—which will be round discs of board 4 ft. in diameter, the best job will perhaps be made by screwing together at right angles two layers of ½ in. match-boarding. The disc for the top, it will be seen, is larger by 6 in. than the others, that it may give overhanging eaves.

In front of each cell we get a good space, 9 in. wide, for the birds to disport themselves, as they delight in doing; and each of these platforms is completely cut off from the rest, which, for the avoidance of quarrels between the cocks, is held to be an essential point. Our arrangement also places the entrance to each cell towards its end, not its middle, which is considered desirable, as giving privacy to the nest.

Having their bases on the disc of board which covers the top tier of boxes, and their perpendiculars against the pole, which is shaved level to receive them, we nail four triangular pieces of 1 in. board to serve as rafters for the metal roof. We give to these pieces a perpendicular height of 3 ft. It will be a good plan to fill the places between them and the metal covering with sawdust, which, being a non-conductor of heat, will tend to equalise the temperature of the cells.

The few pieces of rough wood used as rustic decoration are so plainly figured as to need no verbal description, but before they are fixed in place the planed work should receive a couple of coats of paint. In the interests of cleanliness it is recommended that the insides of the cells should be painted white; the outsides will look best coloured of such a brown as will go well with the bark of the rustic-work.

*The Metal Roof.*—It is proposed that this should be of zinc or sheet-iron. For my own part, I should prefer black (ungalvanised) iron, as on this paint will stand best. Setting out a conical roof is not a difficult matter. We strike a circle of which the radius equals the length of our rafters, or rather, what a rafter would be if they formed a complete cone instead of terminating at the side of the pole. Of the disc thus marked out we measure so much on the circumference as equals the length of our eaves, and from the ends of the portion measured draw lines to the centre. This gives us the piece of metal we require, except that we shall need a trifle more to lap over and nail down. In Fig. 4, drawn to a ½ in. scale, we have such a piece of metal as will be required for the roof before us. The dotted lines at *a* show the over-lap, which is nailed through the corresponding edges of the metal to one of the rafters; and at *b*, *b*, *b* are lines which show where the nails into the other three rafters will pass. At *c* is seen the size of the opening to admit the passage of the pole. Strong copper tacks are best for fixing on the metal cover, and if the latter is of zinc a better job will be made by soldering the joint. There is no reason why the covering should not be cut from two or four pieces of metal, if it is found more convenient to do so.

A good colour for the roof—one which will go well with the body of the dove-cot and rustic-work—will be a dark sage green.

## ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

*Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.*

### Rules for Engine Drivers and Boiler Attendants.

Firing the Boiler—Prevention of Smoke—Fire-Bars—Working Portable Engines, etc.—Working Traction Engines—Working Engines and Boilers in Frosty Weather—Blowing off or Emptying Steam Boiler—Cleaning Boiler—Engine and Boiler out of Use—Stopping Engine—Banking Fires for the Night—A Good Engine Driver and Boiler Attendant.

In continuing my subject I had better point out that Rules 1—18 have been laid down and explained in a previous paper, to be found in page 229, *et seq.*

19. *Firing the Boiler.*—Use good fuel if possible. Do not put coal on in large pieces, but break it to about the size of your fist. Do not put on a large quantity of fuel at one time, but fire little and often. If the fire burns unequally or into holes, level it and fill up the vacant spaces. If anything, the fire should be rather thinner in the centre than at the sides of the fire-box. Do not let the fire get low before a fresh supply of fuel is added; keep the furnace door closed unless there is a surplus of steam. Be careful in regulating the draught in the fire-box or furnace to suit the fuel being consumed. We recommend, wherever possible, the use of an automatic steam damper. A good supply of air promotes combustion, and tends to prevent smoke. In Cornish or Lancashire boilers, begin to charge the furnace at the bridge, and keep firing to within a few inches of the dead-plate. Excessive draught should be avoided, as the heat is carried rapidly away, and sufficient time is not given for the combustion of the various gases. Coke requires a more rapid draught than coak The flame of the fire should never come in direct contact with the boiler-plate above the water-line. The flame should never be allowed to impinge constantly on one spot, either above or below the water-line. The fire should never be collected in a heap in the middle of the grate, as it allows cold air to rise through the bars all round it and strike against the boiler-plates.

Keep ash-pit and fire-bars clean, and free from clinkers and ashes. Do not slack the ashes in the pit, but remove them at once. If it is necessary to use wood as fuel, it should be dry, and be reduced to pieces, say, 12 in. long. For, say, the last half-hour before finishing work, do not put any more fuel on the fire, and raise the water-level in the boiler, so that the boiler may cool down gradually. With some kind of coal it is necessary to clean the grate often, to prevent the fire becoming choked with clinkers, etc.; to clean the front part of the grate, push the fire well back, and use the slicer and clinker hook freely; to clean the back of the grate, bring the fire forward, and pull the clinkers over it. When this is finished, spread the fire evenly again, and put on a moderate supply of coal. The fire should not be allowed to burn too low before cleaning, or the steam pressure may drop considerably, or the fire go out. Before cleaning, see that there is a good supply of water in the boiler, and partly close the dampers whilst cleaning. Remember that scale in the boiler and choked tubes often render it necessary to force the fire to make up the loss accruing therefrom. Fire as rapidly as may be, and do not keep the furnace door open longer than is necessary. Whenever possible, the damper should be kept closed when the furnace door is open, and *vice versâ*. A bright, incandescent fire will reflect a bright light into the ash-pit. If the ash-pit is dark, there is probably an accumulation of ashes or clinkers that require moving. A good fireman will see that no useful cinders are thrown away with the ashes. If a forced draught is used, thicker fires than those already mentioned may be employed, but care should be taken that a forced draught is not used when the grate is partially uncovered, or leaky tubes or seams will soon be the result.

20. *Prevention of Smoke.*—The prevention of smoke is very largely a matter of careful, regular, and even firing, and the admission of exactly the right quantity of air into the fire-box. Furnaces constructed of ample area of cubic capacity will burn smoke better than those that are confined. A good supply of hot air admitted from the bridge of the furnace aids combustion. Use a furnace door through which the supply of air may be easily regulated, so as to spread, as it were, an even sheet of air over the surface of the fire. Alternate firing on each side of the furnace has a tendency to prevent smoke, but with most coals the author can recommend the following plan as a decidedly good and effective one for aiding combustion and preventing smoke. Supposing the fire to be in an incandescent state, and it is necessary to put on more fuel; instead of throwing the coal on in the usual way, push back the fire from the front part of the fire-grate on to that behind, nearer the bridge, leaving the front of the grate bare. Now charge the front part of the fire-box with fresh coal; this will gradually coke, and the various gases, etc., which form smoke will be liberated at a slow rate, and give time for the air passing up through the fire-bars to become heated and mingle with them, thus promoting tolerably perfect combustion. With this plan, with ordinary steam coal and tolerably open fire-bars, a sufficiency of air will pass up through the fire-bars in the front of the grate to consume the gases, and large volumes of smoke need never be made, as is the case when great quantities of fuel are thrown on to a hot fire. The reason of this is that in this latter case, owing to the incandescent fire acting quickly on the coals, the combustible gases or hydro-carbon are so rapidly released that there is not a sufficiency of air admitted to the fire-box and heated fast enough for it to combine with and consume the liberated gases; hence the production of free carbon or smoke. This coking system of firing should be performed at regular intervals, and only moderate supplies of fuel be put on at one time.*

In cases of urgency smoke may be "whitewashed" by turning the exhaust or a jet of steam into the base of the chimney-stack. Bear in mind, a blue flame shows imperfect, and a white one tolerably perfect combustion.

* "A Handbook for Steam Users." M. Powis Bale (Longmans & Co.).

21. *Fire-Bars.*—As the bars are burnt out, renew them; do not wait till the whole set is worn out. Allow a good current of air to enter through the ash-pit and fire-bars, for the latter may become over-heated—specially with some kinds of fuel—and burnt out. If the fire burns sluggish, it may be from insufficiency of draught, or the fire-bars may not be provided with sufficient air spaces, and these, getting choked, require constant attention to prevent the bars warping or burning. Keep the ash-pit and fire-bars clean and free from clinkers and ashes. Do not allow an accumulation of hot ashes in the ash-pan or pit, as they have a tendency to twist the fire-bars. In some cases, with coal given to form much clinkers, etc., rocking fire-bars may be used with advantage. Do not take more time than is necessary in cleaning bars, leave the damper open, and when the coal is pushed back, do not let a fierce fire impinge against one place in the fire-box for any length of time. Hard steam coal requires less air space between the bars than free flaming bituminous coal. Never throw water into a warm fire-box to loosen ashes or clinkers by contraction.

22. *Working Portable Engines, etc.*—In the case of portable engines, place the driving wheel exactly in a line with the pulley of the machine to be driven. Fix the smoke-box slightly higher than the fire-box end. Wedge up the wheels, and see that the engine does not rock in working. Always keep about 2 in. of water in the gauge-glass, and blow off occasionally through the glass to see that the ways are clear. Clean the boiler periodically right through, and if the water is bad, remove the hand-hole in the fire-box, and carefully remove all sediment over the fire. An accumulation of sediment is the chief reason for burnt boiler-plates. On finishing work, a great deal of scum and dirt may be got rid of by blowing off at a low pressure, if possible, when the engine is being removed to a fresh job.

23. *Working Traction Engines.*—As regards the working of traction engines, the rules given above will apply equally well to those as to most other types of engines and boilers; in addition, however, the driver of a traction engine should bear the following points in mind:—(1) Keep a good supply of water in the tank. (2) Disconnect the traction gear, and start the engine under a moderate head of steam—say, 25 lbs. pressure—to see that the pump and all the working parts are in order. (3) Carefully oil all bearings, and grease the teeth of the various wheels. (4) For travelling, get steam up to about 75 lbs. pressure. (5) When going down a hill, the gauge-glass should show 1 in. of water; when going up, about 4 in. (6) In going down hill, lock the hind wheels of any vehicle being drawn; use the reversing lever, both for shutting off steam and for checking the momentum of the engine, by admitting steam to the reverse side of the pistons.

24. *Working Engines and Boilers in Frosty Weather.*—When working in frosty weather, the following additional precautions are advisable:—(1) Close the tap between the boiler and the water-gauge glass when the boiler is stopped for the night, and let the water out of the glass. (2) Leave the cylinder-cocks open to drain off the condensed water, also the jacket-cocks if the cylinder is jacketed. (3) Examine the pump and valves and supply pipes carefully before starting work; if frozen, pour hot water on them till the ice is thoroughly melted. (4) In very frosty weather have the fly-wheel of the engine barred or turned round by hand a few times, in case of ice being in the cylinder. (5) Thoroughly warm the cylinder before starting; carefully try the different cocks, and pour hot water on them if stiff. (6) See to the cylinder and other lubrication. Kerosene mixed with oil will prevent it freezing. (7) Leave all drain-cocks in pipes, etc., open; the water in boiler may be prevented freezing by banking the fire.

25. *Blowing Off or Emptying Steam Boiler.*—If the boiler is emptied under pressure—a practice I do not usually recommend—the pressure should not exceed, say, 10 lbs. per square inch. It is better to let the damper be open and blow off through the safety-valve, at the same time adding fresh cold water to mix with that in boiler if early cooling is necessary. On no account throw cold water on hot plates. The cooling should be gradual and general; it is better not to let the water out of the boiler till the boiler-plates and boiler-seatings are cool. Never admit cold water when the boiler is empty and warm. One disadvantage of blowing off under pressure is that the boiler-plates and brick-work, being left hot, have a tendency to harden any scale or incrustation that may be adhering to them. Before removing man-hole or other covers, lift the safety-valve, and make sure that there is no steam in the boiler; neglect of this precaution has caused accidents.

26. *Cleaning the Boiler.*—To clean the boiler, remove all the covers of the man-holes; scrape, or, if there is much hard incrustation, chip the interior surface, thoroughly loosening and removing all sediment and dirt. Pass a quantity of clean water through the man-hole. Examine and clean all feed-water and other pipes periodically; remove and scrape fusible plug, and renew if necessary. Keep all flues or tubes thoroughly clean and free from soot, etc. Examine all cocks and fittings, and see that they are in order and free from leakage. Examine the flues, and see that the boiler-seatings are dry, and that there is no leakage either from the seams or from the roof. Tubular boiler tubes should be swept once a day, or twice if the fuel be bad. This can be readily done with a jet of steam.

27. *Engine and Boiler out of Use.*—When a boiler is out of use for a time, it should be entirely emptied of water, carefully dried, and painted with an oxide paint inside and out. Several boxes of quicklime for absorbing moisture should be put inside the boiler, and if on inspection it is found much slaked, it should be renewed. Coat the bright parts of the engine with a mixture of white lead and boiled tallow: say, 2 lbs. of the former and 6 lbs. of the latter; or, if preferred, a mixture of boiled oil and turps may be used.

If an engine has been standing some time, it should be thoroughly overhauled and cleaned over with paraffin to remove dirt, and well lubricated. Before starting, the engine should be well blown through with steam to warm the cylinder and try the joints, which may require renewing.

28. *Stopping Engine.*—In stopping the engine, turn off the steam gradually, and not suddenly, as this latter practice has been known to start joints or split pipes from the shock arising from the sudden stoppage of the flow of steam. Unless a barring engine is used, care should be taken that large engines are allowed to stop on the dead-centre, or they will give considerable trouble in being levered round by hand. Large establishments should be so arranged that instant communication can—in case of accident—be made with the engine driver. An electrical apparatus is now in use by which the engine can be instantly stopped from any desired point.

29. *Banking Fires for the Night.*—Although there is some little danger attached to the practice of banking fires, in a series of boilers it saves a great amount of trouble, and is generally resorted to. The following precautions should, however, be observed: (1) Put the safety-valves to blow off at a low pressure—say, 10 lbs. (2) Leave the furnace doors open. (3) Close the dampers and ash-pan lids or ash-pit doors. (4) See that each boiler has a full supply of water and the float is in order.

A good plan in banking is to partly clear the front of the fire-bars and push the fire into a gradual bank at the back, making it as solid and free from air spaces as may be; then cover with wet ashes and coal-dust mixed, to a depth of, say, 6 in. Arrange the admission of air so that there is just sufficient to keep the fire alight, and nothing more. It may be added that judicious banking of a fire is less injurious to a boiler than the constant lighting up and drawing the fire out, as the extremes of expansion and contraction are done away with. It is somewhat difficult and risky to attempt to bank fires in tubular boilers.

30. *A Good Engine Driver and Boiler Attendant.*—The greatest factor in the making of a clever engine driver and boiler attendant is regularity. A good man will keep up an even and regular supply of fire, water, and steam the whole day through, whilst a careless or inefficient man will have steam blowing off one hour and a pressure barely sufficient for the work the next. An incompetent attendant is dear at any price. To test accurately the performance of the engine under his charge, the skilled engine driver should be capable of working the indicator and taking diagrams; this work, however, I am afraid at present is relegated to those higher in authority, but there is no reason why a fairly-educated man should not do it, as several plain and practical treatises are published on the subject.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Lacing—A Shuttle—Splicing—Cutting Up.

"Lacing" is the technical term used by wire-workers for the operation of securing wires to each other continuously at their various junctions. Mr. Frank Hinds, in Work, Vol. II., No. 54, page 22, shows in a very distinct manner a method of thus binding the different wires, and I will ask my readers to refer to his article upon Bird-cages in the number alluded to above, as affording additional explanation to the few remarks I am about to make.

In beginning to lace a certain part of any work, the end of the binding or lacing wire should be tied in place, if there is no possibility of otherwise fastening it to obtain the necessary security. The work is generally proceeded with from left to right if the work is horizontal, and from bottom to top if vertical.

In Fig. 53 it is supposed that the lacing wire is bent as shown in Fig. 46 (page 244); and if the reader will imagine that he can see through what is intended to represent the straight wires in Fig. 51, the parts indicated A, A, in Fig. 53 would be behind those

wires; while those marked B, B would be in front.

When lacing, the travelling end of the lacing wire is put through the second mesh, on the left-hand side, above the cross-wire, brought diagonally behind the first junction, under the bottom of the cross-wire, and out of the first mesh underneath the cross-wire; proceeding in this manner all along, by next putting the wire through the third top mesh, and out through the second lower mesh, then through the fourth and out through the third, and so on. A double stitch or lace is that shown in Figs. 54 and 55. Where there are several cross-wires to be bound, it is the usual practice to lace the first from left to right; the second, from right to left; the third, from left to right, as the first; and continue in this manner until the completion, the tendency of this being to keep the work together in a better manner.

Mr. Hinds, in his article on Bird-cages, shows a shuttle, but does not go to any length in speaking about it. Perhaps a few remarks here will prove serviceable. These articles are generally made of bone or ivory, but I see no reason why a workman should not make one in wood for his use. A and B, Fig. 57, are two pieces shaped as in plan, Fig. 56, and, with the ends (when the various pieces are finally fixed), nearly touching each other. In the middle, between the two, will be a turned piece (C, Fig. 56) screwed in place from outside the last-mentioned pieces. The wire, as perhaps can be comprehended, is wound around the cylindrical portion of the shuttle, as is cotton around a reel. By its means the hand can firmly pull the lacing wire into position, and no inconvenience is created by the wire dangling about, as would be the case without the aid of it or something similar. As the lacing progresses, the wire can be gradually unwound from the shuttle. Of course, it must be comparatively thin in construction to permit it to enter fine meshes.

I feel rather dubious as to whether I shall satisfactorily explain the operation of splicing. The term is associated with the unison of two opposite ends of a piece of work, thereby forming a compact cylindrical

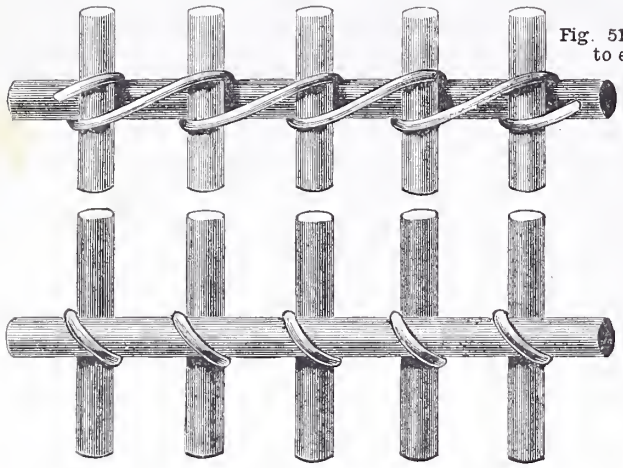


Fig. 51.—Wires laced to each other.

Fig. 52.—Back View of Fig. 51.

Fig. 53.—Lacing Wire in Fig. 51, with thick Wires removed.

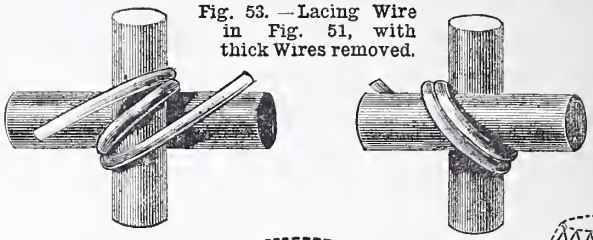


Fig. 54.—Double Stitch in Lacing (Front View).

Fig. 55.—Double Stitch in Lacing (Back View).

Fig. 61.

Fig. 62.

Fig. 63.

Figs. 61, 62, 63.—Various Forms to which Wires shown in Fig. 60 can be easily bent.

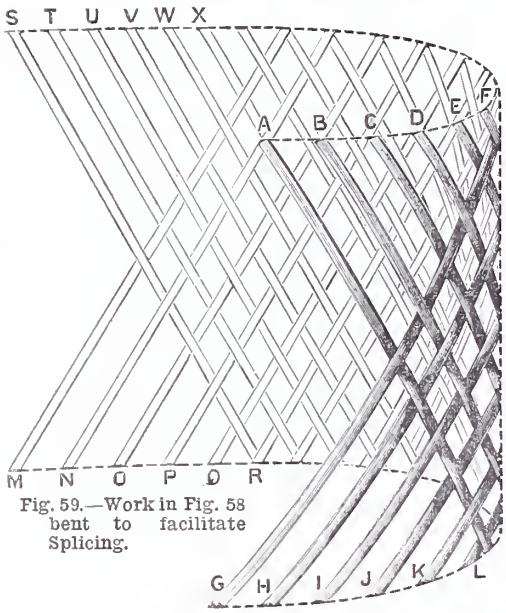



Fig. 59.—Work in Fig. 58 bent to facilitate Splicing.

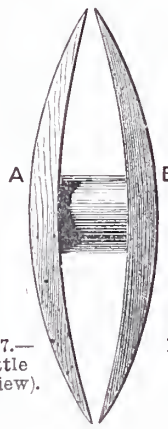



Fig. 57.—Shuttle (Side View).

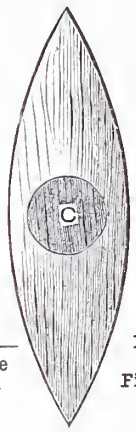



Fig. 56.—Shuttle (Plan).

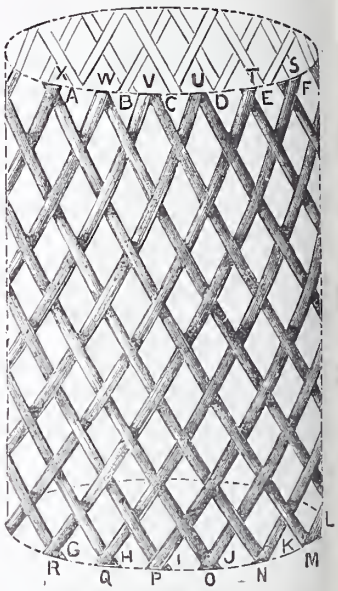
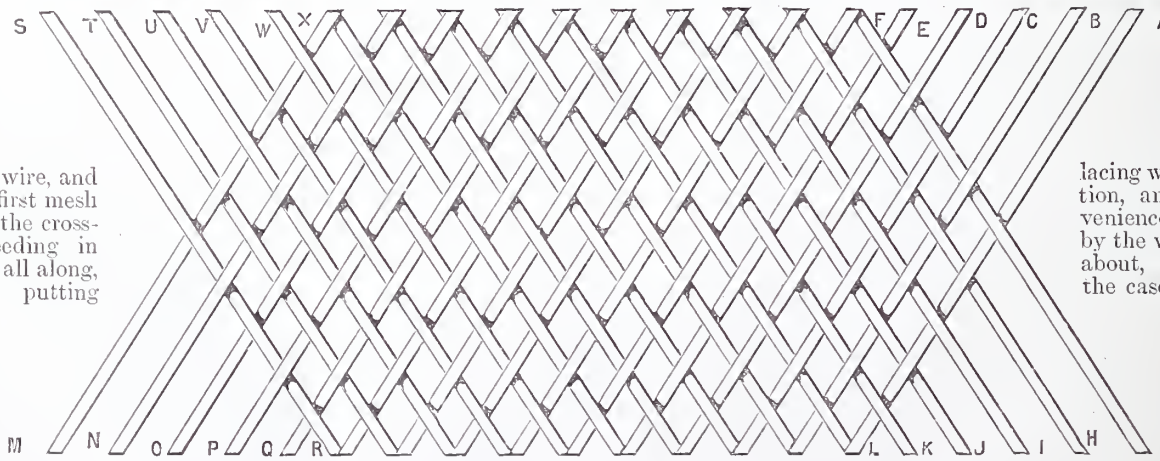



Fig. 60.—Work in Fig. 58 completely Spliced.

Fig. 58.—Piece of Work ready to be Spliced.



object. I must say that the performance, or the attempt at such, is very provocative of tantalisation, as I have personally experienced; for, although I am not a wire-worker, I have a desire to understand as thoroughly as possible what I am striving to convey to my readers, and, with this object, experiment, as well as circumstances will allow, after I have received practical suition from my practical friend.

In Fig. 58 is shown a piece of work supposed to be quite flat. To splice it, it would be bent as in Fig. 59, in order to bring both ends of it in contact with each other. In these diagrams I have lettered the wires that will be spliced. The two ends are brought closely together, when, if found to be too "springy," they could be held in position by having a wire twisted around them bodily. It would then be seen that the free portions of the wires A, B, C, D, E, F would be parallel with the free portions of G, H, I, J, K, L; and those of M, N, O, P, Q, R parallel with S, T, U, V, W, X—thus presenting a continuous and endless series of diamonds completely around the piece of work.

At this point the free portion of the wire A would be slipped under S, over T, under U, over V, and so on. Then the free portion of G, which will then occupy less length, should be slipped under B, over C, and so on. The free end, B, would be the next to be spliced, then T, by following which order the wires can be spliced to the same meshes as those first obtained by putting the wires together as in Fig. 53. The wires M, N, O, P, Q, R would be spliced in a similar but reverse manner to those of which I have just been speaking. Wire M would pass over G, under H, etc., as the other wires did in connection with their companions. When spliced, every mesh should be of the same size, and the wires should cross, each one over and under its fellows, in such a manner that it would be impossible for anyone to detect their junctions.

A piece of work so spliced would be capable of being bent to various forms without losing its strength. It will be found an impossible matter for anyone to pull apart a piece of spliced work without undoing the different wires; mere pulling affects nothing—*i.e.*, except to widen the work. Wire baskets, of which the bottoms are smaller than the tops; gas globes (one particular pattern), of which the middles are considerably wider in diameter than the tops and bottoms; and several other articles, are formed from spliced work which is at first of the same diameter at the top as at the bottom.

Of this I shall speak more fully when I arrive at the descriptions of the various articles alluded to; but to give an idea of the manner in which a piece of spliced work can be bent, I will say that the forms shown in Figs. 61, 62, and 63 are various shapes to which the work shown in Fig. 60 (drawn to much smaller scale, however, in the other diagrams) may be bent or pulled. Each piece would contain the same number of wires of precisely the same length and gauge as the others. No weakening takes place by thus forming the work to these shapes. Perhaps I ought to mention that when the wire is spliced as in Fig. 60 it has a tendency to bend inwards towards the middle, instead of being quite perpendicular all round, as it would be supposed from my diagrams.

For the purpose of cutting wire, the shears are utilised. If a number of wires of one length are required, such as for putting together, etc., they are not cut up one by one, but the wire is drawn from the coil for a distance as far as the shop will permit, and each of these lengths cut off from the remainder, until several are ready, when they, in a bundle as it were, are again divided together into the smaller necessary lengths.

On such occasions as these, it will be found best—indeed, I might say absolutely necessary—to fix the shears in a vice. One only of the handles of the former will be secured in this manner, leaving the remaining handle for the operator to use.

Of course, for cutting short work of only a few wires each time, the use of the hand shears will be quite sufficient.

## A NOVEL COMBINATION PENHOLDER.

BY W. R. R.

INTRODUCTION—PENHOLDER—CORK—INKING PAD—RULING WHEEL AND ATTACHMENT—DESIGNS FOR WHEEL—INK—DESIGNS.

*Introduction.—Multum in parvo* (much in little) is the demand of the utilitarians of the present age. A person requires a pocket-knife, and at the same time remembers he may some day also require a corkscrew, a glass-cutter, a file, a pair of tweezers, a saw, or even a magnet, which latter article is very useful for removing iron specks from the eye. So, for a little extra outlay, he purchases this miniature tool-chest in the form of a "Combination Pocket-knife."

Now, I propose to benefit the wielders of that instrument which "is mightier than the sword" by describing how to make a "Combination Penholder," hoping that it will prove acceptable and be a real boon, from the humblest student, struggling tediously to insert a neat mountain range in his examination map test, to the finished draughtsman engaged in "lining in" his mechanical drawings.

*Penholder.*—Having procured an ordinary wooden penholder and a piece (or pieces) of cork, proceed to shape the cork with a razor or keen-edged knife, as shown at *a*, Fig. 1. If a cork-borer (which is only a bit of tubing sharpened) is not come-at-able, the cork may be split in halves and hollowed out to fit the holder, and then fixed with glue. Some persons may object to this apparently clumsy innovation to the holder, but I can assure anyone who is troubled with writer's cramp that they have here a considerable relief, if not a perfect cure, for that disease of the nerves.

*Inking Pad.*—The next step is the construction of the inking pad for the ruling wheel, *b*, Fig. 1. This consists of a small piece of wood shaped as in Fig. 4, on which is glued a small cotton-wool cushion covered with silk. The pad is held in position by a ring of stout sheet brass and small spiral spring of wire, *c*, Fig. 1. The width of the pad ought not to exceed the diameter of the holder, or else some difficulty will be experienced in holding the pen in position against the edge of the ruler.

We now come to the most important part of the attachment—viz., the ruling wheel, *d*, Fig. 1.

*Ruling Wheel and Attachment.*—The shoulder for holding the wheel and attaching it to the penholder may be cut out of sheet brass or other suitable metal. Draw the pattern on the sheet brass with a needle-point or scriber same as Fig. 2. Cut out and shape on rod of iron same diameter as penholder. The shoulder will now resemble a pencil-point protector.

The ruling wheel itself now claims our attention. It may be made of wood or metal, and the desired pattern engraved upon it, but the most preferable wheel is one with a wooden body and indiarubber tyre, on which the design is cast. The indiarubber type-founding firms would doubtless cast a few strips of designs to order, from which suitable lengths could be cut and glued on to the wheel. Of course, for different designs a different wheel must be employed in the shoulder.

*Ink.*—Coloured ink suitable for using on the pad is made from aniline dye dissolved in spirits of wine, and can be made to dry with a glossy surface by the addition of a few drops of liquid gum arabic. Be careful,

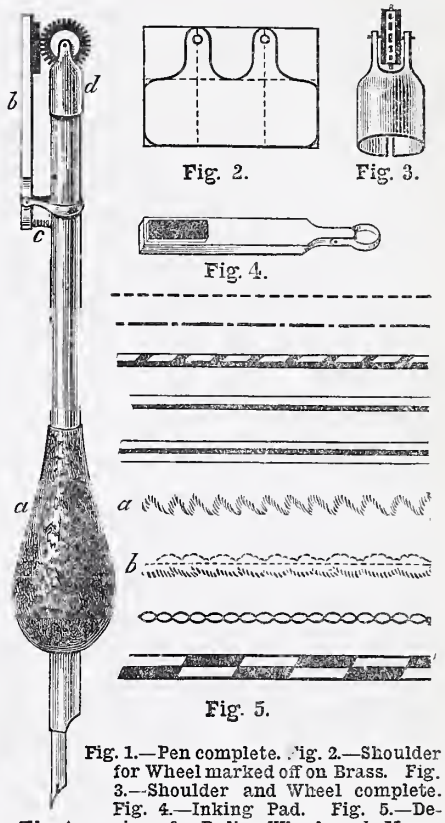



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



Fig. 5.

**Fig. 1.—Pen complete. Fig. 2.—Shoulder for Wheel marked off on Brass. Fig. 3.—Shoulder and Wheel complete. Fig. 4.—Inking Pad. Fig. 5.—Designs for Ruling Wheel—*a*, *b*, Mountain Ranges for Map Drawing.**

however, not to wet the pad too much; a moist surface is all that is required.

*Designs.*—The designs shown in Fig. 5 are merely suggestive of the kind of work which can be turned off by aid of the *novel penholder*.

## FRENCH POLISHING: SPIRITING OFF.

BY DAVID DENNING.

NECESSITY FOR SPIRITING OFF—CLOSE CONNECTION OF BODYING IN AND SPIRITING OFF—SPIRITING OFF DEFINED—PRELIMINARY PROCESS—SPIRITING OFF PROPER—APPEARANCE OF GLOSS—FINAL TOUCHES—HINTS TO INQUIRERS IN "SHOP."

THE final operation in French polishing is known as "spiriting," or "spiriting off." By it the gloss, or shine, is put on the body previously applied, as directed in a former article. Rubber marks and smears of all kinds are removed, and the beautifully finished surface, which is known as a French polished one, should be the result. If bodying is important so far as durability is concerned, spiriting is more so with regard to finish, or fine bright gloss. However

well the rest of the work may be done, if the worker fails in spiriting, his previous efforts will, to a great extent, have been in vain. So far as mere polishing goes, and not alluding to staining, darkening, and other processes, with which a good polisher should be acquainted, the spiriting is perhaps the most severe test of skill. If a man can manage this part of his work really well, he may fairly be considered a competent polisher. To tell how to do spiriting off is a comparatively easy matter, but no amount of explanation will make anyone an adept at spiriting, for there is a knack in it which can only be acquired by painstaking practice. From this it may be gathered that the novice must not be disappointed if his early efforts meet with only partial success; or, to put it more strongly, it would be unreasonable for him to expect that, however closely he may follow ample and reliable directions, he will be able, without practice, to polish thoroughly. Perfection in polishing cannot be attained at once, so, while doing his best, it is no use for the beginner to fancy that he ought to be able right off to do what it takes years for professional polishers to learn.

I hardly know whether the first operation to be described in the present article should not rather have been included in the article on bodying in, for it partakes at least as much of that as of spiriting. It is not, however, of much consequence where it is placed, because at the beginning it is bodying and at the end spiriting. Perhaps I may be better understood by saying that the two processes, bodying and spiriting, merge into each other—there is no abrupt break, as between filling and bodying; hence the difficulty of precisely locating the work now under consideration in its proper chapter. One way out of the difficulty would have been to treat both in the same, and another to consider them all as included under a general heading of polishing. The two operations of bodying and spiriting are, however, so well defined—except for the intermediate stage—both in character and purpose, that to have done so would have been to mar the pages of Work, which is singularly free from technical errors. I may also say that what I have called the intermediate stage is not always practised, but the very fact of its being mentioned as part of the course of polishing shows that it is, at any rate, recommended when good work is wanted.

Perhaps a definition of what spiriting off is may help to make the operation clear. Briefly, it consists in washing the bodied surface with methylated spirit alone. This being understood, it is only necessary to say that the final bodying up, or first spiriting, whichever it may be called, consists in gradually reducing the quantity of polish in the rubber, and supplying its place with spirit. In other words, the polish is gradually reduced by the addition of spirit till all the polish has been worked out of the rubber. Thus the rubber may be moisteued, first with three parts polish and one part spirit instead of pure spirit; next time equal quantities; the third time three parts spirit and one part polish; while the fourth charging will be with spirit only. Of course, I do not mean to imply that these proportions must be, or in practice are, observed, but the explanation will illustrate the process more clearly than vague general description, so that I hope no one can misunderstand what is intended. At the last the rubber will be almost free from polish, and, as previously, it should be worked till it is dry, or as nearly so as possible.

When this stage has been reached the spiriting proper may begin, and a fresh rubber should be used for this purpose. It need not be a new one, but it should be one which has only been used for spiriting, and should have no polish on it. Instead of having only one covering of rag on its face, it will be better if it has three or four, which can be removed as they dry. If only one cover is used the spirit is apt to evaporate more quickly than there is any occasion for.

Now it will easily be understood that the spirit in the rubber partially dissolves the shellae or body on the wood, or at least that its tendency is to do so. That it does to a very limited extent is undoubted, unless the rubber is made too wet, when there is a danger of not only spiriting and smoothing the surface, but of actually washing away the body. This, of course, would be about as awkward a mishap as could occur, and it must be carefully guarded against. There should be enough spirit just to allow the surface of the body to be softened and smoothed, but no more, and it is almost unnecessary to say that the rubbing should be equal, and not more in one place than in another. As there is hardly any likelihood of the novice erring by using too little spirit, I may venture to say that the less of it the better in the rubber at a time. The rubbing should be gentle at first, becoming harder as the spirit dries off, and, of course, oil must not be used on the rubber face as when bodying. If there is any oil either on the rubber or on the work, the polish cannot be brought up.

If everything has been done correctly the gloss will soon begin to appear, and when it seems as good as it can be got, or is approaching that condition, the rubber ought only to be moved in the direction of the grain, and not across it or with circular motion. The final touches should be given with the soft rubber rag alone, the utmost care being taken not to scratch the surface, which is now softened by the action of the spirit. It will gradually harden, but for a time it should be handled with care, and nothing be allowed to come in contact with it, or it is very likely to be marked. It should also be protected from dust, for any settling on it may be retained by the polish, the lustre of which would certainly suffer.

Now, besides amateurs and novices, this article will no doubt be read by many cabinet-makers, of whom some, no doubt, will be masters, and perhaps dealers in furniture. Those who cannot keep an experienced polisher, or who, being in country places, may not be able to get the work done "out," will, I hope, derive some advantage from a perusal of these articles, to which I would now like to add a word of advice for their special benefit. It is that, circumstances permitting, any polished piece of furniture should be "wiped over" with a spirit rubber an hour or two before it is sent home, just to freshen it up; and if the surface is at all soft, neither packing mats, nor anything else likely to injure it, should be allowed to come in contact with it. The polishing on many things sent from London to the provinces is often not fit to be seen—from mat and other markings—till it has been "touched up" after arrival at its destination.

Notwithstanding all that has been said, it is quite likely that the useful, and almost overburdened, "Shop" columns may have further claims on them by someone asking how a particular kind of wood is to be polished; therefore, let me say that the directions for filling, bodying, and spiriting refer to all sorts; and that anyone finding himself in a difficulty must not merely say that he "can't manage" to polish, or that something is wrong in a general way, but must state as fully as he can exactly what he has done, and what is unsatisfactory in the result, if he wishes either me or any other member of the staff of Work to help him. Vague statements that the polish "did not look nice," or something of that kind, give no grounds to form an opinion on, and as no trouble is spared in answering replies, it is only fair that inquirers should help by making their statements as full and explicit as possible if they wish for advice. These remarks apply specially to the subject I have in hand, viz., polishing, but are more or less applicable to all.

In future papers, staining and other processes which are incidental to the polisher's craft will be fully discussed, and the next one will be on an easier method of finishing than by spiriting off—though, I warn readers, not so good a one—viz., the process known, among other names, as that of "glazing."

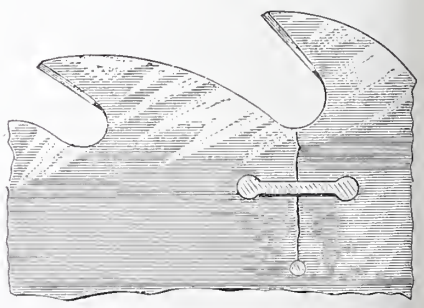
## HOW TO REPAIR A CRACKED CIRCULAR SAW.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

*Author of "Saw Mills: their Arrangement and Management," etc.*

Cracks in circular saws may arise from a variety of causes, such as too hard a temper, striking a nail, saw bending in work, improper shape or size of the tooth for the wood being cut, etc.

Teeth with angular gullets are more liable to crack at the roots than those with rounded gullets, more especially if the gullets are not sufficiently large and deep to allow of a ready escape for the sawdust. If the crack is only a short one—say two or three inches in large saws—it may usually be stopped from extending by drilling a small hole at the extremity of the crack. To do this, a drill of the hardest possible temper will be required, and for this we have found Mushat's special steel suitable.



Mode of mending Crack in Circular Saw.

The drill must be run very slowly and be well lubricated. The hole should be slightly countersunk on either side. For saws up to 3 ft. diameter a hole of about ¼ in. diameter will generally be suitable; with saws above 3 ft. diameter about a ⅜ in. hole.

The illustration represents a portion of a saw showing a crack with a stop-hole drilled at its extremity, and with a yoke fitted across the crack. The stop-hole in this case is carefully plugged up. The yoke is made by drilling two holes, one at either end of the yoke, and by drilling and cutting away the

intermediate metal, as shown in the sketch. The opening should be countersunk, and a piece of steel plate carefully fitted and riveted into the place. The yoke must now be ground down until it is of exactly the same gauge as the rest of the saw and perfectly smooth, so that when the saw is set to work there should not be undue friction at this point. If the saw is a large one, and the fracture extensive, two yokes will probably be required.

## INTERNAL SANITARY FITTINGS OF HOUSES.

BY W. R.

### WATER-CLOSETS.

IMPROVED "BRAMAH VALVE" CLOSET—THE PAN CLOSET—WASH-DOWN CLOSETS—WASH-OUT CLOSETS — PEDESTAL WATER - CLOSETS — ARRANGEMENT OF SEAT.

*Various Forms of Water-Closets.*—One of the most important articles in a house, from a sanitary point of view, is the water-closet, and therefore I will give it precedence in this paper.

The water-closets usually fixed by plumbers during the last generation were the "Bramah Valve" and the "Pan" Closets. The former was invented by John Bramah about one hundred years ago, and has proved, when properly constructed and fixed, a most efficient machine.

*The Improved "Bramah Valve" Closet.*—Many improvements have been made upon the "Bramah Valve" closet, and Fig. 1 represents a pattern which may be relied on. The pan is a large one, and is connected to a small valve-box by means of a gun-metal flange; to this flange is attached a valve, about 3½ in. or 4 in. in diameter, which, when closed, presses tightly against an indiarubber ring sunk in the flange, thus forming a tight joint, and retaining a certain amount of water in the basin. Fig. 2 shows the action of the valve. When the handle is raised, it lifts a lever, which works the tumbler and throws back the valve; at the same time another lever connected to the stool-cock is raised, and, by opening the cock, allows the water to enter the pan. The closet is flushed by means of a 1¼ in. or 1 in. lead pipe (the size depends upon the head of water available), which enters the back of the pan, the water being distributed over the basin either by a copper fan or a flushing rim.

*The Flush.*—The flush may be supplied either by a cistern or by a constant head of water. In the former case the stool-cock and regulator, shown in Fig. 1, are not needed, the water being sent down into the closet by lifting a round valve in the cistern by an arrangement of cranks and wires working from the handle to the cistern; the after-flush or water to be retained in the pan being supplied by the water contained in the pipe after the valve in the cistern is closed. Flushing and syphon tanks are not suitable for this class of water-closet.

When a constant pressure of water is in the service-pipe, the stool-cock has to be used; and to obtain a proper after-flush, a regulator—such as may be seen at A, Fig. 1—is fixed so as to allow the lever attached to the stool-cock to regain its place slowly, the amount of time it takes to do so, and therefore the amount of water in the pan, being regulated by a small cock at the top. The regulator should be lubricated with glycerine. An overflow pipe is formed in the side of the pan, and is connected to the valve-box at the *back* of the valve by a 1½ in. lead **P** trap, as may be seen at Fig. 2. If the overflow enters in front of the valve, there is great danger of its becoming choked by the discharges from the pan. The flush should be so scattered over the pan as to send a certain amount of water through the overflow every time.

*Ventilation.*—Of very great importance is the ventilation of the valve-box for getting rid of the foul gas which is sure to collect between the water-seal of the trap and the valve, and also to prevent the syphoning out of the overflow trap.

A 1½ in. lead pipe should be carried from the valve-box at a sharp rise to the external air, and left open.

*Trap.*—The best trap to use under this closet is a 4 in. drawn lead **P** or **S** trap as may be required, taking care to thoroughly ventilate it.

*The Pan Closet.*—This wretched contrivance, shown at Figs. 3 and 4, has been most extensively fixed in the past, and is still being fixed by some benighted tradesmen, especially in rural districts. The only advantage which it can possess, to my knowledge, is a clean pan, and that is but outwardly, for anyone who has taken one apart after it has been in use some time, can testify to its disgusting uncleanliness.

The earthenware pan is set on an iron container of large dimensions, in which works a copper bowl or pan (from which the closet derives its name), moved by a lever in a similar manner to the valve-closet. Fig. 3 shows a section of the apparatus with the pan open. The service-pipe enters at the back, and is usually a ¾ in. lead pipe, which is, of course, much too small for the flushing it has to do. When the closet is used and the handle raised, the copper pan is thrown back, and the contents are precipitated into the iron container beneath, and thence into the trap, splashing all over the interior, and rendering it very foul in a short time. Very seldom do we find this container ventilated; and if it is, it is generally by means of a small hole in the top of it, open to the air of the apartment. Thus, at every flush the air which has been in contact with this foul interior of the container for some time is forced out into the room. To make matters worse, this defective appliance is usually accompanied by a lead **D** trap fixed under it. Under no circumstances should these closets be used.

*Wash-down Closets.*—Far cheaper and better than the Pan closets are the earthenware closets, which have become so generally used of late years. These closets are simple to fix, and, as they possess no working parts, are not liable to get out of order. Figs. 5 and 7 show two patterns of these closets, and Figs. 6 and 8 sections of the same, and most all others are modifications of these.

Fig. 5 is a wash-down, and may be considered as merely a trap with the mouth enlarged to form a pan. The back is made almost vertical, so that soil shall not be so liable to touch it, but fall straight into the trap.

This, however, does not always happen; and when it falls on the dry pan, it stays there, and defies the hardest flushing to thoroughly remove it. This is the one disadvantage of this pattern, but it may be overcome by flushing before using the appliance.

*The Flush.*—The service-pipe, which enters the back of the pan, should not be less than 1¼ in. in diameter, and should have at least 6 feet head of water, and be free from sharp bends.

A small stream of water is let into the pan by a little hole below the flushing rim, which falls on the paper in the pan, damps it, and sends it down to be carried off by the heavy flush. Flushing and syphon cisterns are very suitable for use with this pattern water-closet.

*Wash-out Closets.*—Fig. 7 is a wash-out pattern, and by its construction always holds a certain amount of water in the pan, as may be seen in the section, Fig. 8, thus preventing the pan from becoming foul.

*The Flush.*—The disadvantage of this pattern is that the two gallons of water which are allowed by the various water companies for each flush of a water-closet is not sufficient to thoroughly carry all soil, etc., through the trap, and thus a source of bad smells and probable stoppage may arise. With three gallons or more the case is different. The flush first strikes the water in the pan and throws it out, and the latter part of the flush rushes over the pan in a sheet, possessing great cleansing power and carrying all before it.

This only occurs if the service-pipe is not less than 1¼ in. in diameter and has a good fall, and is properly brought into the pan without any sharp bends. An after-flush chamber is sometimes made in the back of the pan, into which a certain amount of water is carried by the flush, and finds its way gradually into the pan through a small hole, after the flush has ceased. This is necessary when a flushing or syphon tank is used, as the water passes through the pan with great velocity until nearly the last drop, thus leaving the pan and possibly the trap partly empty. If, however, a cistern with a round valve and service-box be used, the water which is in the pipe after the valve is closed is quite sufficient to refill the pan. Regarding this same round valve and service-box arrangement, some plumbers make egregious mistakes. They imagine that the larger the service-box and the larger the air-pipe attached thereto, the greater will be the flush. This is true if the valve be one of Bell's, and the service-box is full of water, for then, when the valve is raised, the pressure of the water in the cistern is removed from the service-box, and it is necessary to allow the pressure of the atmosphere to bear on the water in the service-box through the air-pipe, which should then be the same bore as the service-pipe.

*Service-Box Ventilation.*—When a round valve is used, the only use of the service-box is to connect the valve to the service-pipe, and, in fact, may be regarded as part of the pipe itself; and so, when an air-pipe is connected with it and the valve is raised, the rush of water to the pan is retarded and impeded by the air drawn through the air-pipe by the water. The only use of an air-pipe with this arrangement is to allow the water, with which the service-pipe is filled after the valve is closed, to dribble slowly out into the pan. A small piece of copper or lead pipe closed over the top, and then pricked with a very fine bradawl, will be found quite sufficient. I have done many a satisfactory job by removing the service-box and round valve, and, after making the bottom of the cistern good, wiping a 1½ in. spindle-valve, such as is used for a pump, directly on to the service-pipe, after having previously tapped the side of the body to receive a piece of ¼ in. copper pipe, which has been brought to the top of the cistern and treated as before described.

*Pedestal Water - Closets.*—Earthenware

water-closets are often made with the pan and trap combined in one piece, thus forming a kind of pedestal which will stand alone. No elaborate construction of woodwork is needed for these closets, but merely a hinged seat, the pan being left bare all round, thus affording no chance for unseen accumulations of dust or dirt. Fig. 9 shows the best method of fixing this class of water-closet. The floor may be of tiles, or covered with lead, so that it may be well and frequently washed. The flush is obtained from a syphon cistern overhead, which should contain three gallons of water, and the pan is provided with an after-flush chamber. The disadvantages attached to this closet are: the impossibility of getting at the trap without taking the whole closet down, and thus exposing the house to the dangers of drain air; and in order to make the outside symmetrical to the eye, the trap is often badly formed internally, and presents odd angles and sharp turns to the passage of the soil.

*Points in the Selection of a Water-Closet.* — Great care should be exercised in the selection of a water-closet, the following points being closely looked to:—If possessed of working parts, see that no more than possible of such parts are liable to contact with the soil, and see that the tumbler arrangement is properly fitted; see that the flush is so arranged as to scour (not merely wet) every part; see that a large service of water is exposed to receive the soil; and if a trap be attached, see that the same is well formed and self-cleansing. The joint of the water-closet to the trap in the case of a valve-closet may be made by good red-lead stopping, or by an indiarubber ring. In the earthenware closets the pan should be set on the trap in red-lead stopping, and the trap should be joined to the soil-pipe either by a bandage joint or by flanges, in the case of a P trap; and by an indiarubber flange or ring when an S trap is used. Brass screws should be used to fasten the appliance to the floor. The connection of the service-pipe to the inlet-arm of the pan is best made with a stout indiarubber socket or connector, shown in section at Fig. 10.

*Lead Safe.*—A lead safe or tray must be fixed under every water-closet to prevent damage to the ceiling below, or a mess about the apartment, in case of an accident —such as the service-pipe or stool-cock leaking, or the pan overflowing. This safe should be the entire size of the space under the closet seat, and at least 3 in. in height, and should be drained by a $1\frac{1}{2}$ in. lead pipe, taken straight through the external wall, so as to show when anything is wrong. The end may be covered by a hinged copper flap, to prevent a draught blowing into the apartment.

*Arrangement of Seat.*—This requires attention. The riser should be hinged at one side, so as to open like a door. The seat also should be hinged, so that it can be thrown back; thus the whole space can be easily and frequently got at and cleansed. No covering, flap, or other cover should be allowed, for this often causes a nuisance by bottling up a bad smell for the benefit of the next comer. Some may object to this by saying it looks bad, but if the water-closet is not clean, it is the fault either of the apparatus or of the users. If the former, change; if the latter, let them change their habits and be clean.

*Position.* — As regards the position of water-closet apartments in a house, they should always be built on an external wall, or, better still, in a separate wing or off-set. The windows should be made to open properly, and, in addition, thorough means of ventilation should be provided; an opening of 24 square inches for every 1,000 cubic feet of air space being provided for inlet, and a corresponding opening for outlet, both connected with the external air.

Thus, every means should be taken to render these very necessary appliances harmless to health, leaving it to the users to keep them in that state, remembering that "Cleanliness is next to Godliness."

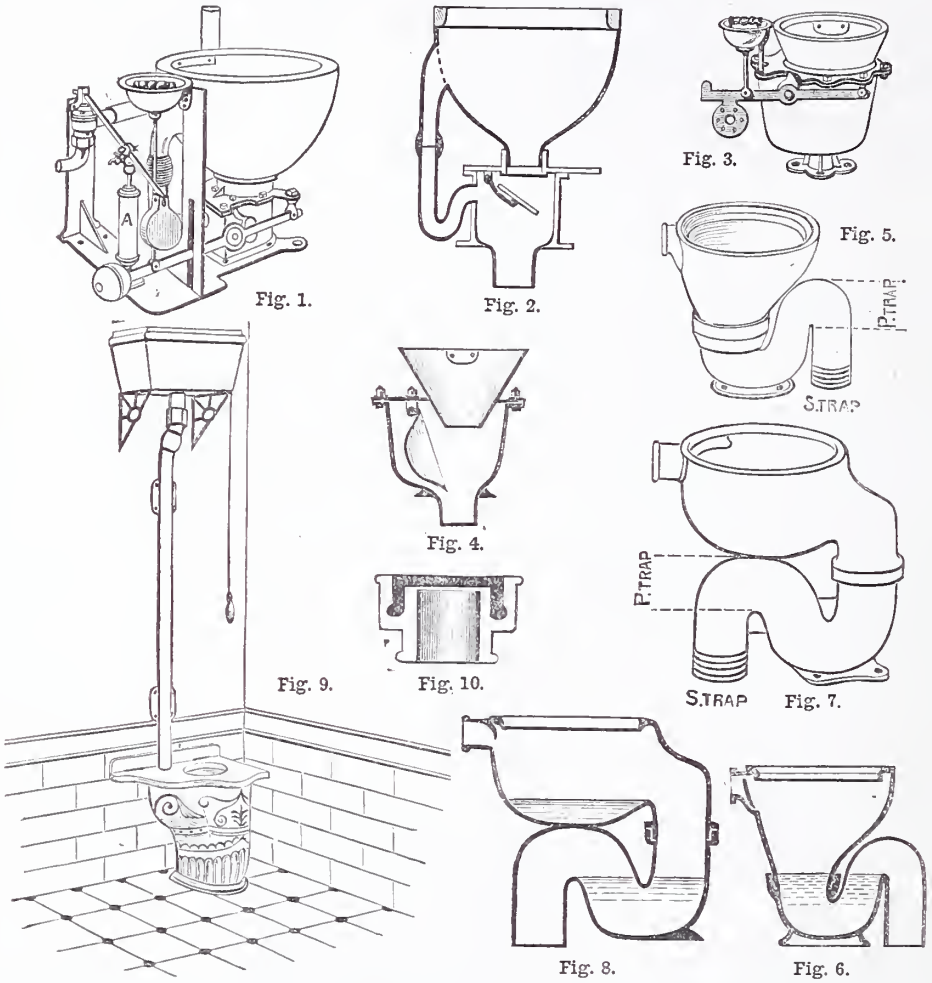



Fig. 1.—"Bramah Valve" Closet—A, Regulator. Fig. 2.—Section of ditto, showing Valve partly open. Fig. 3.—Pan Closet. Fig. 4.—Section of ditto, showing Pan thrown back. Fig. 5.—Wash-down Closet. Fig. 6.—Section of ditto. Fig. 7.—Wash-out Closet. Fig. 8.—Section of ditto. Fig. 9.—Method of fixing Combined Pan and Trap. Fig. 10.—Indiarubber Connector.

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

### Chalk Work on Stone.

Practising with Chalk—Pad—Point of Chalk—Corrections on Stone—Scraping Tint—Lightening Tint with Needle—Solid Ink Work—Middle Tints—Working Tint into Stone—Transfer of Chalk Work—Splash Work.

For practising with the chalk, rule some squares on a grained stone, the same as before, and get accustomed to the working of the chalk by drawing various tints, such as Figs. 24, 25, 26. A small box should be used to put the chalk cuttings into, and bits of the chalk which break off should never be allowed to remain on the stone, or they would settle on it and not be easily removed.

It is better to use a pad instead of the board as a hand-rest for chalk work, and the student will find he can very often sharpen the chalk on the paper by twirling it round from right to left, and left to right, instead of continually cutting a point.

The finer the point is made, the finer the tinting will be, and the first tint drawn on the stone always tells in the work, and is therefore of much more importance than any subsequent ones. In drawing the outline on the stone the point of the chalk can be used, but for all flat tinting it is much better to work on the side.

Should a mistake be made in the tint it would not be well to scrape it, as it would destroy the surface of the stone, and show a different texture in printing to the rest of the tint. Fig. 27 shows where a portion of the tint has been made too dark, and scraped away without due caution.

If in making a tint any small portion of the chalk dots appear darker than the rest, they may be sometimes removed by placing the point of the chalk on that spot and suddenly lifting it up, when the chalk will adhere, and come off the stone. In this way a tint may be considerably lightened, but should never be worked on again, and unless this is carefully done, white specks will appear; and, also, after any part of the tint has been scraped, no future work would print if drawn in the same place, either on a polished or grained stone.

It is best to use the point of the needle to lighten tints, in the same way as it is used for stipple work; and it will be naturally understood that a tint can always be made darker, but very seldom lighter, satisfactorily. In fact, lithography is an art where

mistakes should never occur, for they invariably show more or less.

Any solid or ink work should be done after the chalk is finished, in order not to smear the drawing, and if in colour work the ink is put on first, care should be taken not to lift it off with the chalk, especially where the solid and chalk join. Figs. 28, 29 show good and bad methods of joining solid to chalk work. A ball (Fig. 30) is also excellent practice for shading.

A good rule to be observed in chalk drawings is that middle tints should be drawn as they are required to appear when finished, light tints a little darker, as chalk work loses its strength in printing — especially in light tints — unless worked well into the stone, which will make it appear a little darker than it really is; and dark tints should be worked a trifle lighter than required, as they sometimes clog up in printing, and so print darker, or even solid.

In chalk work the tint must be always worked well into the stone, and not merely put on the surface, else the grain will not hold the chalk sufficiently to print. Figs. 31, 32 give examples of the same tint, or rather the same tint as it appeared before it was etched, only in Fig. 31 it was worked firmly into the stone, and in Fig. 32 it was merely put on the surface. Chalk does not stand so well in printing as stipple work—that is, not so many good impressions can be obtained from it—as the artificial grain given to the stone wears away the work quicker than a polished stone would do; and also chalk not being so strong as the liquid ink, it is more affected by the acid. In the same way in making corrections on a grained stone after it has been etched, the utmost

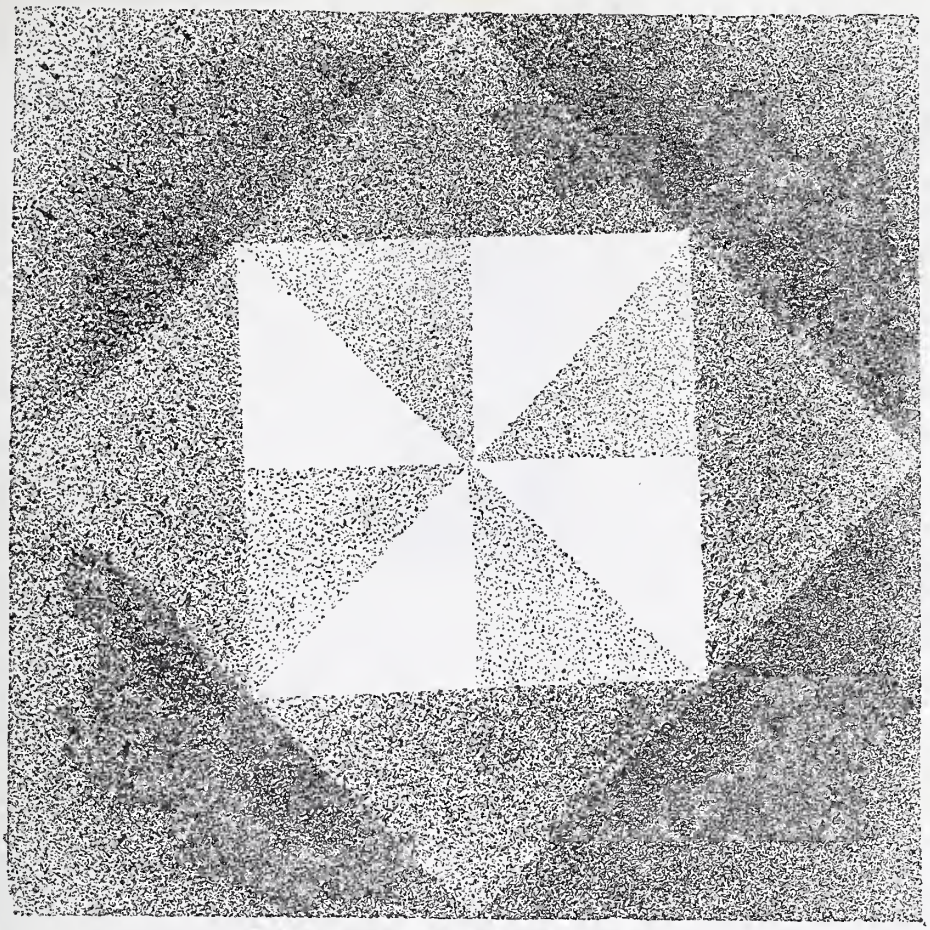


Fig. 33.—Specimen of Splash Work.

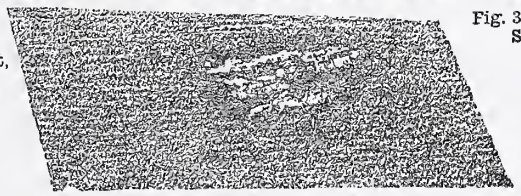


Fig. 27.—Chalk Tint, corrected badly.

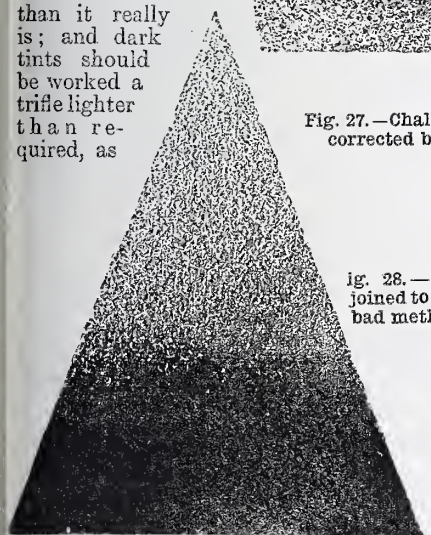


Fig. 28.—Chalk Tint joined to Solid Body: bad method.

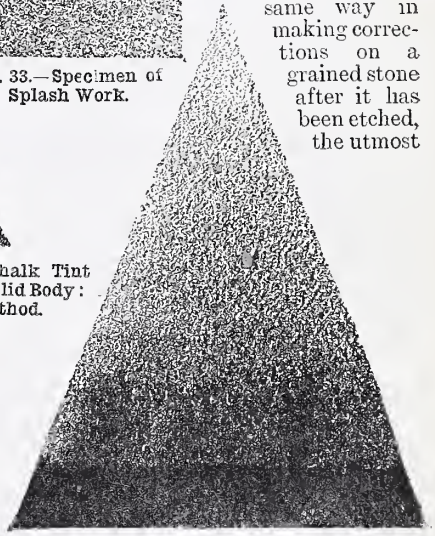


Fig. 29.—Chalk Tint joined to Solid Body: good method.

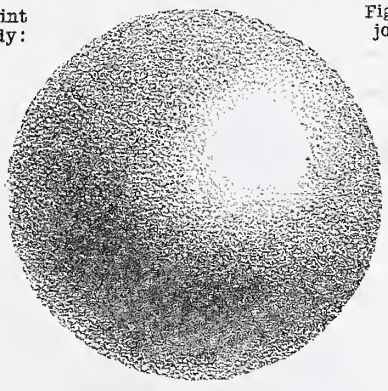


Fig. 30.—Ball shaded in Chalk.

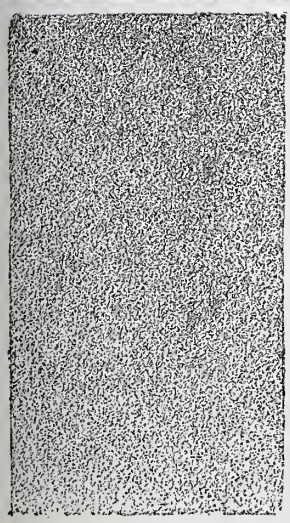


Fig. 31.—Example of Good Tint worked well into the Stone.

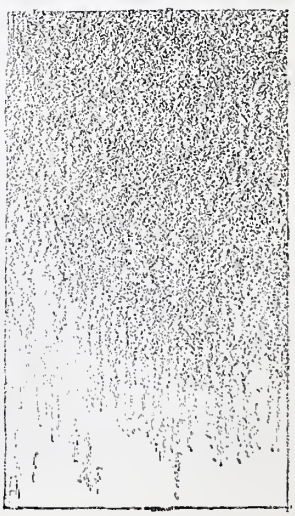


Fig. 32.—Result of same Tint as in Fig. 30, when only worked on Surface of Stone.

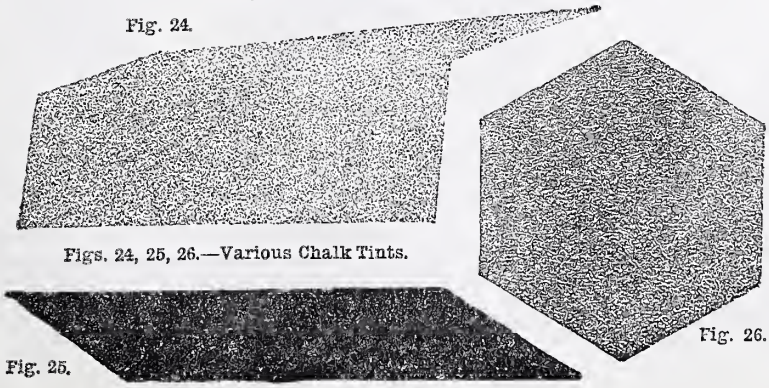


Fig. 24.

Figs. 24, 25, 26.—Various Chalk Tints.

Fig. 25.

Fig. 26.

care must be used, as if done in chalk it will not hold sufficiently to print, and therefore if a tint is required to be darkened it must be stippled with the pen, and that very judiciously for it to hold in printing. If the tint is required to be lightened it might be etched slightly with the acid; but it cannot be impressed too strongly upon the artist how carefully this must be done, else the tint will entirely disappear if too strongly etched, and may work up again if not etched sufficiently.

Chalk work is much more difficult to transfer than stipple, and is never done if a great number of good impressions are required. It is very good, however, for such work as bill posters, which could not be worked quickly enough in stipple, and also for artistic work, as it gives a softer effect; but for Christmas cards, almanacs, and work required to be transferred, stipple is the only satisfactory means of working.

Splash work (Fig. 33) is a very quick method of obtaining an even tint with very little trouble, and is very useful at times in giving a texture which cannot be obtained in any other way. It is done by having the stone flat, and gumming over that part where the tint is *not* required, or taking a sheet of paper having the outline of the tracing on it, then cutting out those parts where the tint *is* required, and laying it on the stone—it must be perfectly flat, and one or two lead buttons or pennies will keep it in position; it must not be lifted in any way or the ink will get underneath. Then fill a small tooth-brush with some ink, and, by holding another and rubbing the two brushes together, the ink will fall on the stone in dots. A small comb and brush—or a brush drawn across a penknife—would answer the same purpose. The closer the brush is held to the stone the nearer together the dots will fall, and the farther away the brush is held the larger the dots will become, and the coarser and more uneven the tint; also the more ink there is in the brush the coarser the dots will be.

If a dark tint is required, it should be done gradually, allowing the ink to dry before going over the same ground again, or the dots will all run together. It being impossible to lay the dots in any decided place in splash work, it should never be worked on faces or in any important parts of the picture; but it makes an excellent texture for such work as the foreground in a landscape or the background of a room, and can be done on either a grained or polished stone.

Much more could be written about the ways and means of working upon stone, but space does not permit. I trust that what has been already said will be a slight assistance to the student, and will, therefore, hasten to our next subject of practical work.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* Work *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* Work *without charge, the notices given partake in no way of the nature of advertisements.*

### 46.—Lowth's Improved Patent "Unique" Honey Extractors.

The Improved Patent "Unique" Honey Extractors, invented and patented by Mr. T. Lowth, Riseholm, Lincoln, are such as appear to merit the attention of readers of Work who take an interest in bee-keeping. The "Section Extractor," shown in Fig. 1, is especially adapted for extracting honey from sections, and is fitted with cases for loose combs. It extracts the honey from three sections, and the can, which is 10 in. in diameter, will hold 10 lbs. of honey. A perfectly steady and easy revolution is produced by

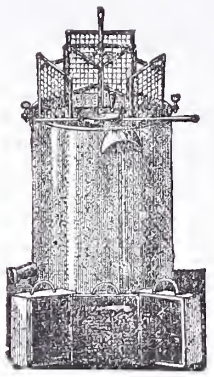


Fig. 1.—Lowth's Section Honey Extractor.

the detachable cages, which cause the ejection of the honey from delicate combs, such as are usually found in sections, with the least possible labour and waste. The inventor claims that the machine will be most useful and handy, especially when a good harvest of section honey is secured, for extracting the contents of unevenly built-out, and therefore unsaleable, sections, thereby preserving the combs and producing the finest samples of extracted honey in saleable form or for exhibition purposes, the quality and brilliancy of the honey being preserved. Thus, by using this extractor, the honey is saved from becoming candied by being left in the sections, and clean built-out combs are provided, which are valuable for securing the early spring crop. Frames or sections, containing honey to be extracted, should be carefully uncapped, placed in cages, and a few revolutions given to eject the honey; the combs can at once be returned for bees to refill, or preserved for future use. Loose combs should be placed in cases provided, and the honey extracted in the same way. The price of this machine is 7s. 6d., and can be sent post free for 9d., in addition to the cost.

The "Bar-Frame Extractor," shown in Fig. 2, is made entirely in metal, with movable folding

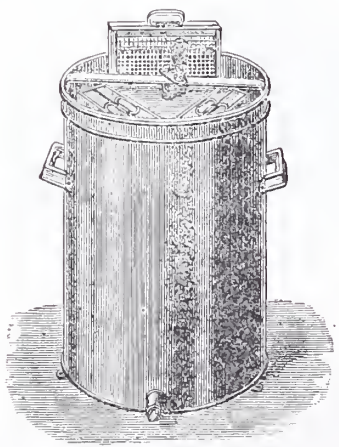


Fig. 2.—Lowth's Bar-Frame Honey Extractor.

cages, and combines in itself all the latest improvements in extractors. By its aid honey is extracted at one operation from three standard or shallow frames, 1 lb. or 2 lb. sections, and loose combs from skeps. The combs are held firmly in position during the process of extraction, thus preventing any breakage of the comb or mess. Each cage can be easily removed for inspection of combs, uncapping, or putting in fresh combs when desired. Brood combs, subjected to the action of the machine, are not splashed or chilled. The internal arrangement of the extractor forms a light running machine, imparting considerable centrifugal force to the revolving cages. The necessary speed for ejecting the honey can be at once obtained, thus saving much time and labour expended in the operation when carried out by other means. The price of this extractor is 21s., or 22s. 6d. if packed in case. Any size machine can be made to order.

The machines above noticed may be described as being thoroughly well made, portable, easy-working, and simple in construction. The internal parts can be promptly removed for cleaning, if desired. The special feature in the Bar-Frame Extractor is its capability for all-round work—namely, the extraction of honey from frame sections and loose combs. The internal arrangement of the cages is such that the honey is more easily ejected from the combs at a lower rate of speed, entirely dispensing with cog-gearing, which is absolutely unnecessary in this extractor. The movable folding cages, moreover, do away with all risk of the comb being broken either in or out of the machine. The covering-in of the revolving parts at the top prevents splashing and chilling of brood combs while the machine is in motion, so that there is no need for a top cover. The height of the cylinder, which forms the case, is 2 ft. 2 in., and it is 17 in. in diameter. About 35 lbs. of extracted honey can be held under the cages. The cylinder forms a useful vat or receptacle for honey when not in work.

### 47.—"Woodwork."

This is the brief title of a handy little volume, designed to meet the requirements of the Minute of the Science and Art Department on Manual Instruction. It is written by Mr. George St. John, Handsworth, Birmingham. It is published by Messrs. William Blackwood & Sons, London and Edinburgh, and its price is 1s. It is intended to point the way to the establishment of classes in manual instruction in elementary schools, and to show the cost of the necessary outfit in tools and benches, always supposing that the school in which such a class may be established is possessed of the necessary accommodation for a workshop. The cost, as to plant, etc., may thus be easily reckoned up; but what if the elementary school is without any adjunct that can be utilised as a workshop, and the School Board, or school managers, as the case may be, have to provide the wherewithal for the payment of an efficient instructor in the person of a skilled artisan, for it will be utterly useless to place the boys at the mercy of an unskilled amateur? "My Lords"—I am referring to the Minute—touch but lightly on the teaching part of the business. "The instruction *may* be given by one of the regular teachers of the school, *if he is sufficiently qualified;* if not, he must be assisted by a skilled artisan." No very great effort of brain power was required to evolve this permissive remark. There are a few teachers who could do the work, as I know, but in the great majority of cases the services of the skilled artisan will be a *sine quâ non*. Again—"The work of the class will be examined by the local inspector of the Department, accompanied, *if necessary*, by an artisan expert on the occasion of his visit to examine in drawing." Which shows that "my lords" are a little bit doubtful about the competence of the local inspectors. The matter given in the book itself is excellent, thoroughly practical, and sufficient for all elementary purposes; but the bench vice, shown in the engraving of the carpenters' bench in page 31, is an ancient form, and by no means convenient to work. There are as cheap and better forms in existence. It is to be hoped that the present volume will meet the purpose for which it was designed, and find favour, in the bargain, with the large body of amateur wood-workers. Its value in schools, however, would seem to turn more upon some better support than is already given to the subject of elementary technical education by the Education Department.

The Editor.

# SHOP:

## A Corner for Those who Want to Talk It

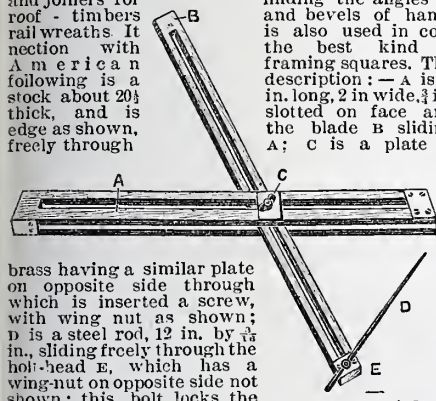
*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Rate of Circular Saw.** — A. R. (*Scorrier*) writes:—"In my letter (see WORK, No. 116, page 187), wrongly ascribed to A WOODWORKER, it is *Woodworker, and not myself*, who thinks *that the speed of a circular saw and feed of timber may be reduced in proportion to the power, and be an advantage.* I omitted to put this conclusion of WOODWORKER'S into italics in my letter on page 187."

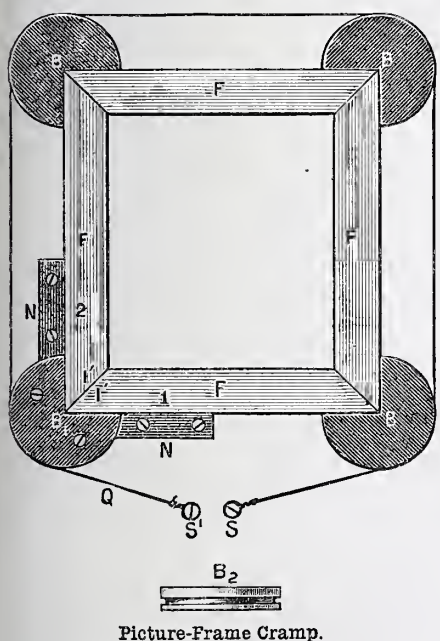
**Instrument for Bevels, etc.**—J. S (*Londonderry*) writes:—"The following is a sketch of an instrument used in the United States by carpenters and joiners for finding the angles of roof-timbers and bevels of hand-rail wreaths. It is also used in connection with the best kind of framing squares. The following is a description:—A is a stock about 20½ in. long, 2 in wide, ¾ in thick, and is slotted on face and edge as shown, the blade B sliding freely through




Instrument for Bevels.

brass having a similar plate on opposite side through which is inserted a screw, with wing nut as shown; D is a steel rod, 12 in. by $\frac{3}{16}$ in., sliding freely through the bolt-head E, which has a wing-nut on opposite side not shown; this bolt locks the steel rod in any position, and by unscrewing the wing-nut the rod can be projected out to the full length (12 in.), and can make a complete revolution round E. I shall feel obliged if some correspondent of WORK (and I know there are some in the United States) would describe how this is used."

**Picture-Frame Cramp.** — S. C. T. (*Knutton*) writes:—"I am sorry to have given you the trouble of returning my first letter for lack of clearness, but




$B_2$

Picture-Frame Cramp.

will endeavour to do better this time. The contrivance is for gluing up picture frames. First take the two pieces 1 and 2 (as shown in diagram), glue the joints 1', 1', and put them in the corner, fastened down to the floor (marked B N), and squeeze them together. Treat the other joints in the same way, placing the three pieces marked B on the joints as shown. Then fasten a piece of strong cord (marked Q) at S, and pass it round the circles, pulling as tight as possible, and tie at S, not letting the string go looser. The pieces should be constructed as follows:—B, B, B, B are circles of wood, about 4 in in diameter (size is immaterial), 1 in. thick, with a groove turned (as shown) near the bottom edge (as shown at $B_2$); each circle has a quarter of a circle cut out of it after turning. One of the blocks, marked B', is fastened to the floor, or a level table, by screws, and N, N are two slots of wood same thickness as circles, and about 4 in long, fastened also to the floor; S', S are two screws let into the floor to fasten the two ends of eord (Q) to. The picture frame should be left in the 'stocks' all night, and then next morning take it out, and it will be found quite firm; then saw a slit with a fine saw through the angle of each corner, and, having glued a piece of match-box, put it in the slit; when hard, trim off, and it will be found quite strong enough for small frames. For large frames, of course, ordinary methods are adopted."

**Repairing Set-Pan or Copper.**—T. W. P. (*No Address*) writes:—"Sometimes a cast-iron set-pan or copper will burn through in one small place, perhaps, which may be a flaw in the casting, or a place subject to more heat than other parts of the pan. A temporary method of stopping this may be of use to some fellow-readers, who perhaps do not want the trouble and expense of a new pan. Take a brass shank button, and carefully rimer the hole in pan till the shank will just pass through. Cover the back of button thickly with white-lead; press the shank through the hole, and wedge on the outside of pan with a small taper nail, which will draw the button quite close to the pan, making a good sound job, which will last for months, and perhaps for years."

### II.—Questions Answered by Editor and Staff.

**Papier-Mâché Rollers.** — F. P. (*Swansea*) should have named the purpose for which the rollers are required. Without a fair statement of the question, it is scarcely possible to give a satisfactory answer. Are they for rolling photos? If so, the sellers of photo. apparatus would supply them. As makers of articles in papier-mâché pulp generally, Messrs. McCallum & Hodgson, Summer Row, Birmingham, might be applied to; or with the directions already given in WORK, why could not F. P. make the rollers himself?—S. W.

**Stationery**—RULER.—Your best plan will be to obtain an index from the publishers or through your bookseller, and look it up, and order your deficient numbers from it. But the best plan of all would be to order *all* numbers which you have not got, and so make your volume complete. There may be many things contained in them which would be of interest to you. There are books published upon bookbinding which are very high-priced, and which contain much information of a certain kind, but not what you desire. There is, however, a series of articles appearing in the *British Bookmaker* upon stationery binding which will suit you, and which you should not fail to consider. The magazine is published monthly, and the price is 6d.—G. C.

**Cabinet-Makers' Tool-Chest, and Clockwork Cradle Swings.**—IMPATIENT (*Thirsk*) —I myself, and others also I believe, have given several useful suggestions relative to tool-chests in "Shop." A paper, however, on this subject will require a portion of the body of the magazine. Concerning the most suitable handles, I think that you, as a cabinet-maker, ought to be the best judge. Unfortunately I do not know where you can obtain the clockwork cradle swings; but perhaps this note will elicit information from someone possessed of such. As you saw one in the York exhibition, perhaps some of our readers resident in that county will step forward for our mutual benefit.—J. S.

**Portable Stand for Optical Lantern.**—F. C. (*Londonderry*) asks for a sketch of a portable stand suitable for a biunial lantern. A modification of the ordinary photographer's tripod, as shown in Fig. 1, forms an extremely portable stand for the purpose, which can be readily made by an amateur carpenter. The upper limb of each leg is formed of a couple of strips of ash or mahogany, 30 in. by ¾ in. by 1 in., the lower limb being a similar 30 in. strip of wood, which measures ¾ in. by 1 in. for 27 in. of its length, and then widens out in the form of a wedge from 1 in to 1¾ in. A mortise is cut through the wood just where it begins to widen, and a flat plate of brass, 2½ in. by ½ in. by $\frac{1}{16}$ in., is drilled and filed to the form of Fig. 2, and inserted and screwed into the mortise in order to form the hinge, as shown in Fig. 3, the ends of the two upper wooden limbs being slit with a saw, and then hinged one on either side of the lower limb, as indicated in the cut. A 2 in. length of ¼ in. iron or brass rod is now tightly fitted into a hole bored through the widest portion of the wedge, with an equal amount of the rod projecting on the outside in either direction. These ends of the rod are made to fit into holes bored in a suitable position partially through either of the movable limbs, by which means the upper limbs will be rendered rigid upon the stand being opened. The lower end of the central limb will require to be pointed and provided with an iron toe-cap (Fig. 4), (to be obtained from Mr. Platt, Birkbeck Works, Birkbeck Road, Kingsland, N. No. 87 in list; 1½d. each); and the outside of each of the upper limbs must be furnished with a small brass plate (Fig. 5), which may be fixed in position by means of a couple of brass screws, as shown in Fig. 6. These plates are No 7 in Mr. Platt's list; 2d. each. The table top of the stand must, of course, be made of a suitable size, according to requirements, but a board 12 in. by 18 in. may be taken as an example of a useful size. The bottom board of this diameter (shown in Fig. 10) should be furnished with a couple of cross ends, and a raised framework screwed round the upper surface, as shown in Fig. 1. The two long sides of this framework are 18 in. long and 6 in. wide in the centre, tapering off to 2 in. at either end (see Fig 7). The two strips for the ends of the framework will be 2 in. wide, and the length of the width of the board. The framework is put together with halved joints, as shown in plan in Fig. 7, and afterwards securely attached to the base-board. The movable table top, which may with advantage be a few inches larger than the base, is hinged to the apex of the raised framework by means of a couple of ordinary brass glass-plates, one of which is to be bent to right angles in the position shown by the dotted line in Fig. 8, and then screwed to the underneath of the table top, and afterwards pivoted to the framework at A, Fig. 7. The slotted arms, by which the position and angle of the table top is adjusted, consist of a couple of stout pieces of brass plate, 6 in. in length, drilled and filed up to the form of Fig. 9. These are pivoted by means of a screw to the edge of the board, and then secured at any desired position by means of a milled screw working in a plate affixed to the side of the framework in the position shown at B, Fig. 7. Mr. Platt's T-screw and nut-plate, No. 105, at 6d.

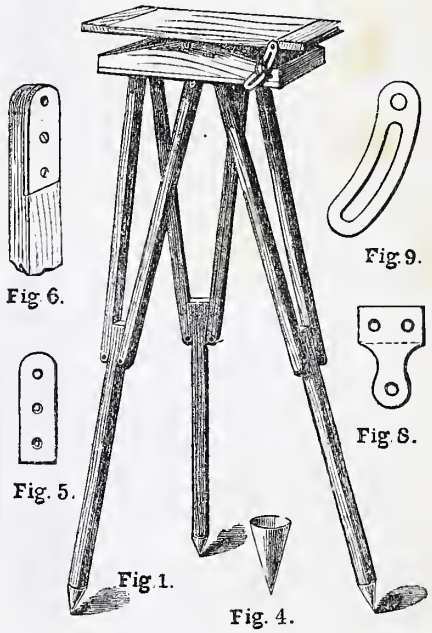


Fig. 6. Fig. 9. Fig. 8. Fig. 5. Fig. 1. Fig. 4.

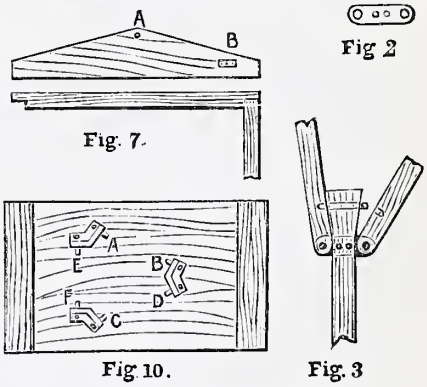



Fig. 2

Fig. 7.




Fig. 10.



Fig. 3

Stand for Lantern.

each, will answer the purpose. The stand is finally completed by the addition of a set of thin bearings, which are affixed to the under-side of the base, in the position indicated in Fig. 10—the distance between A, B, C, D, and E, F, being about 6 in., which will then enable the upper limbs to be sprung on to the projecting pins of each bearing. Mr. Platt can supply a set of thin bearings at 2s. 6d., No. 79. The stand is, of course, stained and varnished, or polished, according to taste. Although a tripod stand of the above description is frequently employed for lantern purposes, it is not by any means the best form of support to my mind, as the spread-out legs have a knack of getting in the way in the dark, which is very exasperating to the operator, and frequently damaging to the apparatus.

Another plan, which is far preferable to the stand above described, is the method adopted by Mr. T. C. Hepworth, a well-known lanternist of considerable experience. The four lower corners of the containing case of the lantern are furnished with iron sockets, into which four substantial iron legs (1 in. wide and $\frac{1}{16}$ in. thick) can be readily slipped, the lower end of each support being turned in the form of a toe, which is provided with a hole in order that the legs can be affixed to the floor by means of screws. In Nos. 37, 38, 39, and 41 of the *Camera Magazine* I have described and illustrated several other forms of photographic camera stands, some of which are capable of being utilised for lantern work.—C. A. P.

**Linesman's Galvanometer.**—J. N. (*York*).—I will endeavour to comply with your request by sending in to the Editor an illustrated description of a linesman's galvanometer. It would occupy too much space in "Shop," as there will be several illustrations.—G. E. B.

**Watch Work.**—APPRENTICE.—I hardly like to advise; but if you have a fancy for watch making—or rather watch jobbing, I suppose you mean—why, there is many a worse-paying trade, also many better. If you go as an apprentice, make sure that the man is a practical one or keeps good workmen, and gets good work. It would not pay you to waste seven years at a shop where they clean watches at a shilling each. A *good* watch jobber can always get a place, and keep it if he likes, and at the same time earn good wages if at all up to the mark. Of course, wages vary in different towns, but roughly from 35s. to 50s. per week. There are plenty of jobbers about that are not worth their salt; perhaps I ought to say butchers, not jobbers or repairers. We are open to take a good jobber, and the last we paid on an average £2 a week and over, sometimes over £3, seldom under 35s.: but you must make yourself efficient, then you need not want a job long. Any further particulars if desired.—A. B. C.

**Oiled Paper.**—MAC.—(1) I assume from Mac's inquiry that he desires to prepare some of the above; I therefore give him the required information, which will enable him to do so with very little trouble, and make a good job of it. First, let him get four ordinary plasterer's or builder's laths, each of them to be longer than the largest sheet of paper he proposes to operate on, and tack, tie, or pin them together at the corners so as to form a frame just the size of the sheet he intends to use, and then to this frame evenly pin or otherwise attach the paper by its edges. Having done this so that the paper will not slip, let him get some good *boiled* linseed oil—not the *raw* oil—and a brush, and then, placing the frame and paper on a flat board or surface, go lightly and evenly all over it with the brush dipped in the oil, until it is evenly covered; and when this is done, set it on one side to dry, taking care, if he stands it in a vertical or sloping position, to reverse it two or three times during the first hour or two, in order to prevent the oil draining to the lowest part and making it "streaky." When dry—say, in twenty-four hours—if not transparent enough, let him give another coat to the reverso side of the paper, taking care in both cases not to use too much oil at once; and when dry, he will find it just what he wants. I have made hundreds of sheets of this for cultivating boxes and frames for raising seeds, etc., as it acted a deal better than glass, at the same time that it gave shade and prevented scorching. (2) No licence would be required under the conditions stated.—C. E.

**Lathe Wheel.**—W. B. R. (*Westbury*).—I certainly do prefer the V grooves and gut-band, but the flat strap is about as good, and with a flat strap it is not necessary to have the rim of the wheel turned, so that saves expense. You could have a 24 in. or 30 in. wheel of about 70 lbs. with two steps for the belt—say, for the largest 24 in., and for the second speed 22 in.; let these work to two speeds on the mandrel of 3 in. and 5 in., and that will give you speed ratios of 8 and 4½ to 1, which is all you want for turning wood. I should try for such a wheel near at hand to save carriage; try at the nearest large ironmonger's or foundry. You must have it bored, but it need not have the rim turned.—F. A. M.

**Cleaning Carpet and Mattress Tick.**—W. B. (*Mildmay Road*).—If there are any special patches of grease on the carpet, pound and mix together fuller's-earth and magnesia in equal quantities; make into a paste with boiling water; lay this on the places, leave it till dry, and when it is thus brushed and beaten off, it will bring the grease with it. If the carpet is only generally dirty and faded-looking, after a thorough beating put a pint of bullock's gall into four gallons of soft water soapsuds, and with this scrub the carpet with a brush having long and softish bristles. The gall will brighten up the faded colours. As to the tick of spring mattress, W. B. is strongly advised to remove and have it washed—it cannot be thoroughly purified without; but if this is impossible, something may be done in the way of removing stains, grease, dirt, etc., by sponging with benzine.—S. W.

**Needle Telegraph Instruments.**—H. H. (*Aston*).—This is rather a large order for "Shop" column, as to give detailed instructions for making these instruments would require much more space than can be spared here. I have, however, drawn out such an instrument, and Fig. 1 gives the general appearance. The case should be of wood, with a glass front and brass handle. What is really wanted is a double bobbin, wound with about 400 ft. of No. 36 silk-covered wire; the two coils should be joined together, as will be seen at the top of Fig. 2. A strongly-magnetised needle is mounted on an axis to swing freely between the coils, and a light pointer is fixed to the axis so as to come to the front of the dial. The signs are made by making the current from a battery flow in different directions through the coil, by which the needle and pointer is deflected either right or left, according to the will of the operator. This is effected by what is called a commutator. Its construction will be seen from Fig. 2. It consists of a cylinder of boxwood, with a brass handle which projects in front of the case (Fig. 1). On its circumference, parallel to its axis, are seven brass strips, which are connected at the end by insulated wires in the following manner: A with B and C, F with D, E with G. Four springs press against the cylinder, X and Y are connected with the poles of the battery, M with the earth-plate, and N with one end of the coil. The line to be used between two stations may be No. 28 B.W.G. well insulated. I think that H. H. can easily make his instruments from this description, as I could not go into more detail at present.—W. D.

Fig. 4

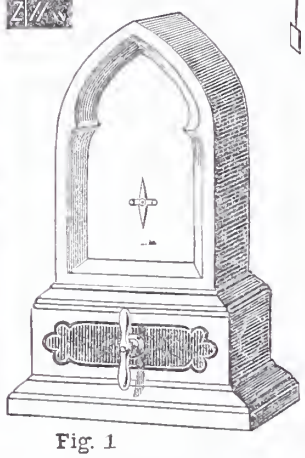


Fig. 1

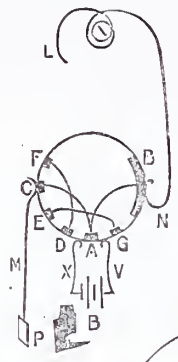



Fig. 3

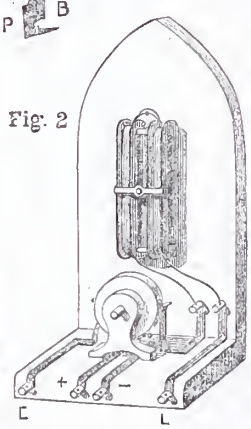



Fig. 2

Needle Telegraph Instruments.

**Carving Designs for Bedstead.**—H. J. (*Bradford*).—I should think that you might find some suggestions in back numbers (see Indexes to Vols. I. and II.). Two good publications sometimes containing Italian carving are *The Cabinet Maker* (6d. monthly) and *Furniture and Decoration* (6d.). You see, one cannot do justice to carving designs in a small space; hence the reason I disappoint you for the present.—J. S.

**Strength of Metals—Patterns, etc.**—BRAMAH.—A very useful book, giving weights and strength of metals of all kinds, is Spon's "Engineers' Tables," price 1s. With regard to patterns of tinware, there were several articles on the subject in WORK, Vol. I. Have you seen them?—R. A.

**Dead Black.**—BRASSWORK.—For a good hard dead black, try "Enamelloid" (see "Guide to Good Things," WORK, No. 106). I have used this for blacking camera, lens, and so on, and find it answer admirably.—R. A.

**Piano Stool.**—F. D. B. (*Stamford Hill, N.*).—I believe that Mr. Gleeson-White, in an article on an Overmantel, and in another one dealing with a Sideboard in turned work, gave the name and address of a firm who supplies amateurs. Refer to the Indexes for the articles alluded to.—J. S.

**Elliptic Curves.**—J. B. (*Reading*).—The matter has been treated fully in former letters, my statements being based on standard works on geometry, to one of which I referred, as being, to my mind, the easiest to understand. As to *foci* not being the plural of *focus*, I must refer you to a dictionary.—F. C.

**Bore Hole.**—W. R. (*Burnbank*).—There is no better tool than the D bit. We are always boring holes of this character, sometimes as much as 8 ft. or 9 ft. long by from 2 in. to 2½ in. diameter. You will necessarily have more trouble with an inch hole than with one larger, because of the choking caused by the borings, and must also put up with the slowness of the process. In large drills we form a lip on the cutting edge to break up the chips, but this is not practicable with small ones. You must withdraw the drill to clear the hole as often as it becomes choked.—J.

**Views on Glass.**—A. E. S. (*Glasgow*).—I am not familiar with the method you name of obtaining views on glass, if it is done by means of a transfer from copper-plate; but there is a process of decorating glass which is something similar to your method, and from which perhaps you may gain a few hints. Designs are traced, in this case upon ground glass, with copal varnish, the best being used, as clear and devoid of colour as possible. It is allowed to stand in a warm, dry place for eight or ten hours until thoroughly dry, then immersed in clear cold water for five or ten minutes, and allowed to drain, being afterwards exposed to a moderate heat; and if the varnish is good it will be firmly set. The very best colours are afterwards used for colouring. Now, if your black was not a good one, it would account for it turning a smoke colour; and it strikes me that perhaps you did not give the varnish time enough to thoroughly dry before subjecting it to heat.—W. E. D., JR.

**Kodak Detective Camera.**—NOVICE.—There are many hand cameras in the market of about equal merit; it would be somewhat invidious to select one as superior to the rest. The qualities necessary for really practical work are, in the first place, simplicity; and secondly, effectiveness and non-liability to get out of order. The "Faeile" and the "Ideal" are excellent, good work being easily done with either. In mentioning these we do not insinuate they are better than many others. In selecting, much depends on the fancy of the purchaser. With regard to the "Kodak," it is especially constructed to work with the roller slide and films. It is very simple; and where weight is of consequence, of course much less weight than if those cameras are used that require glass plates.—D.

**Camera Bellows.**—A. W. (*Paisley*).—Your design leaves nothing to be desired with regard to rigidity, but many other plans have the advantage of working almost automatically, thus saving time. According to plan sent, more time would be occupied in setting up and taking down the camera, as no provision is made for folding. The usual make of stretchers, besides acting as struts, permits the back of the camera to be swung, and by merely loosening or tightening a screw, no further trouble is required in opening and closing the apparatus than this; and the rapidity with which this can be effected is considered very important. The bellows seem to be one of the earliest patterns made.—D.

**Mounting Prints on Linen.**—H. N. (*Ipswich*).—Tack the linen or calico as tightly as possible on a frame or board, then coat it (the linen) with strong size, and leave till nearly dry. The back of the print must then be well covered with paste—this will be better done twice, the second time after leaving the first coat to soak about ten minutes—then place the print on the strained linen, and dab it all over with a clean cloth. When thoroughly dry, give face of print a coat of thin size. When dry again, repeat this. The size should not be too thick, or it will blister; nor too thin, or it will sink in; but a little practice on some inexpensive thing will soon teach you more than I can. When the two coats of size are thoroughly dry, varnish with white crystal varnish, such as paperhangers use, and which you can obtain at any good oil shop. When the varnish is quite set and dry, cut the thing off the frame, and it is ready for framing or mounting. A very good plan of my own for, say, a children's nursery is to simply wet the back of coloured print with a clean sponge, then paste (two coats, as above) round about ¾ in. of margin; stick it on the wall; it will strain quite tight. When dry, size and varnish as above. This gives a very cheerful effect to the room.—F. B.

**Chemist.**—A SUBSCRIBER FROM NO. 1 (*Southampton*).—Write to the Secretary of the Pharmaceutical Society, Bloomsbury Square, London, W., and ask him to send you a prospectus of the next preliminary examination. This will probably contain all you wish to know; if not, send in another query to WORK. Your son should have passed this examination before being apprenticed, so that he could now confine his studies to chemistry. Your best plan is to push him through the preliminary as fast as possible.—F. B. C.

**Decorative Window Frames in Cast Iron.**—S. R. (*Manchester*).—The illustrations in No. 95 (Vol. II., page 689) were original designs, and have not, to the best of the designer's knowledge, been carried out by any manufacturer for "stock." It will be necessary to have patterns made, and place them in the hands of an iron-founder.—H. P.

**Drawings for Patent Specification.**—A REGULAR SUBSCRIBER.—The Patent Office is peremptory in its regulations as to drawings, and we should by no means advise sending a lithograph in lieu of the prescribed Indian-ink drawing on white paper.—C. C. C.

**Crank Pin.**—FAITHFUL READER (*Aberdare*).—The thickness of metal in brasses should be about one-ninth of the diameter of crank pin; the width of strap one and a half diameters. The connecting-rod end should extend one diameter beyond the crank pin, and have a breadth of two diameters of crank pin. The length of the crank pin should be one and a half diameters. These are rough proportions; for good work the stress on each part should be calculated, and the dimensions determined in accordance with the results.—F. C.

**Staircasing and Handrailing.**—J. W. F. (*Cheshire*).—Arrangements have been made for papers on these subjects. Staircasing will be treated separately.

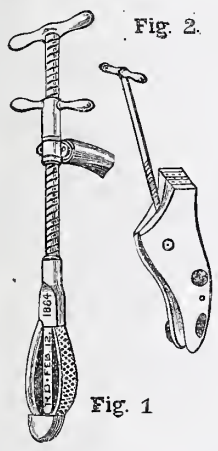
**Spoon Boxes.**—A FRET-WORKER.—Have you searched the catalogues of the firms who deal in fret-work, who advertise frequently in WORK, for fret-work designs of the above? If not, do so. These are the only mediums I am acquainted with through which you are likely to obtain such; unless you inquire also of the editor of the *Amateur*, Messrs. Zilles & Co., Finsbury, London, E.C.—J. S.

**Examination Papers.**—ASPIRANT.—If you wish to obtain copies of the examination papers on electrical engineering given at the Technical College, Finsbury, I should advise you to apply to the secretary for them. I should do so if I wished for them, and should enclose a stamped addressed envelope for reply. You will then learn whether or not they are obtainable.—G. E. B.

**Paddle-Wheel Electro-Motor.**—G. P. (*Bebington*).—The paddle-wheel electro-motor you saw was probably one for rotating vacuum tubes. One for this purpose will be described at the end of the series of papers on Induction Coils. Had you told me what you wanted the motor for, I could have given you instructions for winding it; but I cannot undertake to describe half a dozen different motors on the chance of one of these suiting you. In any case, you must either have a lathe in which to turn the parts of a motor up true, or get them turned for you by someone who has a lathe, whether it is a paddle-wheel motor or any other type.—G. E. B.

**Fret Machine.**—R. W. (*Radnor*).—Enough upon the subject of utilising sewing machine parts for fret machine construction has already appeared in WORK. Consult the Indexes to Vols. I. and II.

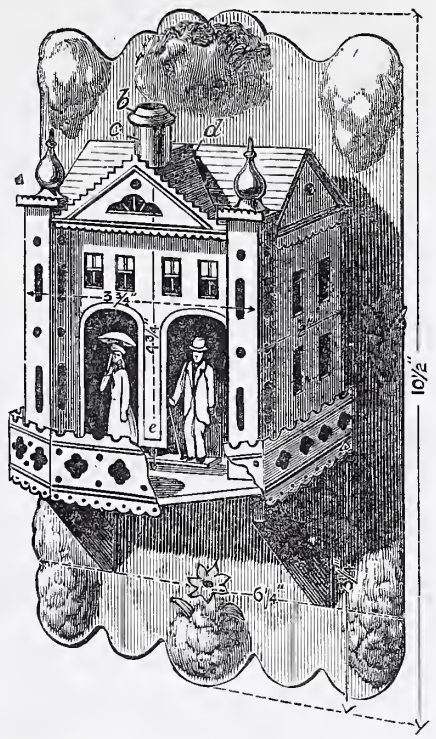
**Screw Lasts.**—D. (*Sunderland*).—As you ask for an "American screw last," I give in Fig. 1 the "Boss," price 12s. 6d., obtainable at the Wells Wire Quilting Company, Leicester. This is a length, as well as a girth, stretcher. Fig. 2 is a joint stretcher only, and can be bought at any leather-seller's shop; cost from 3s. 6d. Should you mean the last for repairing upon, there is only one with a screw in the market, which is called the "Perfect" repairing machine, price 3s. 3d. But if, as you say, you have one, you ought not to need another, as it, with its two caps complete, will fit from the smallest of children's boots to the largest of gentlemen's.—W. G.




Screw Lasts. Fig. 1.—"Boss" Stretcher. Fig. 2.—Joint Stretcher.

**Violin Bridges.**—CLEVUM.—We are without the address of COMME IL FAUT, who should advertise in WORK.

**Model House.**—H. S. (*Oxford*).—These houses are made of different sizes, but Fig. 1 shows a perspective view of a very common size, with a few of the principal dimensions given. The house itself is principally made of cardboard, the flat piece, to which the house is fastened, being extra strong, and its rigidity is increased by three longitudinal strips of wood ¾ in. wide by ¼ in. thick, one fastened down the centre, the others down the sides. The floor of the house is of wood, together with the two inclined supports and the figures and the ornaments on the roof. The sketch shows about the correct proportions and style of one class of house, which can be altered and ornamented to suit the taste. Thin coloured cardboard can be used for the walls, and painted to imitate stone, brick, etc. The decorations consist of gilt and various coloured stiff perforated papers and paper flowers, which, on account of the limited space in "Shop," I shall have to leave. The size of the house will all depend on the size of the figures used, as if the figures are bigger the openings must also be enlarged, and, for the sake of symmetry, the house also. I have shown in Fig. 1 a part of balcony removed, so that the space between the




Model House and Figures. Fig. 1.—Perspective View of House with Part of Balcony removed to show Platform for Figures.

floor and the bottom of the central partition, *e*, can be seen. It is about ⅛ of an inch, and is left to allow the figures to turn completely round, as well as to rise and fall as the gut contracts or expands. The principal difficulty will be in arranging the figures and catgut, so in Fig. 2 I have shown the arrangement entirely separated from the house. The dimensions of the figures, etc., here given suit a house of the size shown in Fig. 1. Having carved or otherwise obtained two figures, fix them by glue (as this seems to be the principal medium for fastening the parts together) to a flat piece of wood. In the centre of this, or, I should say, so that the figures will balance, place the round upright *a*, in this case 1 in. long by rather less than ¼ in. diameter, with a hole in top for gut, which latter should be about the thickness of the medium string in a fiddle, and is fastened therein by means of glue; before inserting the gut, tie a knot on the end. Do not cut the gut to the length shown in Fig 2, but leave it somewhat longer. Turn a small piece of wood, *c*, ½ in. diameter, and fit it on the roof as shown at *d*, Figs. 1 and 2, and in such a position that a line through its centre passes just behind the pillar *e*, Fig. 1. Bore a hole ¼ in. diameter centrally through it, and turn a small cap and pin, *b*, to fit it easily. Bore a hole centrally through this just large enough for the gut to pass. Having fixed on the top, *c*, place the figures in their respective openings, with the central pin, *a*, behind the pillar, *e*, Fig. 1; pass the gut through the roof and *c*, and then thread it through the cap, *b*. Now place cap, *b*, in position shown in Fig. 2, and gently raise the figures by drawing up the gut till they swing midway between the floor and the bottom of the central pillar, *e*, Fig. 1. Now drive a small wooden peg dipped in glue into the hole where the gut is, and cut off both peg and gut. To prevent the figures moving sideways, form a square shaft by gluing to the central pillar, *e*, internally a piece of cardboard, taking care that the pin *a* is within before gluing it fast. A slight amount of play should be allowed between the pin and sides of shaft, so that there will be no perceptible friction to prevent the figures turning easily. The figures are set as shown in Fig. 1—that is, half in, half out, on some moderate day, when neither wet nor fine. This is done by turning the top of chimney, *b*; probably at first it will need a little bit of attention till the gut gets extended. I hope the above few remarks will be sufficient to explain away any difficulties. It is the want of space only which prevents a thorough description.—P. B. H.

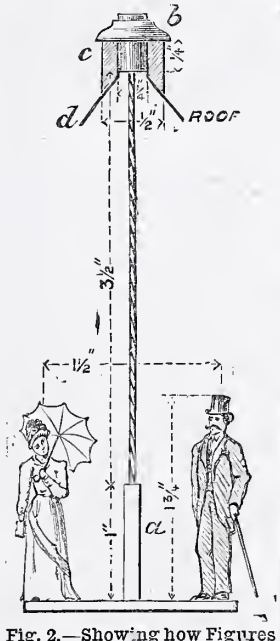
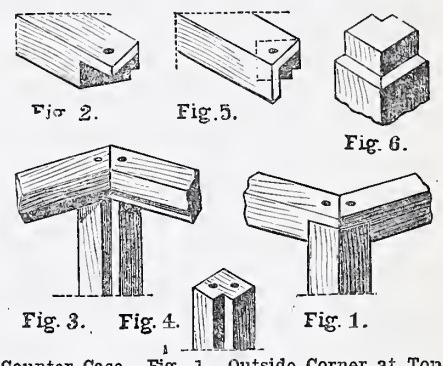



Fig. 2.—Showing how Figures are hung to Gut.

**Shoemaker's Wax.**—J. K. (*Farnley*).—Take 4 ozs. of pitch, 1 oz. of resin, and about a ½ oz. of good tallow, and heat them well on a slow fire in a pipkin or old saucepan (being very careful they do not take fire, as they are very combustible). Stir this admixture till the resin has melted and mixed well with the other ingredients; then pour the whole into a pail of cold water, and when it has got sufficiently cool to handle, put your hand underneath, and turn the edges over to the centre with the other, to make it into one ball. Take it out, and make it into a roll. Take one end in each hand, and pull it out as long as you can without breaking it. Double it, and pull out again and again; the more it is pulled (or worked) the better and brighter it will be. This done, lay it out on a slab, seeing it does not stick. Roll it out, cut it into strips about an inch wide, and cut the strips into pieces about an inch and a half long; each piece is called a ball. Wax has to be made hard in warm weather, and soft in cold. To make it softer, add more tallow; to make hard, use more resin. It is best to make it hard, as it can be made soft *ad lib.* without being again heated—simply by working a little tallow into it. It should always be kept in water to prevent it sticking to anything or together.—W. G.

**Weights of Sheet Metals, etc.**—NO NAME.—Yes, there is such a book; it is called "Engineers' Tables," published by Spon, Charing Cross. It contains, besides the weights of sheet metals, hundreds of other useful memoranda of all kinds, such as weight of hoop iron, chains, nuts and washers, round, square, and flat iron, carpenters' memoranda, bricklayers' and plasterers' ditto, and a variety of valuable information. It is a tiny book, and will go in the vest pocket. Price 1s.—R. A.

**Counter Case.**—H. B. (*Melbourne*).—The corners of your prospective counter case should be constructed after the manner described by the present sketches. As the corners will exactly resemble each other, and as also the bottoms will be similar to the tops, the explanation of one top corner will




Counter Case. Fig. 1.—Outside Corner at Top. Fig. 2.—End of a Top Rail. Fig. 3.—Inside Corner at Top. Fig. 4.—Upright. Figs. 5 and 6.—Alternative Methods of shaping Top and Bottom Rails and Uprights.

be sufficient. A sectionally square upright should be rebated from top to bottom, as in Fig. 4. That part of the upright will face the inside of the case. The horizontal rails will be halved and mitred over and around the block, as in Figs. 1 and 3, and screwed or dowelled there. These rails will be rebated as in Fig. 3. As an alternative method, and one much more difficult, albeit stronger, Fig. 5, as the end of a horizontal rail, and Fig. 6, as the top (and bottom) of the upright, might secure preference. Certainly I should not cut the glass until the wooden portion of the case is constructed. The glass can be fixed in by means of putty, or by sectionally triangular wooden strips glued over them into the rebates. They can then be easily repaired in case of damage. The bottom board could be covered in velvet, and fit within the bottom rebates. It is supposed that a hinged glass lid will bodily cover the top. Drawings are shown free from representations of beads or chamfers, to avoid confusion.—J. S.

**Photograph Enlarging.**—H. J. H. (*Hackney*).—The method of enlarging from ferrotype or other positives is very similar to that of enlarging from negatives. Fix up the picture to be copied in a good light, avoiding reflections, and proceed as in enlarging from a negative. A negative will be the result, and can be printed direct or copied again in the camera, when a positive will result, suitable for bromide and enlargements of that class. The chief difference is in the exposure, an opaque picture requiring rather longer than a transparency. All pictures that have to be copied by reflected light are necessarily produced in a similar manner in one operation if a negative to print from is required, and in two operations if the desired result is to be a developed positive.—D.

**Shoe Gloss.**—SNOBBERY.—No; boot finishers do not put anything into their ink. The cause of the permanent gloss on heels finished by a finisher is the ink which he uses, and the method of ironing afterwards. You should get good American burnishing ink, and add one-third of ordinary shoemakers' ink. Put this on in the ordinary way, and when it has dried to just a nice dark blue (that is not what is generally called "bone dry"), iron up with a warm glazing-iron, or, better still, a double-handled burnisher. It should be rubbed on hard, even, and firm, and with a quick motion. When it is quite bright all over, slightly damp it down, and burnish again. This done, iron on heelball, and then rub it off even with an old cloth. To finish, rub a little whiteball on the cloth, and polish the heel with it. Fake is often used instead of heelball; it is a more ready method, as it is only rubbed on with the finger, and therefore saves the last ironing. It also gives a good polish when used instead of whiteball. To prevent heels cracking, flesh the back and buff off the grain of each piece of leather. Use it when it is only mellow—that is, not too wet or too dry—and do not hammer the heel stuff too hard. Put a little paste on each lift before you put on another, and after the heel is knifed up, properly pare the edge, and never finish till the heel is dry. Rasp each lift to make it rough before applying the paste.—W. G.

**Nails.**—J. C. (*Cheadle*).—Try the large Sheffield nail makers for the nail you require.

**WORK Back Numbers.**—E. H. (*Sunderland*).—The parts of WORK from January, 1891, to May, 1891, price 6d. each, can be had on order of any bookseller.

**WORK Exhibition Certificate Frame.**—N. M. (*Glasgow*) AND OTHERS.—A special article on this subject is not deemed necessary. Any contribution to "Shop," Section I., will be attended to.

**Bicycle Wheels.**—G. P. (*Gloucester*).—The Victor Cycle Co., Grimsby, supply these wheels.

**Turkeys.**—M. H. (*Higher Walton*).—The question you ask is not suited to this Journal. Write to one of the Poultry Journals.

**Umbrella Silk.**—L. B. (*Marylebone, W.*).—A good wearing Union (mixture of silk and wool or silk and cotton) will cost from 2s. 3d. to 4s. per yard; a silk (pure) from 2s. 9d. to 5s.; and can be obtained from Messrs. Morland & Sons, Wood Street, Cheapside, or Messrs. James Ince & Son, 61, Bishopsgate Street Without, E.C.—H. W.

**Violin Making.**—W. W. (*Patterdale*).—You do not enclose stamps, so that the copy of WORK cannot be sent you. Procure the Indexes to Vols. I. and II. through your bookseller. The violin articles are now running through Vol. III.

**Condensing Engine, Book on.**—YOUNG ENGINE DRIVER.—"The Theory and Action of the Steam Engine," by W. H. Northcott, C.E.; 3s. 6d.

**Printing on Tin.**—ANXIOUS.—If this correspondent by "printing on tin" means the decorating of tin, such as the fancy biscuit boxes, etc., I can only say that it is a patent process, and it is not in my power to give particulars of same. Apply to the Tin-Plate Decorating Company, Neath.—R. A.

**Zither.**—J. M. B. (*London, W.*).—The article on how to make a Zither is in the Editor's hands, and only awaits space for publication.—R. F.

**Renovating Chair Seats.**—W. B. (*No Address*).—There is no way of renovating worn leather seats; the chairs must, to make a good job, be re-covered. Any attempt at partial dyeing will make matters worse. The faded leather may, however, be freshened up. Some advise a little French polish to be laid on very lightly, care being taken not to saturate the leather. Some advise white of egg as a reviver; and there is an article sold at shoe and other shops as "kid reviver," which might be used.—S. W.

**Imitation Ivory.**—HARD UP.—I can give methods for home-made imitations of ivory suited merely to decorative purposes, but umbrella handles would need more strength. The best imitation of ivory is, I believe, "ivorine," and this, probably, would be the thing for HARD UP. But he will have to get it from the makers, the British Xylonite Company, 124, High Street, Homerton, E. It costs 4s. or 5s. per lb., and works easily.—S. W.

**Leclanché Cells.**—A. C. (*Croydon*).—It would be well for you to advertise your prices, with name and address, in the cheap "Sale and Exchange" columns of WORK.

**Silent Gas Engine.**—A NEW READER.—The gas engine is rendered silent by the system of compressing the charge before exploding it, and the compression gas engine has not been treated in WORK. Your non-compression engine should give out more than one man-power if of 5 in. diameter and 11 in. stroke; a cylinder of that size on the compression system would be much more powerful, because by compressing the charge the gases burn slower and more gradually; instead of a sudden kick at the crank-shaft, as in yours, you get a longer push. To convert your engine would be very difficult, if not impossible.—F. A. M.

**Binding WORK.**—NED.—You should write upon this subject to the publishers, Messrs. Cassell & Co., Limited, Ludgate Hill, London, E.C.

**Bamboo.**—A. M. S. (*Westminster*).—The firms named below deal in this article:—F. Westbury, 183, Great Dover Street, S.E.; Benjamin & Co., 168, Great Dover Street, S.E.; W. and T. Elmore and Sons, 16, City Road, E.C.; and S. J. Eaton & Co., 3, New Inn Yard, Tottenham Court Road, W.—M. M.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Inking Roller Composition.**—C. D. (*Glasgow*) writes:—"I should be much obliged for any instructions as to how to make a small inking roller, including composition of 'dolly,' to be used for inking woodcuts."

**Rubber Balls and Balloons.**—Z. Z. Z. (*Wednesbury*) writes:—"Will any reader kindly tell me how to make toy indiarubber balloons and indiarubber balls?"

**Steam-Ship "Sarah Sands."**—W. W. (*Canning Town*) writes:—"Will any kind reader, or seafaring one that may have been aboard the S.S. *Sarah Sands*, which was destroyed by fire, inform me where I can obtain a book of the above-named ship that speaks of the bravery of Fireman Woodward?"

**Hydraulic Lifts.**—ANXIOUS writes:—"Would any reader be kind enough to explain the system of the working of hydraulic lifts, etc.?"

**Carpenter's Bench.**—R. S. D. (*Edinburgh*) writes:—"In the number of WORK for October 4, 1890, page 471, under the heading 'Carpenter's Bench,' E. D., in reply to J. B. F. (*Brixton*), describes a bench, and states that it can be obtained for 30s. I should be glad if he could inform me where; also whether a considerably smaller one, with thinner top, could be got for £1."

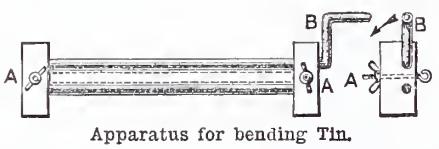
**Ink Blots.**—INKY writes:—"Can anything be made to get out marking-ink blots or names in linen?"

**Tricycle.**—W. R. (*Mile End*) writes:—"Will any reader kindly inform me how to make a tricycle to work with my hands? I want it with a place to convey toy goods in, as I am lame."

**Umbrella Fittings, Negatives, etc.**—CONSTANT SUBSCRIBER writes:—"Will any reader tell me a place where I can get umbrella fittings with which to do jobbing work, repairs, etc.? Also I should be glad to know of a method of getting rid of rain stains on negative caused by getting wet during exposure. I have got silver stains off, but rain stain spots remain."

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Hoop Rollers.**—A. H. L. (*Higher Bebington*) writes, in reply to A. L. (*London*) (see page 91, No. 110):—"A cheap apparatus for bending tin, etc., might be constructed as follows: Take three pieces of iron pipe 1½ in. diameter. To one of these attach a handle, and place it with one of the others, 2 in. from each other, on or in a wooden frame, so that the ends rest on or in bearings, so that they may revolve easily. The third piece of tube should be




Apparatus for bending Tin.

plugged at the ends, and axles formed, of such size as to work in the eyes of eye-bolts, having a nut on the end of each, as in diagram. To work, place the edge of the sheet over the middle roller (piece of tube) and under the other two; turn the wing-nuts till sufficient curve has been obtained, and then draw the sheet through between the rollers, turning the handle (B) in the direction of the arrow."

**Air Cushion.**—E. L. (*No Address*) writes, in reply to H. R. (*Clapham*) (see page 222, No. 118):—"Fill the cushion with wind, and put it under water. You will soon find out by bubbles where the hole is. It depends what material it is made of before I can say what to repair it with, but should think indiarubber solution. Prout's glue is of no use: it cracks."

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. S. R. (*Tewkesbury*); THE GOLDSMITHS' CO.: O. B. (*Preston*); W. H. K. (*Accrington*); T. R. H. (*Manchester*); A. S. (*Rotherhithe*); J. N. (*York*); W. J. T. (*Cardiff*); J. E. W. (*Burslem*). G. F. C. (*Southampton*); T. W. B. (*Leicester*); W. M. (*Derby*); STRIKE-A-LIGHT; H. M. (*Liverpool*); READER OF "WORK"; N. H. (*Huddersfield*); H. J. M. (*Bristol*); F. I. (*Highbury Grange*); A NEW READER; J. G. (*Glasgow*); T. R. E. (*Darlington*); EYRE; W. S. M. (*Brixton Hill*); F. D. (*Leswalt, N.B.*); A. R. (*Scorrier*); F. S. (*Reading*); G. H. (*Clerkenwell, E.C.*); J. B. (*Devonport*); T. W. (*King's Cross*); T. W. W. (*Hastings*); S. R. P. (*Kilburn, N.W.*); L. W. (*Islington*); P. R. (*Birmingham*); W. A. (*Bury St. Edmunds*); W. C. B. (*Bolton*); T. W. A. (*Stockton-on-Tees*); F. M. G. (*Hounsdon*); ANXIOUS; R. E. (*Bolton*); PROTECTION; ALLOY; J. E. M. R. (*Stratford*); A NEW SUBSCRIBER; GUGLIELMUS; X. Y. Z.; W. J. H. P. (*Cookstown*); ANXIOUS B.; B. O. (*Alsager*); CLIP; L. J. K. (*Dublin*); H. H. (*Eastleigh*); C. G. E. (*Manchester*); RINGER; W. J. C. (*Jersey*); H. B. (*Wakefield*).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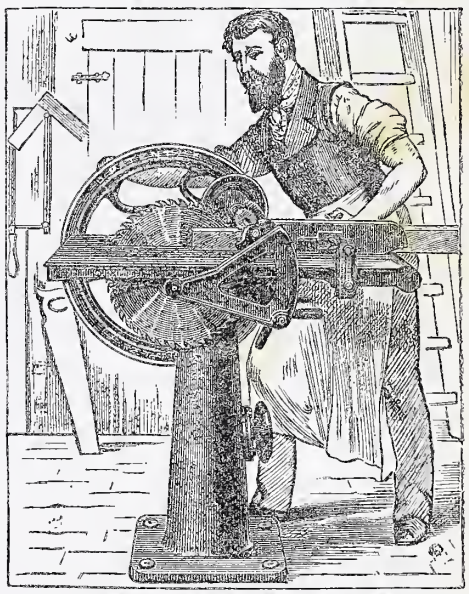

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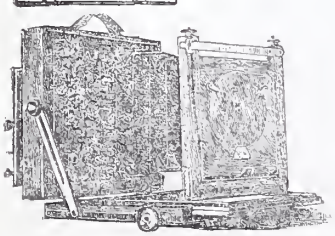

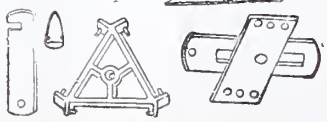

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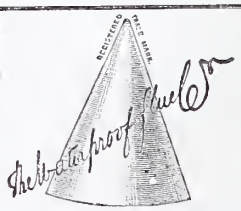


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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 124.] SATURDAY, AUGUST 1, 1891. [PRICE ONE PENNY.

**Full-Size Design for a Dish, Tray, or Plaque, 10¾ inches in Diameter, in Repoussé Work, or Panel in Wood Carving.**

## A FULL-SIZE DESIGN FOR DISH, ETC., IN REPOUSSÉ WORK.

BY J. EADIE-REID, GUILD OF HANDICRAFT.

THE art of beating up metals—such as silver, brass, and copper—is perhaps one of the most beautiful of our handicrafts, and it is with pleasure we see a demand rising in our English market for this work. It is capable of the most varied of treatments—delicate as only the artist hand knows how, yet simple and broad as the most daring.

The technique of repoussé work has been described in Vol. I., so that it only remains for me to touch but lightly upon this side of the subject. Having already made a careful drawing of the design with which you are to ornament your plate, it would be desirable to pounce your sketch, and by this means transfer its lines to your sheet of copper. At this stage go over your lines carefully with Brunswick black or ink. This will enable you to handle your work fearlessly, and will lessen the danger of lost lines and temper. Then begin to chase the outline, taking care not to cut your metal in this fashion, V, but rather make an indentation thus: U. This, if rightly executed, will have marked your design firmly upon the reverse of the plate. Putting it upon its face, you can beat from the back until you have raised it sufficiently on the front to enable you to model with freedom. Having got your ornament into an advanced state, you must proceed to hammer the plate into its concave shape before finishing. This is done by laying it upon a bed of pitch, and beating steadily with the hammer.

The degree of delicacy of both labour and design can only be determined by the metal which you have under your hand. The design which I have made for you would be suitable for copper, while for work of a more dainty finish silver would be preferable. An hour spent amongst the beautiful examples of repoussé work in the South Kensington Museum will be of more use to you than any words of mine on the subject.

As to design: let it be vigorous, and tell its purpose in as few lines as possible, and above all things—be it plate or sconce, whatever you may have set your heart upon beautifying—do not let your ornament cry out at you, and thrust itself forward; let it rather accentuate the principal lines, give richness to the spaces, and always be decorous.

## THE KALLITYPE PHOTOGRAPHIC PRINTING PROCESS.

BY L. IVOR POOLE.

CLAIMS — SIMPLICITY — ECONOMY — RAPIDITY — APPEARANCE OF PRINT—MARGIN—STAINING FINGERS — DRYNESS — OVER- AND UNDER-EXPOSURE—PRINTS FROM THIN NEGATIVES—BROWN COLOUR—CHEMICAL ACTION.

ONE of the simplest photographic printing processes is that which forms the subject of the present article. Simplicity, however, in any new process is not in itself sufficient to entitle it to adoption, for no one should grudge a little extra work to ensure better results by some other means. Although comparatively new, the kallitype process has been introduced sufficiently long to enable one to judge of its qualities. There are few of us who care to take more trouble than necessary to ensure good results, either in our pursuits of matters of business or as pastime, so that when a really good process is brought forward we cannot do less than welcome it. For some time past I have been trying kallitypy, and think, perhaps, my experience may be of use to some of our readers by calling their attention to the process. As stated above, it is simple; it is also cheap and quick—not so rapid as bromide, but more so than the ordinary albumenised paper. I will take up these qualities in the order stated.

*Simplicity.*—The printing is done in an ordinary frame in the usual manner, by daylight, for the paper is not sensitive enough to be used with artificial light, like bromide. The print, which only becomes faintly visible by exposure, must next be developed; and this can be done after any interval, if they are kept dry in the dark. The development is effected by floating them face downwards for a few seconds in a solution formed as follows:—Nitrate of silver, 50 grains; citrate of soda, 1 oz.; bichromate of potash, 1 grain; water, 10 ozs.; ammonia ·880, ½ dram. This solution is used cold, so that the necessity of keeping it to a certain temperature, as in the older platinotype process, is obviated. The print rapidly develops—as stated above, in a few seconds—and is then placed face upwards on a clean piece of glass, a plate, or anything of the kind, for a minute or two, during which the print gains in brilliancy. A washing solution of the following is then used:—Kallitype developer, ½ oz.; citrate of soda, 2 ozs.; water, 20 ozs. In this the print is immersed for, say, twenty minutes, for considerable latitude is allowable, and then removed to another washing solution made of citrate of soda, 1 dram; ammonia ·880, 2 drams; water, 1 quart. This should be divided in two portions to form two separate baths, the final one of which should be renewed as soon as it assumes the slightest tinge of yellow, when it may be used as the first one of this washing solution, or be added to it. The third washing bath is for the purpose of thoroughly completing the chemical process undergone during development. The print, after being in this solution for twenty minutes, or, say, ten minutes in each bath, is finally washed in clean water for a few minutes, after which it only requires to be dried.

*Cheapness.*—The expense is inconsiderable, either for the paper or the chemicals. The former can be had cut to the usual sizes or in the full sheet, measuring 26 in. by 20 in., costing from 9d. to 10d. per sheet, according to the number purchased. Cut, the paper ranges in price from 9d. for full quarter-plate size, to 2s. 6d. for whole plate per two dozen package. For purposes where cost is of more consequence than quality, a cheaper paper is supplied at 12s. per quire of full-sized sheets. This make is recommended when large numbers, as for advertising purposes by manufacturers, are wanted; and I have seen some really excellent work done with it, though it is not to be compared with the better quality for ordinary photographs. The chemicals are both inexpensive in the first cost and economical in use, sufficient of the salts to make 10 ozs. of developer being purchasable for 1s. 3d., while the cost of the washing solutions is merely nominal. The greatest point of economy, however, lies in the fact that all the solutions can be used over and over again, and will serve for a large number of prints. By degrees the developer gets exhausted, but may be renewed by adding two grains of nitrate of silver for every ounce of the solution. The first washing bath is usable so long as it removes the yellowness from the prints, and the others should be fully charged with ammonia, and are efficacious, as has been stated, till the final one becomes tinged with yellow. It will thus be seen that there is no toning bath required, so that the costly material known as chloride of gold is dispensed with.

*Rapidity.* — Although printing is more rapid than ordinary sensitised albumenised paper, I must confess that I do not find it so rapid as it is sometimes said to be. Whether, scientifically, six times the rapidity of ordinary albumenised paper, as it is stated to be, I am not able to say; but, so far as my experience goes, the degree of extra rapidity seems to increase in ratio according to the light. That is to say, the speed, comparing it with albumenised paper, is not so great in a dull light as in bright sunshine. In a poor light the extra sensitiveness of the paper is by no means so marked.

The chief point in respect of speed is the short time in which a print can be completed, for it is quite possible to develop, wash, and dry a perfect one in three-quarters of an hour; while if only a rough proof is wanted, it can be ready in very considerably less, as the time occupied in washing may be reduced to a few minutes.

*Appearance.*—The prints are a fine black, very much resembling those produced by the bromide or platinotype processes; and, provided the right exposure be given, which is very easily learned, it is almost impossible to fail—provided, of course, that due care is taken with cleanliness and purity of chemicals. The surface is a matt one—*i.e.*, the prints are not glossy.

By using masks, a white margin may be left round any photograph, which can be written on easily as ordinary writing-paper, thus affording a ready means of writing titles, etc., on them. It may further be noted that the prints do not curl, but dry flat; so that by having them with a white margin, mounting may in many cases be dispensed with.

As against the manifold advantages connected with the kallitype process, is the fact that in working it the developing solution is apt to stain the fingers to such an extent as to remind one of the days of wet-plate photography. To avoid this, indiarubber finger-stalls or a pair of pliers, or something convenient, should be used to lift prints in and out of the developing solution. Without some such appliance, it is almost impossible to prevent the finger-nails being stained.

The paper should be kept dry both before and during exposure, as well as during any interval prior to development; otherwise it is difficult to determine whether the exposure is correct, and impossible to get a good colour. I have not, however, found that the paper is particularly susceptible to damp, so that no extraordinary precautions, such as keeping it in calcium tubes, are necessary. If it should be damp, it may be dried by the fire before exposure; but this should be done carefully, as if the paper is made too hot, the subsequent print may be "fogged." Over-exposure should be carefully guarded against, as it is impossible to counteract ill-effects from this cause, the resulting print being "mealy" in appearance or muddy-looking, and very apt to show stains and markings. Under-exposure may, to some extent, be overcome by prolonged development. The best results are naturally got from good negatives; but if these are thin, the prints may be remarkably improved by the addition of bichromate

of potash to the developer. A very small quantity only is necessary.

It is not necessary to develop, etc., in the "dark" room, but certainly the operations should not be done in bright daylight, more care, if anything, being required than with albumenised paper.

Should the print be of a sepia or brown colour, instead of black, it is probably owing to an impure citrate of soda having been used; but if there should be any difficulty in obtaining it, a suitable quality can be had from the manufacturers of kallitype paper.

A not unimportant matter in connection with prints made by this process is that they are considered permanent.

Such, in the main, are the chief features of kallitype and its working; but perhaps a few remarks on the chemical changes on which it is based may not be uninteresting; and for these particulars I am indebted to the courtesy of Mr. Lewis, the founder of the Birmingham Photographic Company, Limited, who manufacture the paper. The paper is sensitised by ferric oxalate. The action of the light changes this from a ferric to a ferrous salt. During development the processes are somewhat complicated, and may be briefly explained thus. The ferrous oxalate is dissolved by the citrate of soda, which enables it to reduce the nitrate of silver, and prevents the precipitation of iron by the ammonia. This is required to dissolve the citrate of silver which is formed by the nitrate of silver and citrate of soda. On floating the paper on the developer, metallic silver in the form of a black powder, which forms the picture, is precipitated. The bichromate of potash assures contrast, and being a very powerful oxidiser, is used in very minute quantity, for in excess it would dissolve the half tones. The final baths, in which ammonia is the principal chemical agent, fix the prints, and if this is not done thoroughly, it seems hardly necessary to say that discoloration will speedily ensue. With this *résumé* of the chemical actions involved, my remarks must be brought to a close. It may be well to add that the process has been considerably improved on since it was introduced in the early part of last year; and that, bearing in mind the demands on the "Shop" columns, it will be as well for those who meet with difficulties or want further information about kallitype to apply direct to the manufacturers. Their address is 99 and 100, Gladstone Road, Sparkbrook, Birmingham.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

FITTING BEARINGS ON BOTTOM BRACKET—FITTING THE CRANKS—TURNING AND FITTING REAR FORK ENDS—TURNING AND FITTING STEERING BARREL AND TUBE—FITTING FRONT FORKS—HANDLE-BAR, ETC.—CENTRE BRACKET—CUTTING THE TUBES TO LENGTH.

WE have now to look up the illustrations accompanying these papers in page 168, in order to find the parts of our machine requiring turning and fitting. Suppose we take the bottom bracket casting (Fig. 4, page 168). We have first of all to get a pair of knuckle-joint ball-bearings, which may be Bown's or Rudge's, or the Birmingham small arms' make, which are the cheapest of the three. The forks in the lower end of the bracket have to be filed out to fit the knuckle-joint. (See Fig. 4B.) To file them both straight and true with each other, they should be finished with a long flat file, and both at once, to ensure their being true, so that the two bearings will, when fitted, be truly parallel with each other; as, unless they are so, when the axle is inserted it will only run freely in the bearings if they are truly set in line. The knuckle-joint should fit the fork tightly and without shake, as, apart from the unpleasantness of pedalling with loose, shaky bearings, the shaky movement twists the shaft in the bearings at every stroke, and in a very short time destroys them. The bearings neatly fitted, bolt-holes must be bored through the jaws of the fork to carry the bearings. These are usually $\frac{5}{16}$ in., and require to be very accurately bored, in order to meet the hole in the knuckle-joint, which must not be tampered with in any way. As the forward ends of the rear tubes are bolted to the back of this bracket, it is necessary to file the back edges quite true, as also the face of the cross-plate on the end of the rear tube. This plate is also bored with $\frac{5}{16}$ in. holes, for bolting on; the lower end is held by the bolt that holds the bearing, and the upper end by a similar bolt passing through the fork at the semicircular projection.

The two sockets on the top have to be bored or reamed out to fit $1\frac{1}{8}$ in. tube. This done, the whole bracket is filed up neatly; and at this stage the pedal shaft should be fitted.

The pedal shaft is a piece of round $\frac{3}{4}$ in. steel; $7\frac{1}{2}$ in. long over all. It is turned for bearings and cranks, as shown at Fig. 16. The central part, which is $\frac{3}{4}$ in. thick, is $4\frac{1}{4}$ in. long; on this part, as indicated at W, the chain-wheel is keyed on. A good long flat, at least $\frac{3}{8}$ in. broad, is made on the $\frac{3}{4}$ in. part of the shaft, and a key-slot in the boss of the wheel, with a key of steel well fitted. The chain-wheel is to be keyed on the shaft, exactly in line with the cog on the rear wheel hub; and, of course, this cannot be done till that wheel is in its fork. Meantime, fit the two sleeves of the ball-bearings (see Fig. 16) on to the parts marked B, B on the shaft. These sleeves, which should have a $\frac{11}{16}$ in. hole, have each a small flush set-screw, which enters a small hole in the shaft. Of course, these two sleeves must be placed on the shaft, so that when the balls are inserted the cases will hang parallel in the bracket, and the shaft turn freely when the bearings are adjusted. The parts C, C are reduced to $\frac{5}{8}$ in. for the cranks, the boss of which is usually $\frac{3}{4}$ in. through the hole. The cranks should be bored first, and the shaft ends turned to fit. Now, cranks may be keyed on hard and fast, or they may be detachable. Keyed-on cranks are cheapest, but they have a nasty trick of coming loose when not wanted to. They have also a nasty trick of resisting every attempt to get them off when wanted. (For keyed-on cranks, see Fig. 17.) A flat is made on the parts C, C on opposite sides of the shaft; then cranks are slotted, and keys fitted same as for the chain-wheel. In detachable cranks (Fig. 18), a pin with a nut passes edgeway through the boss end of the crank, as shown; the hole bored for the pin cuts a piece out of the shaft. After the hole is bored it is made taper, and a taper pin fitted; this pin is often flat on one side, and a flat filed out of the shaft to fit. When a crank of this sort becomes loose the pin is simply drawn in, and the nut takes and keeps it up; by removing the pin, the crank may be readily taken off; hence its name, "detachable."

If the cranks are bought as rough stampings, they have got to be bored for shaft, slotted or bored for keys, filed out in the long slots for pedal-pins, then finished up and polished for plating.

Now we will lay this bottom bracket aside, to be taken up when the tubes are fitted and brazed.

Fig. 6 (page 168) is the fork end for the rear wheel. The one shown is that for the left side, having the extension for the step. The hole for the step is tapped $\frac{3}{8}$ in. The centre hole for the adjusting screw should be bored and tapped $\frac{5}{16}$ in., and a square-headed pin fitted; this pin is 2 in. long. Now the tenons A and B are turned: A to fit inside $\frac{3}{4}$ in. tube, and B inside $\frac{5}{8}$ in. tube. The shoulders should be cut square in, so as to ensure a good joint when the tube is fitted. These parts may now be laid aside, as they will require to be filed up after brazing, and the screw-holes cleaned out with the taps.

Fig. 7 (page 168) is one form of step which is commonly used. A rubber step would simply have a $\frac{3}{8}$ in. pin about 2 in. long, and a foot-rest rubber put over it with a $\frac{3}{8}$ in. nut on the end.

We now take the steering barrel (Fig. 8, page 168) in hand, with the front fork crown. The two ends of the barrel have got to be coned out in the lathe. For this purpose it is mounted on a mandrel, like Fig. 19. The ends of the mandrel are reduced to $\frac{5}{8}$ in., to allow a side-cutting tool to work in making the coned parts. The cones are made to an angle of about 60°. This done, the outside of the barrel is turned on the same mandrel, all but the parts where the projecting sockets interfere. Opposite these the file must be used. The two sockets are now cleaned out to fit $\frac{1}{8}$ in. and $\frac{5}{8}$ in. tubes respectively. Then the inside of the barrel is reamed or bored out, to allow the 1 in. tube to pass up easily. This 1 in. tube, called the "steering tube," has got to be fitted to the top of the fork crown, A (Fig. 8); and from the abutting shoulder of the tube the coned part falls away, as shown. This is of the same angle as that in the barrel, so that the one will fit neatly on the other. The crown piece may have a $\frac{5}{8}$ in. hole bored through its centre to lighten it, or a $\frac{3}{8}$ in. hole may be bored and tapped for a screw to fix the mud-guard. This hole must be bored and tapped before the forks are brazed on. These may now be fitted to the two tenons, B, B (Fig. 8), on the crown piece. These should be fitted without shake, and to fill the forks all round, else they will not be good brazing joints. The forks have to be pinned on with $\frac{3}{16}$ in. wire pins, or screws of the same thickness, which are sold for the purpose. But before pinning them on, the lower ends of the forks should be prepared for the front wheel axle, or pin. First of all, the two forks should be made exactly one length, and that length to allow 1 in. clear between the rubber tire and the fork crown, as this is the space required for the brake-spoon. A common practice with hollow-front fork ends is to squeeze them, shut in a vice, and bore the hole for the shaft through the two thicknesses. This is a slipshod method, though it is done by good makers. A better plan is to have solid ends, as Fig. 20, brazed into the fork ends. These are $\frac{1}{4}$ in. thick, and the holes for the screwed parts of the shaft are $\frac{1}{2}$ in. These two solid pieces when brazed into the forks have to get a little set inwards, to be parallel with each other where they abut on the hub ends. The fork ends should be nicely filed up after brazing, and the axle holes bored before they are pinned on to the crown piece.

Returning to the steering tube, which is 11 in. by 1 in. outside diameter, we have to fit a ring or collar, C, coned to fit the upper part of the barrel. This ring is ¼ in. thick, and stands ½ in. above the end of the barrel. A small flush set-screw is put in for adjustment, which presses against the side of the tube, without any perforation to receive the point, which should be blunted or flattened off. On the upper end of the steering tube the lamp-bracket collar is fitted and brazed. This serves a double purpose, as it has the binding screw behind and the lamp bracket in front. The adjusting screw in this is $\frac{7}{16}$ in., tapped. The handle-bar tube, a part of which is shown in the figure, is 8 in. long, and should pass freely inside the inch tube, though without shake. Inside this ⅛ in. extension tube a piece of ⅞ in. tube should be driven, so that the two thicknesses may the better resist the pressure of the set-screw. Sometimes the extension piece is made solid for this reason. The handle-bar T-piece is a stamping or casting (see Fig. 21), with a hole bored horizontally to admit a ¾ in. handle-bar. The tenon A is turned to fit inside the ⅞ in. extension tube. This tenon is about 1 in. long. It takes 32 inches of ¾ in. tube to make a handle-bar. They are now made of many forms and twists, some of them remarkable only for their ugliness. I usually make the handle-bar as in Fig. 22, with a rather sharp turn at B, B, 8 in. from the ends. The horn handles take up 4 in. of this. The T-piece must be fitted on before the second bend is made, as it cannot be put on afterwards. After making one bend, draw it on a board with pencil, and make the second bend to fit the drawing. The T-piece should, of course, be placed in the centre of the straight part, and it must be set before pinning at an angle to fit the steering tube, as in Fig. 1 (see page 33), where it will be seen that the bar is level to within an inch of the horn handle, when it is bent downwards, allowing a more natural grip of the handles. In plan, however, the bar looks as if straight after leaving the bends, as in Fig. 22. The handle-bar, with its extension piece, should be finished up and polished for plating before the horn handles are put on. If the lamp-bracket collar, above referred to, is neatly fitted to the tube, and two small flush screws, one on each side, inserted to bind it to the tube, the brazing may be dispensed with, and the bracket can then be plated, which adds considerably to the appearance of the machine. The adjusting collar, C, is also plated.

We now turn our attention to what may be called the centre-frame bracket (Figs. 9 A, 9 B, page 168). To this part we have no less than four tubes attached, as well as the L-pin and its binding screw. The part containing the L-pin is vertical, the L-pin hole ⅝ in. and the metal surrounding it $\frac{3}{16}$ in. The upper projection is the socket for the upper tube of the frame that runs forward to the steering head. The lower projection is simply a solid part, through which a ⅜ in. hole is bored, and tapped $\frac{7}{16}$ in. for a set-pin to bind the L-pin. The part of the bracket drooping away from the L-pin socket has the eye or socket for the bent tube 1⅛ in. diameter. On the sides of this are the two long sockets for the rear tubes, ⅞ in. diameter. (See Fig. 9 B.) S S is a full-size section of the central part of the bracket. This is a part of the machine that cannot be bought of any of the makers or dealers in this form; consequently, a pattern has got to be made, from which any number may be cast in malleable steel—or cast steel, as it is called. For the benefit of those who would prefer to buy all the parts without troubling about pattern making, I here show (Fig. 23) a bracket for this part of a diamond frame. This is used by several makers in lieu of Fig. 9. It is bought in the rough, and the tenons turned to fit the frame tubes. The two rear tubes join on to it by a bolt passing through an eye on the end of each tube, and through a corresponding lug on the rear of the bracket. (See A, Fig. 23.)

Fig. 16.

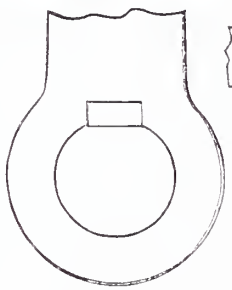


Fig. 17.

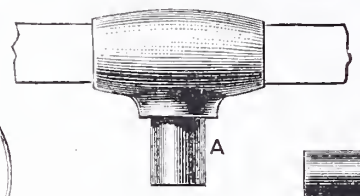


Fig. 21.

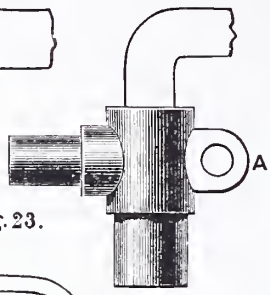


Fig. 23.

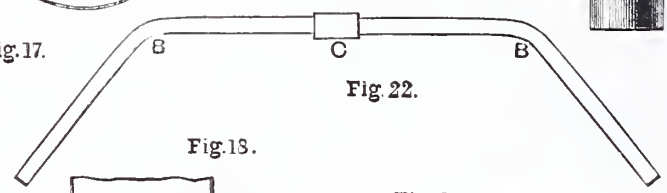


Fig. 22.

Fig. 18.

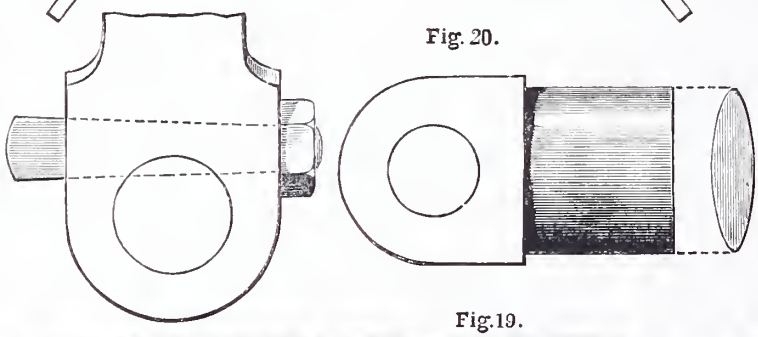


Fig. 20.

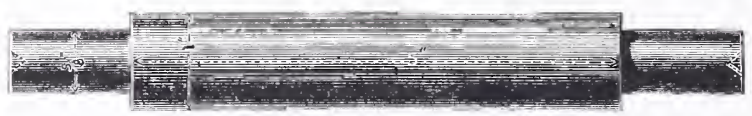


Fig. 19.

Fig. 16.—Pedal Shaft (half size)—W, Chain-wheel Boss. Fig. 17.—Crank keyed on (full size). Fig. 18.—Crank with Collar and Nut (full size). Fig. 19.—Mandrel (half size). Fig. 20.—Stamping for Fork End (full size). Fig. 21.—Handle-Bar T-Piece (half size). Fig. 22.—Handle-Bar (⅛ full size). Fig. 23.—Bracket for Ordinary Diamond Frame (half size).

With regard to the bottom bracket above described (Figs. 4A, 4B, page 168), the same objection to pattern-making may obtain. There are quite a lot of styles of bottom ball bracket in the market, from which our cycle-maker may choose, if he refuses to face pattern making. Being a pattern maker, the thing offers no difficulty to me, and I show in these papers my own designs of certain parts, which, of course, have got to be made from patterns not being in the regular market. The fork-bottom bracket, as shown, is my own; and I am satisfied that while it may not be the best, it is much better than many in the market.

Several of the dealers in cycle material issue elaborate catalogues, in which most of the parts are illustrated, and from which the buyer sees what will suit him, there being generally a variety of patterns of the same thing. I should, however, advise our cycle maker, if he is anything of a mechanic, to make all he can make, else he will hardly be able to say he made his machine.

I have now gone over most of the parts of the frame, except tubes and brake work.

The parts here treated being finished and placed in position upon the full-size drawing, the exact length of all of the tubes will be readily measured. The tubes, being cut to the proper length, are to be filed dead square on the ends: this is done with the tube caught upright in the vice. A small engineer's square is used to the ends when filing. The square is applied at three or four different places round the sides of the tube, with the blade across the end. In this way all the tube ends are treated that abut on a shoulder on the solid connections. Those, however, that enter sockets need not be squared on the ends. All tubes that are to be brazed into socket should have an inch or so on the *outside* cleaned with a file; likewise all tubes that have tenon pieces entering them, such as those squared on the ends, should have an inch or so of the *inside* filed clean. This is done that the brazing metal may take proper hold. These connections, moreover, should be kept quite free from dirt or grease. All brazing joints have got to be pinned—that is, small holes must be drilled through all junctions of tubes and solids. If plain wire pins are used, it is best for them to pass quite through both sides, and rivet at the ends, as a plain pin through one side only is apt to drop out while in the fire. Most makers use small $\frac{3}{16}$ in. screws for holding the parts, called "brazing screws." Being screwed in, they do not drop out. The object of this pinning or screwing is to prevent the parts of the frame moving in their sockets while in the fire; as, though they may be tightly fitted, they soon get loose under the heat, and, having been set

rue to square before pinning, it is very lesirable that they should remain so.

I fear I have given many of my readers rouble by referring them to diagrams that ıave appeared in preceding chapters. I am orry to have done this, but it will, I think, ›e perfectly clear to them that it is a case ›f necessity. The repetition of figures ılready given could not be expected, as he adoption of such a course would involve he sacrifice of much valuable space, and, n consequence, there was nothing left for ne to do but give references, so that the liagrams may, at least, be easily found.

The "Loop" or "Bend" Shortening (Fig. 55) is the simplest of these. The rope is merely bent as much as is required, so as to form two bights, and the two parts seized together with small stuff. This is a simple and good method of shortening ropes.

The "Chain Knot" (Fig. 56) is another method of shortening ropes. In commencing it, we make a running knot (Fig. 57), and then draw a portion of the part A through the loop B; this is done with the forefinger and thumb of the left hand. It will now form another loop, through which a fresh piece of A is to be passed. This process is to be repeated until all the slack of the rope is taken up. There are two ways of finishing it off: either by putting a piece of stick or belaying-pin through the last loop, or by drawing the end itself up through the bight.

The "Twist Knot" (Fig. 58) forms another handsome shortening. In commencing, we place the cord to be shortened as in Fig. 59. One of the outside parts is then brought over the middle strand, and the outer strand on the opposite is brought over this, which is now the middle part. This is continued as long as required, the outside strand alternately being placed over the centre strand, as in an ordinary three-plait. Fig. 58 shows the plait completed, and the way of finishing off the end. These shortenings are ornamental as well as useful. Among other purposes, they may be used for thickening a piece of small cord, so as to give more substance where it has to be hauled upon, and thus prevent the hand being cut with the cord.

Fig. 60 is the "Sheepshanks" or "Dog-shanks"—a very old-fashioned method of shortening, and one that is a good deal used, as it is applicable to any size of cordage. The twist and chain knots are not suitable for very stout rope. Two bights are formed in the rope, as in Fig. 59; a half hitch is then made at each end, and slipped over the bights. This is made more secure if a seizing is put round the two parts, at A and B. It can also be secured when ends of rope are free by passing each end through adjoining bight, as shown in Fig. 61.

Fig. 62 is a "Knotted Sheepshanks." This is very similar to the last, the only difference being that the ends are fastened in a rather different way. The two bights are made as before, and each end, after passing through the bight nearest to it, is put through the bight it has just made, thus forming an overhand knot at each end.

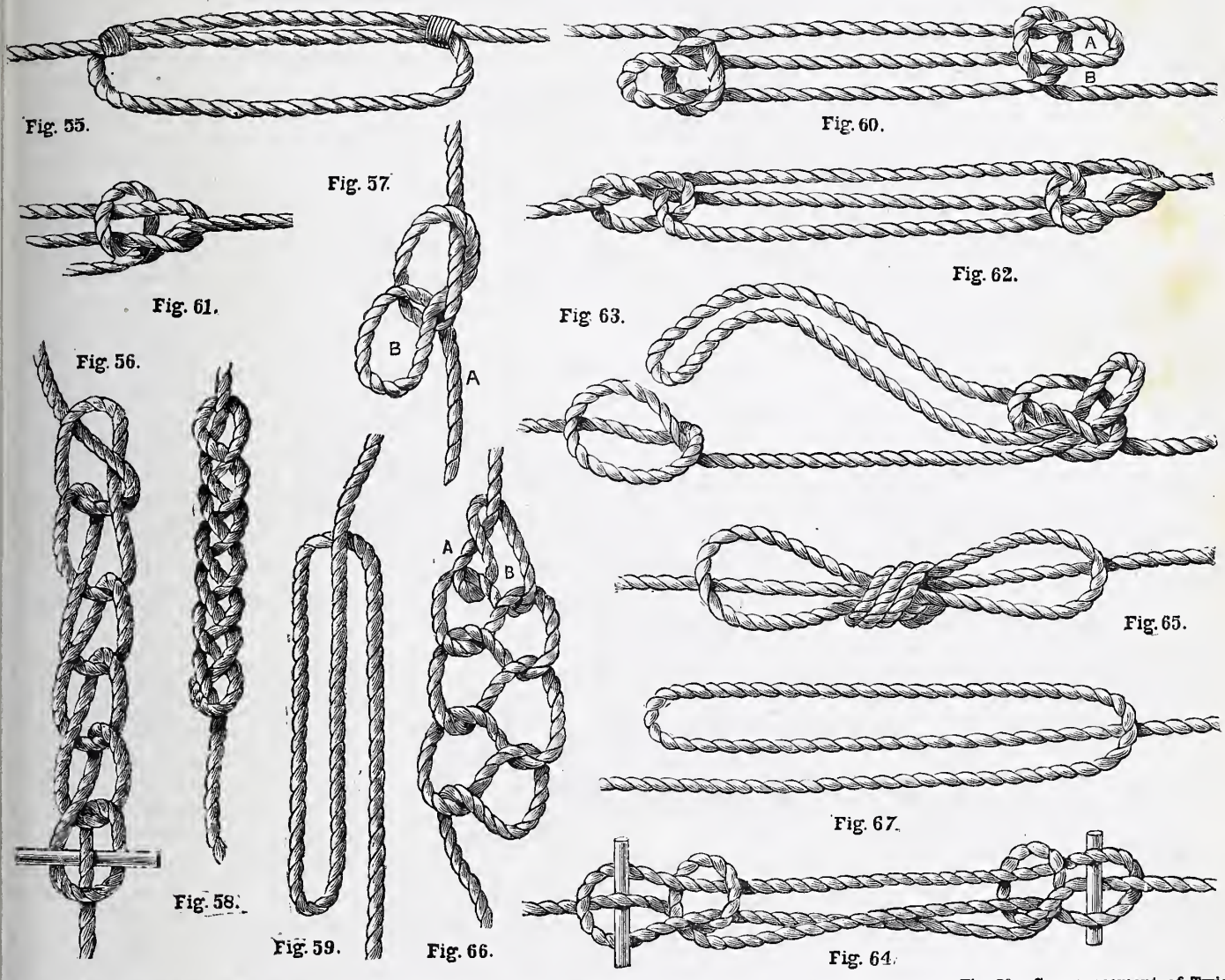



Fig. 55.—Bend Shortening. Fig. 56.—Chain Knot. Fig. 57.—Commencement of Chain Knot. Fig. 58.—Twist Knot. Fig. 59.—Commencement of Twist Knot. Fig. 60.—Sheepshanks. Fig. 61.—Sheepshanks fastened. Figs. 62 and 63.—Sheepshanks knotted. Fig. 64.—Boat-Knot Shortening, or Sheepshanks toggled. Fig. 65.—Knot Shortening. Fig. 66.—Double Chain Knot. Fig. 67.—Double Chain Knot connected.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Shortenings.

Bend Fastening—Chain Knot—Twist Knot—Sheepshanks—Sheepshanks Fastened, Knotted, and Toggled—Knot Shortening—Double Chain Knot.

It frequently occurs that a rope is too long for the purpose for which it is required, and as it would be inadvisable and wasteful to cut it, some method of reducing its length had to be devised; hence arose what are termed "Shortenings."

In making Fig. 63, the parts of the rope are arranged as before. A marlinespike hitch is made at each end, and the bight put through it. The left side of the figure shows the knot made, and the bight in the act of being passed through it. It goes over the outside strand, under the centre one, and over the next. On the right side of the drawing the loop is shown in its place, ready to be hauled taut.

The "Boat-Knot" Shortening (Fig. 64) is another form of Sheepshanks. In this the ends are secured by bringing a portion of the loose part of the rope through the bight at each end, and toggling it with a belaying-pin or piece of wood, as in the Boat Knot. This has the advantage of being loosened very readily. This can be made when both ends of the rope are fast.

The "Knot" Shortening (Fig. 65) is a ready mode of taking up the slack of a rope, though it is not suitable for very stout ropes. It can only be made, however, where one end of the rope is at liberty. The rope is laid as at Fig. 67. The three parts are then grasped with both hands near the bights, and an overhand knot is formed with the whole of the strands. It forms a good shortening for moderate-sized cordage, where the strain is not too heavy.

The "Double Chain Knot" (Fig. 66) is perhaps the most ornamental knot of this group. A turn is first taken round the standing part, and the loose end is then passed through the loop thus formed at A. In doing this another loop (B) is made, through which the end is brought. The end is thus continually passed from one side to the other through the preceding loop until the knot is of the proper length. It may be finished, if required, by making an overhand knot with the end over its own part, or merely passing it through the last loop, and hauling on it.

## THE MAINTENANCE OF A TRUE HORIZONTAL AND LATERAL POSITION IN DRAWERS WHEN PULLED OUT TO THE FULLEST EXTENT.

BY THE INVENTOR.

DROPPING OF DRAWERS WHEN DRAWN OUT—MODE OF PREVENTING THIS—NATURE OF INVENTION—FLAPS—HOW AND WHERE FIXED—ADVANTAGES OF INVENTION—CASES IN WHICH INVENTION IS SPECIALLY APPLICABLE.

IT is well known that drawers, however well made, are very liable to, and usually do, stick when being pushed in, unless during such operation they are held in a true position. For instance, when drawers, as at present constructed, are drawn out more than half way, they invariably *drop*, so that to enable such drawers to be easily pushed in (when out for more than the distance referred to) it becomes necessary to raise the drawers at the time of pushing them. It is also necessary to apply the pushing force centrally. For instance, in drawers as at present constructed, should they be provided with two handles, they often stick if only one handle be used.

The inventor claims that a drawer, when constructed with the following simple improvements (for which a patent has been applied for), may be drawn so fully out that the *back* of the drawer may be flush with the front of the cabinet, and that drawers when so drawn out can be moved in again with the greatest ease, however carelessly pushed. Nor is it necessary that care should be observed in the pulling out of the drawers, as a stop should be fixed to prevent their being pulled out altogether.

The invention consists in fixing to the back of each drawer hinged flaps, which open as the drawer is pulled out. For ordinary drawers three flaps are used: two (one at each side) which when open fall downward and keep the drawer laterally true; and a centre flap which opens out like an ordinary door, this flap keeping the drawer horizontally true.

Fig. 1 shows an elevation of the back of a drawer fitted with such flaps closed. The thickness of the flaps may be $\frac{1}{2}$ in., or less; a drawer with $\frac{1}{2}$ in. flaps would be only less by this thickness than the width of the cabinet.

Fig. 2 is a sketch of the flaps when open. The flaps, being prevented by checks from opening to more than an angle of about

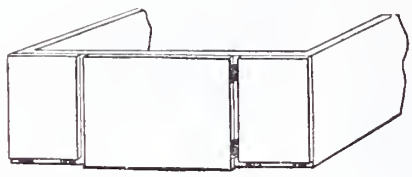


Fig. 1.

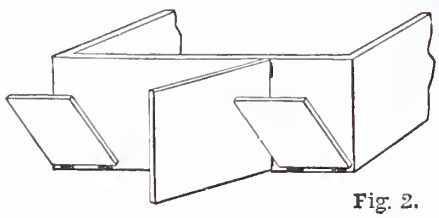


Fig. 2.

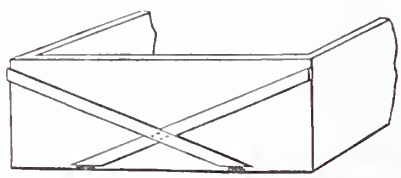


Fig. 3.

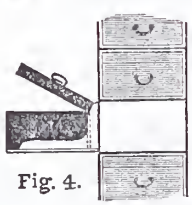


Fig. 4.

Fig. 1.—Back of Drawer fitted with Flaps closed. Fig. 2.—Back of Drawer fitted with Flaps open. Fig. 3.—Substitute for Central Flap. Fig. 4.—Sliding Shelf fitted with Flaps.

45 degrees, will close of themselves as soon as they press against the back of the cabinet, should they not be closed before reaching the back when the drawer is being pushed in. It is suggested that a slight spring be fixed to each flap, to force it outward, though it will be found that even without a spring the flaps, by friction against the sides, do in practice usually open of themselves.

Drawers fitted with such flaps *cannot*, however far they may be out, stick when being pushed in, because the flaps which act as guides touch the sides, and these flaps, when the drawers are being pushed in, coming in contact with the sides, commence closing, and so give the drawer a start to slide easily. The expense of providing such flaps is trifling, as they can be made of deal wood.

The vertical flap, which keeps the drawer from *dropping*, is necessary if it be intended to pull out the drawer more than half way; but where it is not considered necessary to pull it out more than half way, then the vertical flap (the centre one) may be dispensed with, and one flap extending across the back of the drawer, fitting the sides, is all that is necessary. This flap may be simply made with two pieces of wood crossed, as in Fig. 3, which shows this description of flap closed.

The inventor considers, though, that the chief advantages to be derived from the invention (for which object the flap which opens vertically is also used) are, that drawers may, when so fitted, be drawn *fully* out, and may be pushed in again with the greatest ease. No care as to the manner of drawing out or pushing in need be observed, as the drawers will be found to move freely however one-sided or carelessly the necessary force is applied.

It is obvious that drawers which can easily be drawn *fully* out and pushed in again must possess advantages over those which do not permit of this. Drawers, as at present constructed, cannot be pulled fully out, and consequently their whole capacity is often not utilised.

Drawers of small width are at present the most liable ones to stick when being pushed in, and so their utility is impaired. This invention entirely removes the difficulty, and the inventor is of opinion that drawers of small width will now become more used. The invention should be especially applicable to drawers containing heavy weights, such as coin, etc. Sliding shelves may also be fitted with this invention, and shelves so fitted would be especially useful for the reception of deed and other boxes, as the drawers could be pulled out and the boxes opened whilst they were still upon the shelf, as in Fig. 4.

This is the only invention which permits of the drawer or shelf being *fully* drawn out without any supports in front.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

FORMATION OF RINGS—PUCKERING OF METAL DUE TO BENDING—BENDING BLOCKS—BLOCK FOR BENDING FLAT BARS—BLOCK FITTED WITH SCREW FOR GENERAL WORK—DETAILS OF RING FORMATION—WELDING ENDS—APPLIANCE FOR LIFTING HEAVY RINGS—USEFUL BLOCK FOR MAKING RINGS IN QUANTITY.

IN previous papers in Vols. I. and II. of WORK I have taken a general survey of the various typical operations performed by the smith. The historical and ornamental branches of smiths' work formed the first section; the general practice of modern forging by drawing down, upsetting, welding, and shaping by various tools, with some practical examples, formed the second. In this, the third series, I shall discuss certain of the special operations and branches of this craft, which, though not of necessity distinct from its general practice, can nevertheless be better treated under separate headings. In this way I hope to write on the methods of making holes, on the working of steel, the making of tools, hardening and tempering, model work, repairs, and some other matters of a special character. The present paper will deal with the formation of rings.

Curves and rings of light section are easily bent over the beak of the anvil or around a mandrel of suitable diameter. The case is different when the sections are heavy, and then some kind of appliance is necessary. I shall therefore describe some serviceable bending blocks.

It is easy enough to bend iron flatwise, but not so easy to bend it edgewise. The reason

apparent if we consider that when a wide ar is bent two things must happen. Along ıe centre of the bar (Fig. 1, A A) there will e a portion of metal that is simply bent, ithout compression or extension of fibre. ut on the outside, B B, of this neutral axis ıere are successive zones of metal that re variously extended, and on the inside, C, of this axis there are zones of metal ıat are variously compressed. We know hat must happen then. The metal in ension and the metal in compression will eek relief from the intense stresses to hich it is subjected by corrugation into lanes above and below that of the main ody itself. It will become wrinkled and uckered upwards and downwards. This endency has to be corrected by hammering, r by the use of mechanical devices.

Quite an infinity of devices are resorted o in the smith's shop for the purpose of ending work of various sections and outnes. The making of a cast-iron templet r bending block is a question of relative ost. In some cases, where only a few plain ieces have to be bent, it will not pay to ake the simplest block. In others, where here are dozens, scores, sometimes hundreds f pieces, all alike, it pays to cast the most laborate blocks, and fit them up with lips and cottars, or whatever besides may e necessary. Of course, I cannot show a ithe of the blocks that may be formed. When a smith sees what is wanted in forgngs, it is usually easy to design blocks for hose forgings.

Fig. 2 shows a very common type of block ısed for bending flat bars. Made in suitble sections, it is also often employed for ending T-iron. As drawn, the working dge, A, is a regular curve; but other urves could be imparted to it equally well. The block has a stout cottared pin cast in it, rojecting from its bottom face. This pin asses through a suitable hole in the levelng block, C, and is cottared beneath. This s, on the whole, the most convenient nethod of holding cast-iron templet blocks lown—better than having movable clips. ), D are clips, by which one end of the bar, E, to be bent is confined in its groove. They ıre fastened with bolts through some of he holes which are usually cast in profusion n all bending blocks, and the cottar, F, passng through slot holes in D, D, holds the ar, E, fast down in its groove. As the free nd of the bar, E, is carried farther round, nore clips are brought to bear upon it; otherwise, the bar would rise up from its eating.

Fig. 3 shows a common levelling and bending block, fitted with a screw for general work. Such a block is useful for several purposes. Upon it, bars and plates of metal that have to be made true can be straightened and levelled by hammering. From its face, many forgings in process of formation can be tested by the square, one edge of the square being laid upon the block, and one edge against the vertical face of the work. The bevel can be similarly used. Work can also be taken out of winding upon its surface; and it is used largely for bending iron bars to various curves. The block, A, is pierced with numerous holes of circular, and of slot, shapes, for the purpose of receiving pins of various kinds, which form the necessary points of leverage when bending. There should be no stint of holes, short of unduly weakening the plate. At B there is a screwed block, secured to the plate with a shank or pin through which a cottar way passes. The driving-in of the cottar underneath secures this block in position, and by the interposition or removal of a ring the height of the block can be varied. Through the block the powerful square-threaded screw, C, passes, and is operated by the heavy cross, D. It is evident that if pins be inserted in holes, say, at *a*, *a* or at *b*, *b*, they will afford points of resistance to a bar that is laid against them when pressure is brought to bear about its central portions by the screw, C. As the ends of the bar cannot yield, the result is that it will become bent. By shifting the positions of the pins into other holes, the curvature of the bar can be varied at pleasure.

Fig. 4 illustrates another method of the making of a ring upon the bending block shown in the previous figure. A is the block itself; B is a sweeped templet casting, cottared down to the levelling block through the medium of rough holes cast in the sweeped templet, the pins passing through any of the holes cast in the bending block that happen to be conveniently situated. The block is set so that its curvature is made to follow round some particular hole in the bending block, in order that the radius bar or lever, C, with its roller, D, may operate with equal pressure upon the ring E in every position. The lever moves upon a substantial pivot, F, whose shank or pin passes through the plate, and is cottared below. The detail of this fitting is shown in Fig. 5, where F is the solid body of the shank, whose pin, G, passes through the bending block, A. H is the pin upon which the bar, C, pivots, and J is a collar, one or more in number, for adjustment for height. K, K are top and bottom cottars.

One end of the bar, E, to be bent (Fig. 4), being heated, is first secured at one end of the curved templet. As these templets are of necessity of quite a special character, made to suit each special job, and not for general work, it is usually praeticable to cast a stop at the end where the bar is first secured. Such a stop is shown in Fig. 4, at L, and in detail at Fig. 6.

This particular templet represents one used for making rings from which to cut the reversing links of the motion work of engines, the links being of the type shown in Fig. 7. Where such links are made in quantity, this is by far and away a cheaper method than forging and filing, or machining each link separately. Making a ring with radius equal to the curvature of the link, it is turned all over in the lathe, and then the separate links are slotted out of this ring—a dozen or fifteen, as the case may be, and all are exactly alike.

In such a case as this, a flat oblong stop, L, cast on one end of the templet block, is suitable. We know that when bending any rigid article it is very difficult to get the extreme ends properly curved—they stick out at a slight tangent. Now, in this case, the stop will hold the end perfectly fast, and the curvature can be commenced from the very end.

To prevent that end from rising during the process of bending, the clip, M (shown in detail at Fig. 6), is made to bear upon it. This is a piece of wrought iron of stout section, pierced with a hole for the cottared pin, N, screwed into the bending templet. The long leg of the clip rests upon the face of the bending block; the short leg is pressed down upon the bar to be bent by the pressure of the cottar. The bar is thus pinched at one end.

The opposite end, if heavy, is supported by one of those kinds of appliances common in smithies (see Vol. II., p. 805, Figs. 114, 115). A man, or two or three men if need be, stand at that end, and pull the bar by main force round the curved templet, the supporting rest being moved along with the bar. The bar has a tendency to crumple up along the portion where the bending is taking place. This is corrected by hammer blows from a sledge. Also to prevent the bar from becoming curved to unequal curvatures, pins are inserted at intervals in holes cast in the plate, and iron wedges, o (Fig. 4), are driven between these pins and the bar.

Much force is required to pull round the roller, D, against the edge of the iron. To avoid having a long lever sticking out in the way, a bar, P, is often slipped over the end of the radius bar, C, and removed when not in actual use. The mechanism of the roller, D, is shown in detail in Fig. 5. A block, Q, slides along the bar, C, and may be wedged at any radius with the wedge, R. A stout bolt, S, is tapped into or forged on this block, and the roller, D, slips over it, and is held up by the nut underneath.

In an ordinary forge fire a heat cannot be taken over a great length. Therefore, after a short section of a bar is bent, say, from twelve to fifteen inches, it has to be released from the templet and put back into the fire to get the next section hot; and so on, and so on, until the entire ring is complete. Each time it is put back on the block the portion already curved is secured with wedges. Sometimes also one or two clips like M (Fig. 6) are cottared down over the bar to prevent it from rising up. When the curvature is completed and the circle formed, the ends have to be welded.

The ends of the ring are upset before being brought into juxtaposition, as is usual in making weld joints. They are spread out in all directions—top, and bottom, and edges. But these upset edges are not welded to each other, but are united by means of intermediate "stick in" pieces, thus:—Into the V-like space on one side formed by the abutting ends, a square bar of iron (Fig. 8, A) is laid, and all being simultaneously brought to the welding heat, a few blows of the hammer serve to produce union of the bar and the ends of the ring. The bar is not cut off to the neat length required at first, but any length of bar that happens to be handy is taken, and the end only is brought to a welding heat, the opposite cold end serving as a porter. After the welding is done, the supplementary end is cut off with the hot set.

The ring is then turned over, and a similar "stick-in" piece, B, welded into the opposite V, precisely in the same fashion as in the first case. Of course, the surfaces and edges are very rough and uneven; but the essential work is accomplished, and the rest is merely a matter of battering off the faces with the flatter, and the trimming of the edges with the hot set and flatter.

A heavy ring such as this cannot be manipulated by hand until the men's hands are relieved of its dead weight. Fig. 9 shows a simple and effective rig-up for this purpose. Use is made of the movable jib, which in some form or another is a belonging of most forges. The jib is pivoted against the wall. Upon its cheeks, A, A, runs the jenny, B, consisting of four wheels and carriage, with depending hook, C.

To this hook is attached a lever having a long arm, D, and a short arm, E. At the end of the short arm there is a square nut, F, screwed to take a coarse, square-threaded screw, G, which passes up clear by the side

of the crane. At the lower end of this screw there is a swivel, H, through which the screw works, being turned by a podger passing through the hole in the boss at the lower end of the screw, G. From the lower end of the ring, being rapid and immediate in action. The exercise of very little force, such as a man can apply with one hand, is sufficient to raise and lower the ring upon the anvil or the bending block. It can then

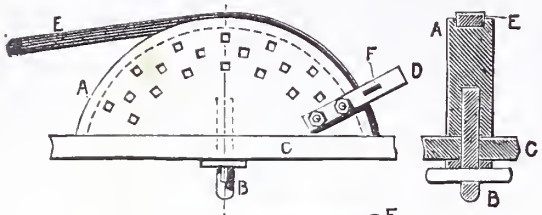
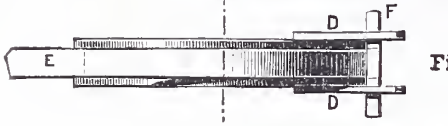



Fig. 2.



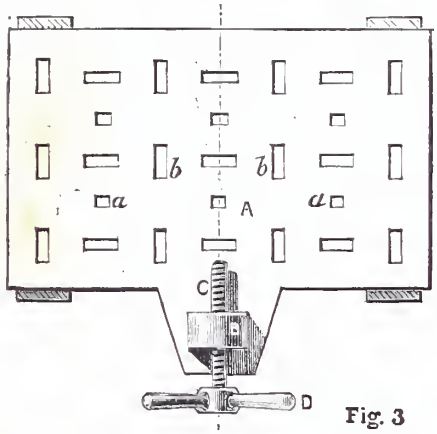
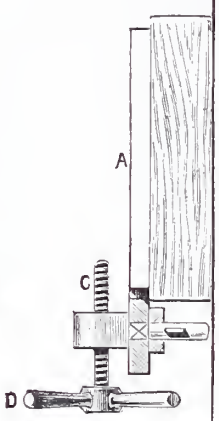
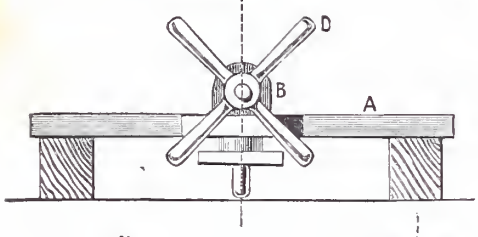




Fig. 3.



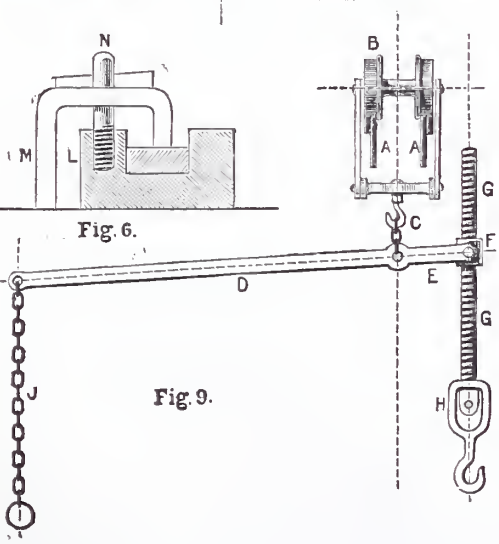




Fig. 6.

Fig. 9.

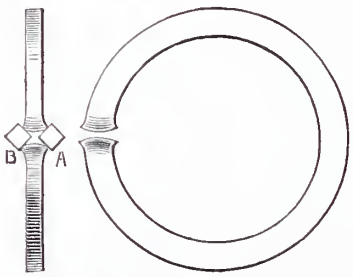



Fig 8.

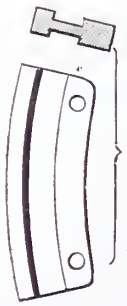


Fig. 1

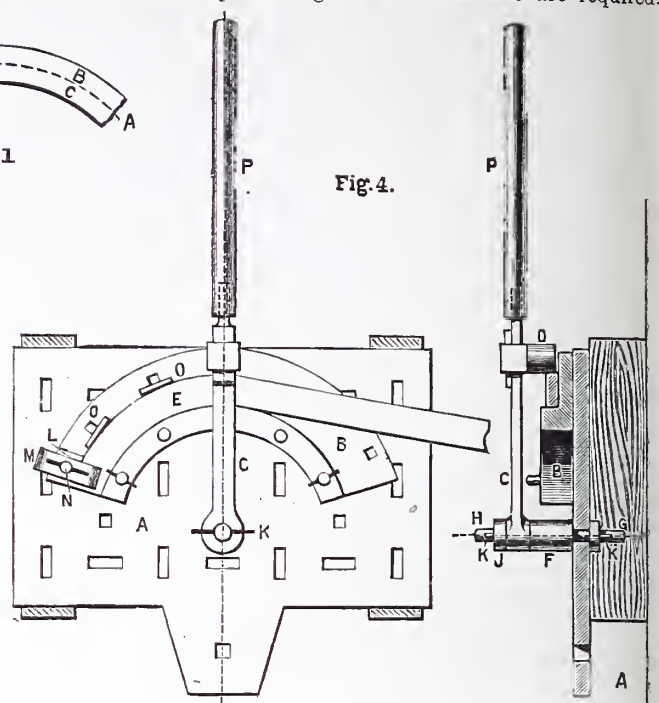



Fig. 4.

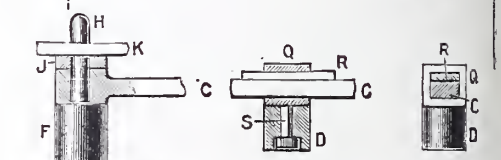



Fig. 5.

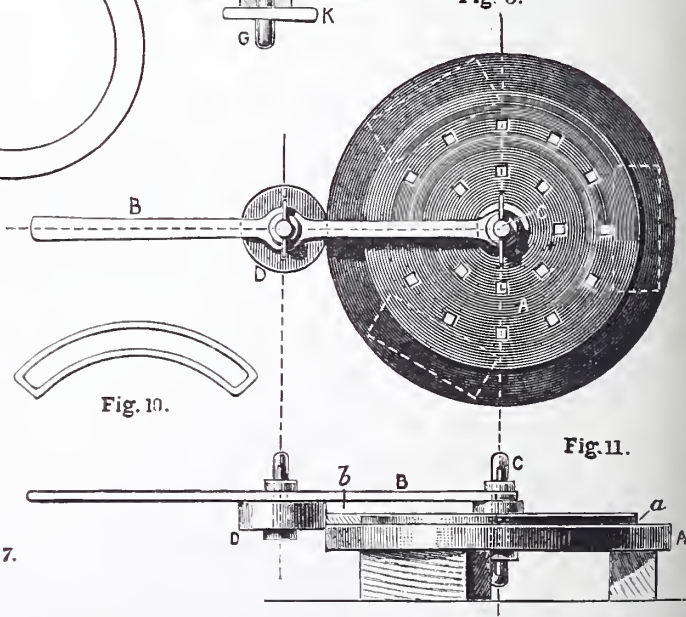



**Fig. 1.—Diagram to illustrate Tension and Compression. Fig. 2.—Bending Block. Fig. 3.—Levelling Block, with Screw. Fig. 4.—Ditto, with Bending Templet. Fig. 5.—Details of Lever. Fig. 6.—Details of Clip. Fig. 7.—Reversing Link. Fig. 8.—Welding the Ring. Fig. 9.—Apparatus for lifting Heavy Forgings. Fig. 10.—Iron Segment for increasing Radial Capacity of Templet. Fig. 11.—Circular Bending Block.**

swivel depends the chain and clip in which the ring is suspended. Now, adjustment can be made of the height of the ring, first by turning the screw, G, the range of height being equal to the length of the screw ; and second, by pulling at the chain, J, at the long end of the lever. The latter is the adjustment used during the manipulation of be turned about, or turned over, or moved in any position that may happen to be required.

If a ring, or segment of a ring, is wanted larger by a few inches only than the ring, B (Fig. 4), for which the templet is primarily made, the smith will, to save the expense of a new block, make a filling-up-piece (Fig. 10) of square bar of the width required to make up the difference in diameters.

Fig. 11 shows a block of a useful type for employment when a large number of complete rings of the same size are required. The principle of its construction is very similar to that rigged up on the levelling block (Fig. 4) ; but in this case a complete circular disc, A, instead of a segment only, is used. A lever, B, is pivoted in the centre of this disc by means of a cottar and pin, C, or a bolt. A roller, D, is pivoted on this lever. The ring is bent round the

nnular recess, *a*, in the disc, and the roller, eing pulled round with the lever, is pressed gainst the edge of the ring, which, confined etween the roller, D, and the edge of a ecess on the disc, as shown by shading at *b*, annot fail to become circular.

The ring will have to be held down at arious sections with clips, as in the previous xample, for which purpose the holes cast bout the central part of the disc are tilised.

A templet like this can also be used for ings slightly larger in diameter and of dif- erent widths, by placing rings around the entral portion, *a*, of the recess, and by alter- ng the diameter of the roller, D. It is, of ourse, not necessary that the periphery of he roller should coincide with the periphery f the disc. If the ring to be turned is arger than the outside of the disc, then the oller will be correspondingly smaller. If he ring is smaller than the disc, then the ottom of the roller will touch on the bottom f the recessed portion.

When a smith wants bending blocks of his kind, it is as well to know that complete wooden patterns are seldom made for them. If a pattern segment of the block is given to he moulder, with a sketch or drawing of he complete block, with suitable instruc- ions, that is all that is required. The noulder will place also ny number of plain ores in the mould for he pin-holes with suffi- ient approximation to he accuracy wanted in work of this class.

## A DRYING-HORSE FOR BOOTS.

BY HIRAM PRICE.

Standard for Boot-Horse —Iron Rack for Boots — Fastening Rack — Alternative Rack in Wood.

Being some time since, in muddy weather, at a house where all domes- tic matters were ad- mirably managed, I ob- served that each even- ing at bed-time a board, on which were ranged the boots and shoes of the family—a numerous one—was placed before the fire-place. The board served as a tray; all the boots were brought in upon it bodily, and could in the morning be carried upon it altogether to the place where boots were wont to be blacked. The idea struck me as a good one, yet the arrangement had certain defects—the boots were not raised to a level with the grate, and did not, there- fore, derive all the benefit they might have done from the drying fire, and as they rested on their soles, those parts which needed it most had the least chance of drying. I put on my considering cap, and debated with myself how I might best improve upon the plan for the advantage of my own house- hold.

The result was the contrivance shown in the three first of the annexed diagrams, which I find to work satisfactorily.

The end elevation (Fig. 1) is one of the two standards of my boot-horse. I cut it from stout board, the upright piece being, of course, mortised into the foot. It is of such a height as to bring the boot well up to the level of the grate. I made the standard of my own horse 2 ft. high—which, I imagine, would be a fair average height—but some grates might still need it to be a little bit higher, some a little lower. In this diagram, A and B are the ends of two wooden bars (indicated by the same letters in the front elevation, Fig. 2), which act as braces to hold the horse together; the

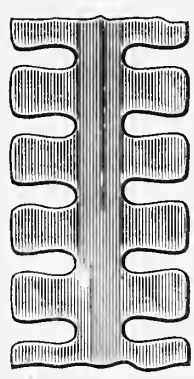


Fig. 5.

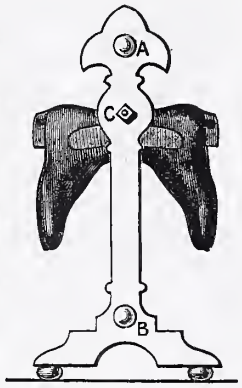



Fig. 1.

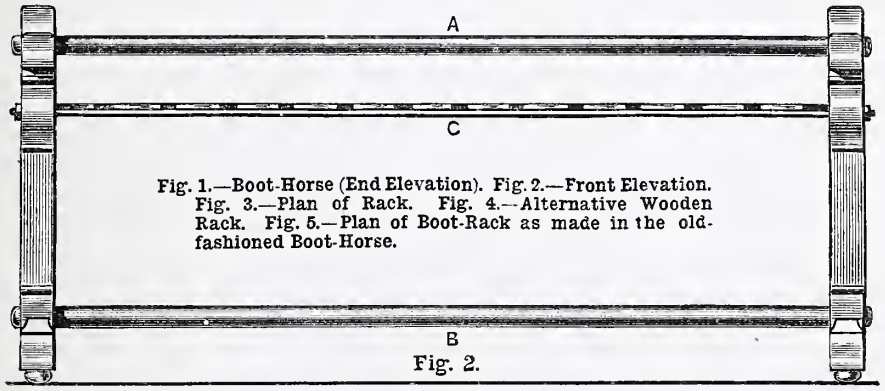



Fig. 2.

**Fig. 1.—Boot-Horse (End Elevation). Fig. 2.—Front Elevation. Fig. 3.—Plan of Rack. Fig. 4.—Alternative Wooden Rack. Fig. 5.—Plan of Boot-Rack as made in the old-fashioned Boot-Horse.**

Fig. 3

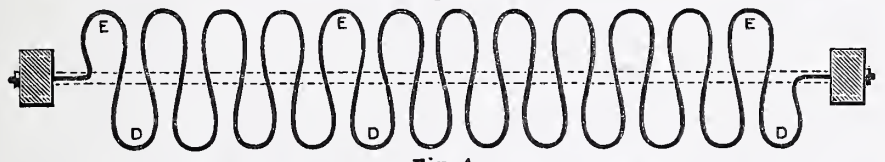
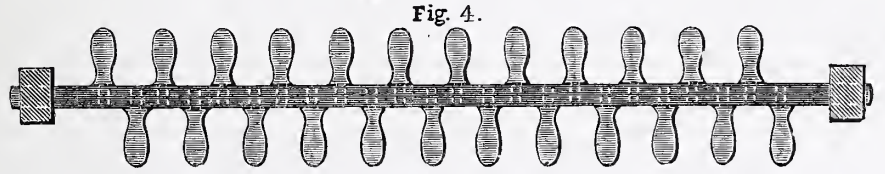



Fig. 4.



upper rail, A, is, moreover, the handle by which the contrivance is lifted.

Fig. 3 gives a plan of the iron rack to hold the boots. All other parts I made myself, but for this I called in the aid of a blacksmith. It is made of a thin (⅜ in.) rod of iron, bent into the waved form sketched in the figure; and as, when thus bent, it would of necessity give way under its load of leather, it is supported by the stouter iron rod, indicated in the plan by dotted lines as running beneath its centre. To this at its ends it is welded. This stouter rod passes through the uprights, and is secured by nuts, as shown at C, Fig. 1. In Fig. 2 the rack, seen edgewise, is marked C.

Supposing that the side of the horse on which are the points, D, D, D (Fig. 3), is that set nearest to the grate, all the boots hung upon it would have their soles brought opposite to the fire, and be in the most favourable position for drying; whilst those on the side E would have their upper leathers nearest the grate, and at a more respectful distance, which, indeed, would be better for the boots. In some cases only the soles may need much drying, and these may be hung on the side E; if all need drying equally, the whole horseful may be turned in a moment.

The horse before us is 4 ft. 6 in. in length —longer, indeed, than most families would need, as it is capable of drying a dozen pairs of boots at a time. But by making it of this length, I wished to show how easily the comfort of the largest family might be provided for in this particular. In most houses a shorter horse would suffice—my own is 3 ft. long. A horse of a greater length than that given would be cumber- some; and should my plan be adopted—as it might be with advantage—in schools or hotels, I would recommend that instead of a longer horse, *three* horses of moderate lengths should be provided, which, being arranged so as to form a sort of fender round the fire-place, all warmth would be utilised.

The iron rack is, in my opinion, strongest and best for the purpose, and well worth its trifling extra cost; but as it is to home- workers, like myself, that this contrivance will more particularly recommend itself, and as many home-workers like to carry through any work they under- take from beginning to end with their own hands, I give an alter- native rack in wood, which will be an effi- cient substitute. This is shown in plan in Fig. 4. It consists of a centre-bar, made of 1 in. or ¾ in. board, 3 in. deep, along the middle of which, at intervals of about 2 in. from centre to centre, are bored a series of ½ in. holes; into which, on each side alternately, pegs are glued — the pegs being sawn from ¾ in. or ½ in. board.

The scale on which the diagrams to this Drying-Horse for Boots are drawn is 1 in. to the foot.

[Of a truth, there is nothing new under the sun. When I was a boy, far away back in the thirties of the century, when the glorious memories of Waterloo were far fresher than they are now, being revived from year to year by the annual recurrence of the Waterloo Banquet, and when Wel- lington boots and Bluchers were generally worn, I remember, among the equipments of my father's bedroom, a boot-horse of solid mahogany, very much like the drying- horse described by Mr. Price. It differed from the latter in being as high as a towel- horse. The standards were connected by three rails—one at the top, one in the middle, and one at the bottom. In the top rail were inserted on each side turned mahogany pegs, on which shoes and slippers were hung; and on the upper surface of the central rail was placed a shelf, notched,

as shown in Fig. 5, to take Wellington boots and top-boots, the boots being inserted in the notches, soles upwards, just below (according to this position) the stiffened part of the heel. Furniture was furniture in those days: as witness the fine old carved four-post bedsteads. I have never met with more than two of these old-fashioned boot-horses; but, doubtless, some are to be found, even at the present time, in good old country houses.—ED.]

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 48.—THE "ART DECORATOR."

IF I remember rightly—and it is scarcely worth while to refer to back numbers, or even the Index to Vols. I. and II. of WORK, to see whether memory is right or wrong, when time presses, and much has to be done under its pressure—the *Art Decorator* has been already mentioned in these pages. Nevertheless, its publishers, The Electrotype Company, 80, Fleet Street, London, E.C., have sent me some specimen pages (forming together Part 19 for July, 1891), and these pages, or sheets of drawings, which are sent out in a wrapper, are, generally speaking, so cheap and so good—the Parts being sold at 1s. each—that it is well worth while, in the interest of the readers of WORK, to call attention to it again. The illustrations, or rather the sheets, are five in number, and if the title page and contents of Vol. II., which is included in the Part, be taken to rank as equal to one of them, the average price of each sheet is 2d. The first sheet, in black, gold, and white on a grey tint, is devoted to emblems of great artists, including Dürer, Holbein, Michael Angelo, Raphael, and Rubens; and, as the characteristic portraits of each are given, the sheet itself is well worth the price charged for the whole Part to decorators who introduce portraits and the human form into their work, as suggested by my valued contributor, "A London Decorator," in his design for a ceiling in stencil for a sitting-room, in Vol. II., page 133. Then follows a sheet of examples for wood inlay, a centre panel and borders, the former being quaint in its introduction of a rabbit and fowls among the foliage, and the whole characterised by elaborateness of design involving the utmost care in the execution. The woods, too, are well set forth in black and white and various tints of brown. The third, a lunette, "The Vine," with two nude figures of children, a boy and a girl, by Professor G. Sturm, is a photo-print by E. Schreiber, of Stuttgart, suggestive of a sketch delicately executed in Indian ink, and this, perhaps, is the gem of the whole Part. Two chromo-lithographs complete the tale of plates—one of three polychrome friezes in Italian renaissance, and the other of two decorative landscapes, rich in colour, suggestive of the Bay of Naples, but with skies savouring far more strongly of our British climate than the cloudless unbroken blue of sunny Italy. To all decorators and amateurs I strongly recommend the *Art Decorator*. A new volume is commenced with Part 19; and I must tell my readers that if the successive Parts are not secured as they appear, the back parts, after a time, like the Sibylline books, are subject to an increase in price. And this is a good and valid reason for not putting off till next year a purchase which you can make now on far more advantageous terms.

### 49.—BANNING'S PATENT BOTTLE BRUSH.

Mr. R. Banning, Mineral Water Manufacturer, 56, Legge Street, Birmingham, has sent me a photograph of his new Patent Bottle Brush, for the inside and outside cleansing of bottles. The bottle brush itself is so constructed that it may be worked, and, from its appearance, I should say, must be worked, in a lathe. Three brushes, consisting of knots of bristles set in twisted wire, are set at one end in a circular piece of lignum vitæ with brass fittings, and at the other end in a circular plate. Another wire proceeds centrally from the lignum vitæ boss, and through the centre of the plate, terminating in a small brush not unlike a shaving brush. The three outside brushes are set at equal distances from one another. Mr. Banning kindly offered to send me one that I might make trial of it; but washing bottles in a lathe is not exactly in my line, and I have no lathe that I should like to put on such watery duty. He has made trial of his invention now for about six months, and as he says his object is to sell his patent rights, I have now done as much as I well can in giving his address and mentioning the existence of the brush. It seems to me that it is likely to be useful in any place in which the washing of bottles is carried on on a large scale; and as ale and wine bottles can be washed with it, it is to be presumed that it is a good bottle washer all round.

### 50.—BIGGS'S PATENT TUBULAR REVERSIBLE LOCKS.

Some time ago, a gentleman living in the neighbourhood of Northampton called my attention to Biggs's Patent Tubular Reversible Locks, which are sold by Messrs. A. M. Perry & Co., of that town. I wrote to Messrs. Perry & Co., asking for samples, and they forwarded my letter to the Tubular Lock Syndicate, Limited, from whom I received a reply enclosing drawings and press notices, but no samples, so that I am unable to say anything respecting the locks themselves beyond what I can gather from the papers mentioned. Moreover, I was bidden to note this:—"Of course, if you put a notice in your paper it must be free of charge." This was unnecessary, as no charge for notices of articles in WORK has ever been made, or will ever be made, but it seems to intimate that it is not every paper that is as blameless in this respect as WORK. This, however, the Tubular Lock Syndicate, Leadenhall Buildings, London, E.C., did not know, and so made a slight mistake through want of better knowledge of WORK and its aims and purposes. I may add that, as many of my readers very well know, samples sent for inspection are always returned if a request is made to that effect. Although I cannot speak of these locks by experience, I know the Yale Lock, which seems to be made on similar lines, and I can testify to the goodness and utility of that. All tubular locks are easily fitted and fixed, and they are particularly well adapted for the purposes of amateurs in every way. Therefore, I trust that such of my readers who want locks for new doors and new drawers will do as I intend to do when I am wanting this kind of thing—namely, give Biggs's Patent Tubular Reversible Lock a trial, and if they like it mention it to their friends. Handles of doors, too, for the most part are troublesome things, but the Syndicate supply a great variety of mortise lock furniture in fancy woods and brass, to be used with the tubular locks, and which appear to be unique in the manner of fixing, and likely to be far more durable than the door handles in ordinary use. These door handles are made on Pitts's Patent.

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*** I have to acknowledge the regular receipt of *The Machinery Market and Exporter*, published at 181, Queen Victoria Street, London, E.C., and *The Amateur*, published by Mr. Henry Zilles, 24 & 26, Wilson Street, Finsbury, London, E.C. These serial publications are well worthy the attention of all readers who take an interest in machinery and all kinds of wood-working of an ornamental character.

THE EDITOR.

## NOTES FOR WORKERS AND HINTS TO INVENTORS.

HOT-AIR ENGINES.—Amateurs of an inventive, as well as constructive, turn of mind may usefully direct their attention to a much-wanted article—a really light and *cheap* hot-air engine sufficiently powerful to drive sewing-machines, fans, etc. Those at present in the market are all too clumsy and heavy. Robinson's, recently described and illustrated in several technical journals, most nearly approaches the ideal pattern, but is open to much improvement in the direction indicated.

PIANO HAMMERS.—Nearly all the hammers made for English pianos have a tendency to harden on the striking face after a few years' use. The felt buffing becomes partly compressed and partly worn away, the result being that the strings emit an unpleasant "tin-kettle-like" sound. As re-buffing the hammers in many parts of the Colonies and India is impracticable, except at a heavy cost for transporting the instrument to one of the large towns where repairers can be found, some device to either easily replace the old buffing with new or, perhaps better, change the entire hammer head would find much favour.

A VERY NOVEL ADVERTISING MACHINE.—Inventors are frequently asked if they cannot devise some entirely novel method of advertising. Originality in such a direction, however, seems somewhat difficult, if, as is usually stipulated, cheapness and efficiency have to go hand in hand. It has been reserved for an American genius to suggest a device, the home manufacture of which is within reach of the humblest purse, while dispensing with the services of the bill-poster, or the space of a show-window or hoarding. It consists in an "advertising arrow," projected from a toy gun of somewhat greater strength than that usually sold to children, and intended to be fired at trees, fences, wooden buildings, etc. etc., which the sharp point of the arrow will readily penetrate. It certainly has the defect of being useless against stone or brick buildings, but there is wood enough still employed throughout all civilised countries to give the new idea a pretty wide field of operation.

The arrow is feathered with light cardboard in four sections, upon which the advertisement desired may be printed, while the heel is bound round with cord to keep the cardboard in place. The gun, of which elastics form the springs, has a longitudinal kerf slit along its entire length to allow one of the card "feathers" to travel in it. If preferred, the advertisement printed on a tag may be attached separately to the arrow. To people in want of a new method of advertising, this device will commend itself, especially in country districts.

"CASTOGRAPHY."—Our French contemporary, *La Nature*, describes an ingenious method of producing ornamental designs on cardboard, to which the inventor, Mr. Mills, an American, has given this title. It must, however, be premised that only people possessed of some artistic talent could essay the process, which consists in going over the outlines of a drawing or written device upon the card with a very sharp penknife, held so as to form a more or less acute angle with the surface. With the back of the knife, the portion cut is raised so as to be converted into a sort of bas-relief, and this, on being illuminated sideways, presents lights, half-lights, and shadows, such as would result from a carving in stone. It is not easy to secure the necessary effect on a first trial—the tendency of the knife, which must be very sharp pointed, being to slip through the cardboard. This, however, is soon overcome by practice, though few are likely to acquire the lightning rapidity of Mr. Mills, who produces most beautiful effects in less than a minute, dispensing with any previous outline. Some approach to the idea has already been made by the stamped lamp-shades on sale at many well-known establishments, but they do not compete with the artistic results achieved by the ingenious American. Readers, anxious to find a new way of passing spare time, might do worse than turn their attention to this interesting occupation.

## SHOP:

CORNER FOR THOSE WHO WANT TO TALK IT.

** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*, answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Speed of Waggon.** — INCLINED PLANE. — The riction of the usual railway waggon properly ade, with its bearings well lubricated, is about lbs. per ton on a horizontal line. This corresponds ) an inclination of one in 280, so your waggon ould start and run on rails with the inclination ou give: viz., one in 108. The accelerating force n the waggon will be to that of gravity acting irectly in proportion to the rate of inclination; us, if $v$ = velocity per second in feet acquired fter the force has acted for one second, then $= \frac{32{\cdot}2}{108} = 0{\cdot}298$ ft. per second if there is no friction; ut the friction represents an incline of one in 280, nd, therefore, all there is left to cause motion is a ise of $1 - \frac{108}{280}$ in 108: that is, a rise of $1 - 0{\cdot}385 = 0{\cdot}615$ n 108, or 1 in 175·56. This gives for the acceelerating orce parallel to the rails $\frac{32{\cdot}2}{175{\cdot}56} = 0{\cdot}183$. Replacing or 32·2 by this in the ordinary formulæ for falling odies, your questions are solved as follows:—If = the distance (corresponding to hcight in falling odies)

$$v = \sqrt{2\,g\,d} = \sqrt{2 \times 0{\cdot}183 \times 99} = 6{\cdot}019 \text{ ft.}$$

er second at the end of the run, giving an average elocity of $\frac{0 \times 6{\cdot}019}{2} = 3{\cdot}0095$ ft. per second. If = time in seconds to make the run, then—

$$t = \frac{2\,d}{v} = \frac{2 \times 99}{6{\cdot}0195} = 32{\cdot}89 \text{ seconds.}$$

ou may not find this realised in practice, for two easons. First, the data I have taken for friction ay not apply to your waggon; second, no allownce for resistance of the air has been made, but as he speed is so low this would hardly be perceptible. ou can, of course, apply this method with other ata.—F. C.

**Cracked and Dull Polish.**—TABLE TOP.—The op of your table has, undoubtedly, been hurriedly inished. The cracked, dull surface to which you efer is known in French polishers' parlance as "sweating." It may be due to the fact that the workman was insufficiently paid for his labour, so ould not afford to spend the necessary time on it to urn out work that will "stand"—*i.e.*, retain for an ndefinite time its original lustre; or it may be that oo much oil has been used. The fact that only the able portion is cracked and dull would serve to how this, this portion having been finished out vith the rubber. The turned portion being mostly arnished out, consequently less oil is used there. t would, of course, be better for you could you mploy a French polisher's services for a few ours. He would probably soon restore it by working t up again with a little polish and spirits. If you lo not, as you say, care to employ one, the next est thing to do would be to wash it with a little veak soda and water—common washing soda, the ize of a walnut, dissolved in a pint of warm water; vipe dry, then use a little of the reviver made as ollows: ½ pint lime water, ½ pint linseed oil, horoughly well mixed; then add ⅛ pint of sweet oil, nd well mix; then thin down with nearly ½ pint of urps. Apply with soft rag or wadding; wipe off vith soft clean rag fairly moistened with methylated spirits.—LIFEBOAT.

**Polishing Tool Handles.**—TURNER.—A sufficient polish for these is sometimes obtained by holding against them, whilst revolving in the athe, a handful of fine turnings of the same kind of vood as the handles, especially if wiped over first vith a little linseed oil. Many turners use the ollowing:—Dissolve 1 oz. of sandarach in half a pint of spirits; shave 1 oz. of best beeswax in sufficient urps to form a paste. Mix the two together by legrees. Apply with a woollen cloth whilst the work is in motion; polish with soft clean rag. Thus reated, they should appear as if highly varnished; whilst others apply a little French polish with wool or flannel, finishing off with a few drops of methylated spirits on a piece of soft chamois leather; others, again, simply press a piece of beeswax against them while revolving. Experiment with hese till you find the one to suit your purpose best.—LIFEBOAT.

**Polish Reviver.**—PIANO.—I have myself long discarded the reviver you mention on account of its disagreeable smell, caused by the vinegar soon turning sour, and have used with satisfactory results one made as follows:—¼ pint lime water, ¼ pint linseed oil, thoroughly well mixed; then add ⅛ pint sweet oil, well mixed; then thin down with nearly ½ pint of turpentine. Apply with wadding or soft rag, wipe off, and finish with soft clean rag fairly moistened (not wet) with methylated spirits. Of course, if the work is very dirty or sticky with wax, it should be well washed with weak soda and water to be effective. I find this reviver and the mode of using it the best, for, apart from the doing away with the disagreeable smell, and dispensing with the use of wax—which, by-the-bye, has little to recommend it as of use in reviver, except as a dust accumulator—I find that if the reviver does not bring up the work so satisfactory as desired, it is easy to take a rubber of "half and half" and work it out, thus bringing up the polish to its original lustre: a thing next to impossible if using many of the so-called revivers. —LIFEBOAT.

**Tinning Copper Pans.**—J. F. (*Elgin*).—You wish to know how to re-tin copper stewpans that have been tinned inside and out. These articles are more correctly termed bain-marie pans, or bain-marie pots, as some call them. They are some trouble to re-tin unless you have the use of a large bath of tin, in which case there is no difficulty in the matter, as after the usual pickling, scouring, etc., with which I presume you are acquainted, they are placed in the bath, and tinned by rubbing with the tinning rod, with an occasional dip all over to keep them hot, and, when well tinned and thoroughly hot, lifted out and rapidly wiped. I have, however, had to do them when limited to half an ingot of tin—about 14 lbs. In this ease I make a square pan of stout sheet iron, dog-earing the corners to prevent the molten tin from running out. This pan must be large enough to allow the largest pan to lay in on its side, handle as well; place a pan in the tin (when melted over the fire), and flow or splash, as it were, the tin on to the pan. Keep turning it over, so as to get it equally hot all over. To do the inside of the bottom, it will have to be stood upright in the pan, and well rubbed with the tinning rod, using plenty of finely-pounded sal-ammoniac. When completely tinned, wipe as usual. Some tin them all first, and then remove the pan, and make each one hot again over a clear charcoal fire, and wipe. You will perhaps find this the easiest way. A little dust of sal-ammoniac thrown on as you begin to wipe will help a great deal. To wipe the insides, especially of very small ones, a piece of stick with tow tied round it will be found useful. With regard to the measuring for price, they are measured from lag to brim—that is, diagonally from one side of the bottom to the other side of the top—but half as much again is allowed for the extra tinning; for instance, a bain-marie pan measuring 8 in. would, if paid for tinning at 1d. per inch, which is a fair price (for the tinning only, not to the customer), be reckoned as 1s.; a 6 in. pan would be 9d., and so on; covers the same. One caution, in conclusion: do not get the tin too hot so as to burn it; it is no joke to spoil 14 lbs. or more of block-tin.—R. A.

**Size from Parchment Scraps.**—WORKONIAN. —We doubt whether size could be bought positively made from the above. To make it, the scraps of parchment should be put in a bag (flannel by preference), which must be hung in a vessel of water and boiled till the parchment is boiled down. By removing some of the water, and ascertaining if, when cool, it sets to a clear jelly, it will be seen whether the boiling is sufficient; when it is, squeeze the bag (but not too hard) to force out the remaining gelatine. Evaporation by boiling will make the size stronger if required.—S. W.

**Sale of Poisons.**—RAYNOR.—By the Pharmacy Act of 1868, which please consult, it is enacted that none of the poisons there enumerated shall be sold by any person unless he be registered as a chemist and druggist. This applies to poisons whether sold alone or in combination. RAYNOR should get the above Act, with any additions that have since been made (which he can do through any bookseller), and see whether the poison in which he is interested is one of those mentioned, or whether it comes within the meaning of the Act.—C. C. C.

**Lead Burning.** — A PLUMBER, H. W., AND OTHERS.—A lead-burning machine is a self-acting, self-regulating gas generator for giving a continuous current of hydrogen gas. It is a cylindrical vessel, about 3 ft. high and 12 in. in diameter, divided into three compartments, having communication with each other by means of pipes and stop-cocks. Zinc cuttings are placed in the bottom one, and dilute sulphuric acid in the top, and the gas generated by these two substances when in contact with each other flows into the second chamber, and thence to the blowpipe, where it combines with air under pressure. I cannot give you a sectional drawing, as I have never had one to pieces; but I must say that I do not think it would be practicable for you to make one yourself with the sole aid of a drawing and description. There is a patent lead-burning machine and blower manufactured by Mr. P. J. Davies, 78, Earl's Court Road, Kensington, that I have heard highly spoken of, and as you reside in London it would be worth your while to call and see it. Mr. Davies is a well-known plumber, and author of a standard work on plumbing, and would, no doubt, be pleased to show you the machine and its working.—R. A.

**Answers in "Shop."**—B. A. W. (*Croydon*).—Replies in "Shop" must take some little time before they can appear—for these reasons: There is a great demand upon "Shop"; four pages of the paper have long been devoted to "Shop," and this is rather a large proportion of the journal itself; and all replies are submitted to outside specialists, who are paid to give careful and adequate replies. There is the "good all-round man and London Directory" principle of dealing with correspondence, but this is not adopted in WORK.

**Chemistry of Photography.**—W. T. (*Stratford-on-Avon*).—The best publication you can study is "Hardwick's Photographic Chemistry."—D.

**Watch Oil.**—W. J. (*No Address*).—Grimshaw & Baxter, 33 and 35, Goswell Road, Clerkenwell, are the sole agents for Ezra Kelley's watch and clock oils. They will also supply you with anything and everything for watch, clock, and jewellery making and repairing, including hands, glasses, etc., and tongs, joints, and catches.—A. B. C.

**Fancy Furniture.**—POLISHER.—By metallising I presume you mean enamelling—that is, giving a painted appearance in many colours of art shades instead of polishing or varnishing in imitation of various woods. Much artistic furniture is enamelled and decorated. If this is what you mean, it is done by mixing dry colours or pigments of the required shade in spirit or oil varnish. For instance, if a bright red is required, vermilion, or its cheaper companion, vermilionette, is carefully mixed with spirit or copal varnish, according whether a quick or slow varnish is required; spirit varnish dries in ten minutes, oil varnish requires at least six hours. If a white colour is required, use flake white; but unless you require it in large quantities, it can be bought much more cheaply at any druggist's or oil and colour warehouse than it can be made. In oil varnish enamels, Messrs. Aspinall, of the Enamel Works, London, S.E.—who advertise in this paper—are considered by some the best known makers; while for spirit enamels, that known as Foo-Chow, prepared by Donald Macpherson, Manchester Colour Works, Knott Mill, Manchester, is as good as any. Both makers prepare it in about one hundred different shades. If, however, you mean by metallising, giving to the articles a metallic appearance in imitation of brass, copper, or silver, they should be first painted any suitable colour, then varnished—which latter, while still tacky or not quite dry, should be wiped or dusted over with gold, copper, or silver bronze powder, or the whole in combination as may be required.—LIFEBOAT.

**Stain for Varnish.**—VARNISH STAIN.—Nothing is as yet known that will dissolve in spirits, similar to Bismarck, and yield a brown colour suitable for a walnut stain. The usual plan is to stain first, then varnish or polish. You may, however, add to your varnish a little brown umber (in the dry state), a dash of black, and a little Bismarck till you have the required shade. Strain through fine muslin before using.—LIFEBOAT.

**French Polishing.**—HOUSE PAINTER.—You did not put sufficient polish on your bureau: the three rubbers you gave would not be enough to fill up the grain of oak, especially if you used no "filling-in." No definite rule can be laid down as to the number of rubbers of polish required, some woods being much more porous than others; but in the bodying up the grain should be left filled, and just a little over; then set aside for some hours, or over-night, to allow for sinking. When you take it up again it would require a few more rubber of polish previous to spiriting out. If at this stage you gradually worked out the polish in your rubber by putting on a few drops of methylated spirits at a time, and worked it out fairly dry, you should leave no streaky marks for the spirit rubber to remove—only a semi-transparent film of oil, to remove which some polishers dispense with the spirit rubber as made of wadding, using instead a swab of clean soft rag, fairly moistened with methylated spirits, and pressed well in, which should be applied to the work very slightly, at first with a straight, then circular, motion, applying pressure as it gets drier. New spirit rubbers in the hands of the inexperienced are very deceptive. One is apt to get them too wet, thereby softening and tearing up the gums instead of clearing out the oil and increasing the lustre. Your chief cause of failure has been an insufficient body of polish, and trying to make the spirit rubber do what the polish rubber should do.—LIFEBOAT.

**Books on Flues, etc.**—ST. MUNGO.—The "Engineers' Practical Guide to the Fixing of Hot-Water Apparatus and Warming Greenhouse and Building" will probably contain some, if not all, of the information you require on flues, boilers, and hot-water work in general. The author of the book is John Eldridge, hot-water engineer. The book is illustrated with plans and sections; the price is 1s. only. Publisher, Spon, London.—R. A.

**Electric Belt.**—W. S. (*Cambridge*).—The clasp of the belt may be made of copper, brass, silver, German silver, or any other metal, and may be made in any form you may select, providing it forms a complete metal connection between the ends of the row of discs on the belt. The wires do not cross each other, since they are merely short pieces, of about 3 in. in length, connecting each copper disc—except one on the outside—with each zinc disc in the next couple on the inside, except one. A copper disc at one end, and a zinc disc at the other, must be connected to the two halves of the clasp. Thin pieces of steel, 3 in. in length by ½ in. in width, such as crinoline steel in short pieces, well magnetised, then sewn into a flannel belt at distances of 2 in. apart, will do equally as well as this electric belt, and will not need any connecting wires or metal clasp.—G. E. B.

**Electrical Instruments.**—N. F. M. (*Paddington*).—Complete replies to your four questions would

occupy one whole number of WORK, and would give me a fortnight's hard work. We cannot devote so much time and space to one correspondent. (1) A simple cigar-lighter may be made of a few inches of No. 24 platinum wire made into a spiral, the ends soldered into two strips of copper, and these connected to your battery. The platinum will be raised to a white heat, and will then light a cigar. Space will not allow of a sketch. (2) I cannot tell you here, in "Shop," how to make an ammeter to read from 1 up to 20 ampères. Space cannot be spared for the necessary engravings and description. (3) The foregoing remark applies to your third question, respecting an automatic magnetic cut-out to work with current up to 20 ampères. (4) I do not know the "West Rheostal," so cannot tell you how it is made.—G. E. B.

**Electric Candle-Lighter.**—A. F. E. (*London, S.E.*).—I cannot clearly understand what you mean by wanting an electric apparatus, "not more than 6 in. square, to give 200 sparks, each of sufficient size and duration to light a candle." If you want an electric candle-lighter in a small space, I advise you to get a pair of the small but powerful lithanode cells made by Messrs. Cathcart, Peto & Co., 57B, Hatton Garden, London; and get them to make for you a portable cigar-lighter, to be worked with current from those cells.—G. E. B.

**Repairing Broken Carbons.**—R. B. (*Durham*).—I do not know of a method by which broken carbon rods or plates can be cemented together and made "to work the same as if they had not been broken." You may drill holes in the carbons, and put in brass screws, fastening with molten lead. As the carbons are broken off level with the tops of the pots, you will have to get new ones. It rarely pays to repair old Leclanché cells.—G. E. B.

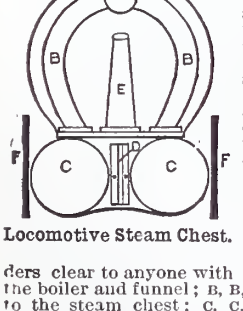
**Glass for Overmantel.**—WALLSEND.—I deal with J. M. Newton, 7, New Inn Yard, Curtain Road, London. His prices range from 1s. 9d. per foot for the small sizes mentioned by WALLSEND, to 2s. 1d. per foot for plates of 5 ft. in area. ¾ in. bevel costs 3d. per foot, measuring margin extra to the above. The silvering is good (pure silver process), and I have always been pleased with the article supplied.—B. A. B.

**Medicine Chests.**—H. F. (*Wigan*).—If H. F. wants anything specially good he should write to Betjemann & Sons, Pentonville Road, London, N. If ordinary goods are required, Betjemann, of whom I have inquired, recommend Maw, Son & Thompson, Aldersgate Street, E.C. If H. F. wishes to place orders for a considerable number, he should obtain prices from a *fancy* cabinet maker or a leather-case maker, in that case obtaining a sample for the maker to work to; or better still, devising some improvement himself. The making and lining of these goods are separate trades carried on by different people; liners abound in Clerkenwell, London.—B. A. B.

**Fish Glue and Copal Resin.**—W. J. P.—Address of dealer in the above commodities: C. W. Waters, 72, Great Eastern Street, London, E.C. This is a firm doing a big business in polish, varnish, lacquers, glues, gums, gelatines, etc. As to terms, "wholesale" will depend on the quantity you wish to purchase, no matter with whom you deal.—F. P.

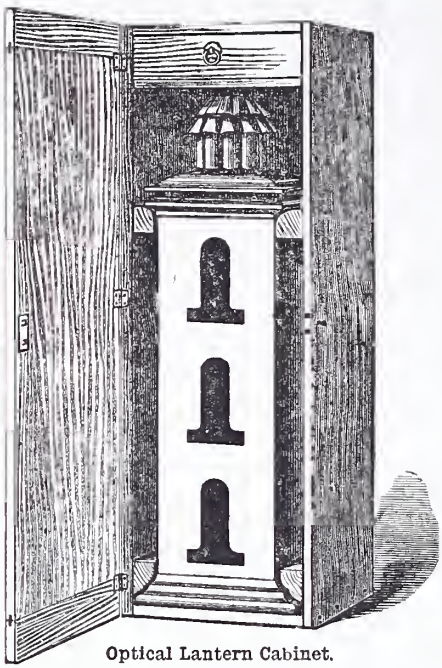
**Reflector.**—LOVER OF "WORK."—It seems unlikely that a window having a south aspect requires a reflector; but if so, it must be because the light is obstructed by buildings or trees. LOVER OF "WORK" had better try various angles until the result is satisfactory; he will then be doing as others do in similar circumstances. He does not say if his workshop is on the ground floor. This is of importance in deciding.—B. A. B.

**Steam Chest.**—READER.—(*No Address*).—The steam from the boiler, on passing through the regulator, flows to the steam chest or valve box, in which the slides for admitting the steam to and releasing it from the cylinders are placed, and by their means is permitted to act on each side of the piston. The diagram shows a cross section through the cylinders, slide-valves, and framing of an inside cylinder locomotive, with the steam-pipes to and exhaust-pipe from the cylinders. An examination of this, reference being had to the letters, will, we think, make the path of the steam from the boiler to the cylinders clear to anyone with very little trouble. A is the boiler and funnel; B, B, the steam pipes leading to the steam chest; C, C, the two cylinders; D, the slides or steam-valves; E, the exhaust-pipe, by means of which the steam escapes up the funnel; F, F, the side frames supporting the cylinders, boiler, etc.—C. E.



Locomotive Steam Chest.

**Optical Lantern Cabinet.**—F. C. (*Londonderry*) asks for a sketch of a travelling cabinet in which to pack an optical lantern. This is an article which will require to be carefully thought out by the operator himself, in accordance with the requirements of the lantern to be packed. In the cabinet shown in the sketch, the lantern is slid into the case in an upright position by means of a door at the back, which is hung with brass butt hinges, and furnished with one or two locks and a pair of handles. Some operators prefer to use pull-off hinges in order that the door can be taken off bodily when desired. Some felt-covered guides should be screwed to the sides of the case on the inside, in a suitable position, to hold the instrument in place, and keep it from moving during transit. The internal arrangements of the case will naturally depend upon the requirements of the apparatus, but at least one drawer should be set aside to contain the usual requisites of the operator, including


Optical Lantern Cabinet.

the tin or bottle of lime, cylinders, a box of matches, a hammer, screwdriver, gimlet, gas pliers, nails and tacks, a few screw hooks, some gas joints and connections, and last, but not least, a measuring tape and some useful lengths of red rubber tubing. Some operators arrange a special drawer for the lecturer's reading lamp, and another for the rubber tubing. Lantern slides must never be packed in the cabinet with the lantern; it is best that they should have a separate box to themselves. Another useful form of lantern cabinet is a shallow box with a deep lid, so that the instrument can be laid on its side, with numerous compartments in every available space between the lenses and hood to take the accessory appliance, the box being made of sufficient size to allow of the screen being laid over the lantern in order to form a soft packing. The various accessories must, of course, be tightly fitted into the compartments, which will naturally require to be cloth lined. The case should be made of straight-grained yellow pine, which may be painted with Aspinall's black or chocolate enamel outside, with "This side up, with care," in white letters on the top.—C. A. P.

**Repairing Silver Locket.**—QUÆSITOR.—This correspondent wants to repair the hinge of his locket, and from the materials he says he has, he evidently thinks of pewter soldering it. Now, merely pewter soldering one knuckle of the hinge by itself will not do: there is not sufficient hold to be obtained for security, unless a lot of solder is used, and, after all, pewter soldering is a botching way of repairing work where hard soldering is possible. If it has to be done without hard soldering, I should obtain a piece of thick silver or metal wire, fit and drill one end to form the hinge, while the other end should be hammered and spread out to fit on the bottom of the inside of the locket; by these means a strong job will be made. Why not hard solder it? There are many answers in "Shop" bearing on soldering (see WORK, Vol. I., Nos. 14, 19, 38, and 46; and in Vol. II., Nos. 76 and 104). An easy way of repairing the hinge would be to hard solder a piece of flat silver on the knuckle, and pewter solder this in. This will avoid the risk of melting the locket by hard soldering; the risk, however, is not great. There is a reply to T. N. (*Halifax*) on soldering to follow this, which will give you all particulars. If it is not clear then, please write again; and if you have an opportunity, try and see somebody hard solder any article, and note the sort of flame they obtain. Any detail overlooked in these replies will be explained on a note being sent to our Editor.—H. S. G.

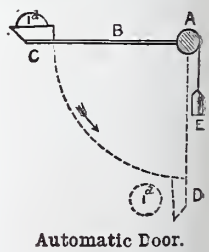
**Atkinson's Electro-Motor.**—H. J. H. (*Hackney*) and W. H. O. P. (*Homerton*).—Mr. Atkinson's electro-motor, described and illustrated on page 71, Vol. III., of WORK, can be reversed and driven as a dynamo, if the lead of the brushes is altered so that the commutator does not ruffle them; but the current obtainable from the machine when thus driven would not do any useful work. Neither Mr. Atkinson nor myself have experimented with the machine with a view to using it alternately as a dynamo and a motor, so have not determined on the gauge of wire to be wound on the armature and fields. The castings are not sufficiently massive to be used for this purpose. If you decide on trying a set of castings, wind them with No. 24 silk-covered copper wire, and get as much of this on the fields as they will hold. The direction of winding will be the same as for a motor, and the fields must be connected in shunt with the armature. At 3,000 revolutions per minute you may get a current of ¾ ampère, at a pressure of from 6 to 8 volts.—G. E. B.

**Electro-Plating.**—Z. Z. Z. (*Wednesbury*).—(1) There is no difficulty whatever in electro-plating standard silver. First swill in hot caustic alkali to remove grease, then rinse in warm water. Next, scour off all corrosion, and polish the surface. Again dip in caustic solution, and rinse. Swill next for a few minutes in weak nitric acid, then in quicking solution; again rinse, and transfer to plating-bath. Full instructions in the "Electro-Plater's Handbook," price 3s. (2) To get a higher tint of gold, raise the temperature of your gilding bath, and use another cell to your battery. Work the bath at 160° Fahr. The colour of 18 carat gold can always be given to a deposit of pure yellow gold if you have an alkaline solution of copper in working order. Deposit a thin film of copper on the pure gold, then flash a thin coat of gold over this; rinse, and dry off without scratch-brushing. Practice will give you skill in this mode of colouring gold.—G. E. B.

**Power of a Dynamo.**—SOLDAT.—The electric power of a dynamo is, or should be, calculated by its designer before it is built, and the calculations are based on the following lines:—First, the volume of current and its pressure is determined, and the machine is designed to give the required volume at the required pressure. The iron for the field-magnet cores is selected of such a size, weight, and quality as to be only half-saturated with magnetism when the full current is passing through the machine. The iron of the armature should be one-seventh the weight of the field-magnet cores. The wire on the armature of a shunt machine must be large enough to carry safely the full current, and its resistance should be one-twentieth that of the working circuit. The value of this resistance is obtained by measurement. The wire on the fields must be large enough to carry 5 per cent. of the total current, and have a resistance 400 times that of armature wire. Series machines and compound machines are of different design to shunt machines. Full instructions are given in the latest edition of "The Dynamo: How Made and Used," by S. Bottone, Wallington, Surrey.—G. E. B.

**Solenoid.**—J. G. (*Nottingham*).—You get the best result from the Fuller cells connected in two rows of three abreast, because then the internal resistance of the battery is reduced and more current is available to go through the coil of the solenoid. You may wind on more wire until the coils are three times the diameter of the plunger: each extra turn of wire in this direction will increase the pull of the solenoid. An iron tube should not be used, because this absorbs energy which should be exerted on the plunger. You will gain very little by increasing the length and diameter of the plunger. The internal resistance of your battery must be high, or you would have got better results from the six cells in series. To balance this resistance, you must wind on more wire or a finer wire on the bobbin. If you use the larger wire you must also employ larger cells in your battery. Of course, you will understand that I am working in the dark in thus advising you, for you do not give me any idea of the apparatus you wish to work in this way. A few badly-arranged or badly-fitted joints may quite hinder the working of the solenoid.—G. E. B.

**Automatic Door.**—G. S. (*Skipton*) has made a model of a chapel, and wishes to fit the inside with mechanism which will, on the insertion of a penny, cause the door to open and a figure to appear. Let A in the annexed figure be an axle, B an arm from it extended as far as space will allow, and provided with a cup, C, to receive the penny. The weight of the coin will cause the arm to descend until the 1d. falls out, as at D, when the weight, E, will cause the arm to resume its normal position. The power will, of course, depend on the leverage afforded by the arm, B. By this means nearly a quarter circle motion can be gained; and if G. S. is anything of a mechanician, he can, by taking thought, get from it the effects he wants. He will require a "fly" to retard the descent of the penny, so as to give time for his levers to open the door, push the parson forwards, and pull him back again. Unless I could see the space and arrangements of his model, I could scarcely give him further advice.—C. C. C.



Automatic Door.

**Rotating Bookcase, with Map Compartment added.**—AMATEUR.—I strongly advise you to adopt the pattern of revolving bookcase shown

here. It is square, and, therefore, there will be an equal pressure all round the central pivot; whereas I gather from the sketches of American case sent, they represent articles narrower at two sides, thus creating an uneven pressure on all parts outside the pivot. If, however, they *are* square, the width may be in excess of that required for the hooks, thereby wasting space. The English articles are made similar to Fig. 1, but are supported upon cross-shaped feet. Perhaps it may be advisable to

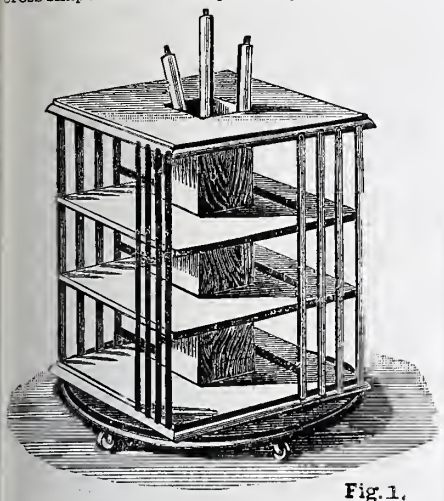


Fig. 1.

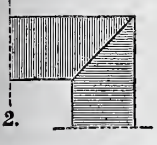


Fig. 2.

Fig 3.

**Rotating Bookcase. Fig. 1. — Bookcase, etc. Fig. 2.—A Corner of Shelves. Fig. 3.—Ditto, exhibiting the form of Joint at Mitre.**

support the body upon balls. If this is done, I recommend the cutting of a shallow groove at a few inches within, and parallel to, the circumference of the turn-table, within which you should place three or four metal balls loosely at equal distances apart. Then pivot the body to the turn-table, and the balls will revolve in the groove when the case is turned. I think it is quite a new suggestion on my part to utilise the middle space formed by middle upright boards, instead of covering it in, as is usually done. You could therein store any of your maps when rolled. Join or screw four mitred or dovetailed boards of any desired height (say, about 26 in.) to a bottom board about 2 ft. square and 1 in. thick. Shelves could be mitred up as in Fig. 2, back parts of them being tenoned into the upright boards, and mitres being joined as in Fig. 3. Upright boards could be tenoned into shallow mortises in top board, or merely screwed. Upright rails, of about 1½ in. width, should be pinned as shown, and stop-rails fastened within the case. Wood is obtainable at any timber merchant's. Oak, walnut, mahogany, or any common wood is suitable for this article.—J. S.

**Sofa-Bedstead.**—H. S. (*Birmingham*).—You ask for a settee with folding bedstead. I presume you

Fig. 3. Fig. 1.

Fig. 2.

**Sofa-Bedstead. Fig. 1.—The Sofa, exhibiting Bed-Frames being unfolded. (The narrow end Frame is separate, and would not fold, as in sketch; but it is so shown to facilitate understanding.) Fig. 2.—Catches to be fixed to narrow Frame and end Bed-Frame. Fig. 3.—One of two Sofa Bolsters.**

mean the old-fashioned sofa-bedstead. There is a distinction, but not much difference, between a settee and a sofa. All that you require is shown in the drawings. Of the construction of the sofa proper, I can say nothing more, on account of space, than to advise you to consult Indexes to Vols. I. and II. for details of joinery. To the back of the sofa is hinged a mortised and tenoned framing of a width nearly equal to that of the sofa seat. Two other frames of the same size are hinged to this, and also to each other. Be particular that they fold as shown. You must allow a sufficiently deep rebate on the inner side of sofa framing to allow the bed-frames to lay flush with the edge of the said framing. On to the outside of the end frame (which is towards the front in the sketch) there is slipped a removable frame of about 9 in. width, by means of the catches used upon shop door shutters, of which two of A (Fig. 2) are to be attached to the large end frame, and two of B to the narrow end frame. Webbing will be on top of frames. In recess thus formed in narrow end frame hinge two supports, as shown. The legs attached to large end frame are removable, and secured by means of a spiral screwing into a worm in the frame corners, under which circumstances it is advisable, perhaps, to but half-joint those particular corners. The outside of narrow end frame is to be polished. Underneath the front of it fix two dowels, which will drop, when bed is folded, into holes in edge of sofa frame at the front. When closed, a loose cushion, of 4 in. or 5 in. depth, is placed as a seat, the ends above being occupied by loose bolsters of the pattern Fig. 3. Horsehair bag underneath seat is intended for the reception of the bedding, but, if dispensed with, appearance will gain by its absence. Read my reply (see Indexes) "Press Bed." These bedsteads, as I can testify from youthful experience, are very awkward to handle, although useful articles.—J. S.

**Battery Power for Lamp.**—CORRESPONDENT.—The battery power required to light up a 10 c.-p. incandescent electric lamp will depend upon the resistance of the lamp filament, or what is popularly known as its voltage. This term is used to convey an idea of the electric pressure required to send the necessary current through the lamp filament, and to raise it to a glowing incandescent condition. The lamps vary in voltage from 12 to 120 volts. Each cell of a bichromate battery will give a pressure of 2 volts, regardless of size. If, therefore, you divide the voltage of the lamp by two, you will get the number of cells required to light the lamp, whatever its candle-power. It follows, therefore, that a lamp of low voltage will take less cells than one of high voltage. But lamps of low voltage take a larger volume of current than those of high voltage; therefore large cells, holding not less than a gallon of liquid in each cell, must be used for low voltage lamps, whilst cells of a smaller size may be employed in lighting a lamp of high voltage.—G. E. B.

**Mordey-Victoria Alternator Dynamo.**—NED.—"The electricity is produced in a Mordey-Victoria Alternator with exciter" much in the same manner as it is produced in any other dynamo. The exciter is merely a small dynamo furnishing a current to excite magnetism in the cores of the larger machines.—G. E. B.

**Drawer Supporter.**—A. M. I. C. E. (*West Kensington*).—It seems strange that so little attention has been given to the fact of the tendency of drawers in a piece of furniture to drop upon extraction. The only inventions with which I am acquainted are my own (see Index to Vol. II., price 1d.), and one of which an advertisement and editorial notice appeared in *Furniture and Decoration*, price 6d., issue for Feb. 1, 1890 (Messrs. Smith & Botwright, 6 and 7, Eldon Street, Finsbury, E.C.). The latter, although a simple contrivance in its way, is complicated when compared to my suggestion. Moreover, it is patented, whereas my idea is not patented, whether useful or not, but is (as with all I do) given to my readers to utilise as they wish, without fear of that hawk, the "patent rights," picking holes in them for so doing. I might, in justice to the "drawer equaliser," as it is called (which is made by Messrs. Bate & Kempson, 307, High Holborn, W.C.), say that, as its title implies, it *equalises* the drawer during extraction, while my invention *retains* it horizontally when *almost fully drawn out*. I am not acquainted with any cabinets fitted with drawers with either attachment.—J. S.

**Model Printing Press.**—HOPEFUL.—This is a subject which will require a separate article in the body of WORK, not in "Shop."

**Removing Stains from Marble Mantel-Shelf.**—E. L. C. (*Portland*).—Dissolve American potash in warm water, make it into a paste with whiting, and spread the mixture over the marble. If washed off in a few minutes, it will bring with it all ordinary surface stains and discolorations. Obdurate stains may take a longer time—some hours perhaps—but if left on long, the caustic potash is apt to corrode and injure the polish of the surface. Chloride of lime is another good agent to remove obstinate stains. But if smoke has penetrated right into the substance of the marble, I know no way in which it can be removed and the original whiteness restored without taking the shelf to pieces, laying the portions in wet sand so as to leave one surface only exposed, and sprinkling this over with pipe-clay. The moisture rising will generally drive the smoke stain into the pipe-clay; but in some cases this will not perfectly succeed.—M. M.

**Planchette.**—B. W. (*Manchester*).—Take a piece of ½ in. board, say, 15 in. by 6 in., mount it on four legs, with castors which will admit of perfectly free movement in every direction, and in the middle fix a blacklead (*a*), all as shown in the side view, Fig. 1, and you have planchette. To use it, lay a sheet of paper on the table, and on it set the instrument. The two operators sit on either side, and place their hands upon it, with fingers spread out and thumbs somewhat overlapping, as in Fig. 2. Planchette is secretly asked to answer questions. After a time there is an unconscious movement of the hands, and consequently of the machine (be the cause

Fig. 1

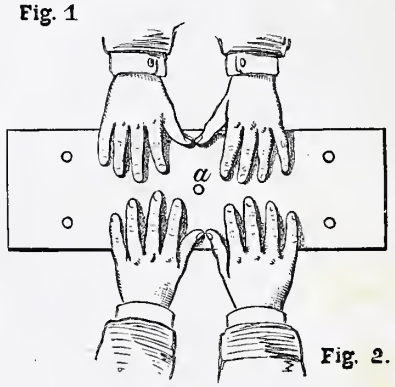



Fig. 2.

**Planchette.**

what it may), and the pencil, of course, makes scrawls upon the paper beneath it. If faith and ingenuity are present in sufficient quantities, these scrawls may be interpreted into words and answers to the questions asked. In the newspaper cutting sent by our correspondent, we read such marvels as that planchette has written a story which was accepted word for word by a magazine editor. B. W. must be told that the author of this statement is by nationality an American, and by vocation a writer of fiction, and that discount must be allowed accordingly.—S. W.

**Marine Boiler.**—R. S. (*Oldham*).—You are mistaken in saying you have such a boiler as I suggest on page 174 of No. 115 of WORK, as I describe a *vertical* boiler, and yours is *horizontal;* nevertheless, a paraffin burner may suit your purpose if properly made. As you do not give dimensions of fire-box, I cannot give you exact sizes, but these you can work to if you have the design. I assume from your sketch that the furnace has a flat top. I should advise you to make the lamp of sheet-brass, and on the plan illustrated herewith. In a horizontal fire-box there is more difficulty in obtaining a uniform air supply than in a vertical one, and special means may be required to distribute the flames equally to the tubes. Fig. 1 is a transverse, and Fig. 2 a longitudinal, section of the fire-box, the former being taken on the line 1—2 on the latter. The same letters refer to the same parts in both figures: A is the boiler shell; B, the fire-box; C C, the lamp or burner, in which are four wick tubes (D) extending about three-fourths the length of the fire-box. These holders (D), which are to contain the ordinary woven wick, have inclined upper edges, as shown, in order that the flame may be evenly distributed over the flue tubes. Air

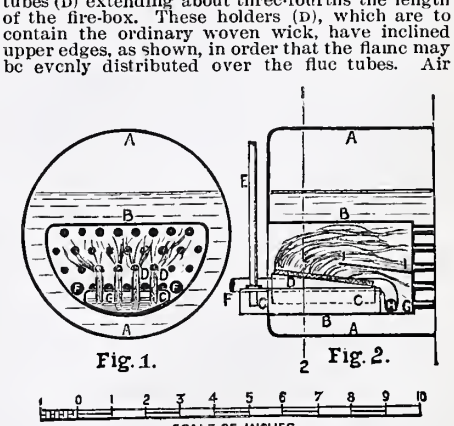



Fig. 1. Fig. 2.

**Marine Boiler.**

flows in between the wick holders from the front. The ordinary wheel arrangements may be attached for adjusting the wicks. Paraffin is supplied to the burner, C C, from a reservoir (not shown) by a pipe, E, which must of course be fitted with a cock to regulate the supply of oil. The oil should be of a high flashing temperature to obviate accidents. By

means of the cock on the pipe, E, you can adjust the supply to any requirement, from merely keeping the water at boiling point to maintaining the highest evaporation of which the apparatus is capable. In order to supply air to the back part of the burners, and prevent smoke and soot, a cross-pipe, G, is there placed, having perforations or a long slot, H, in it, directed towards the burners as shown. A baffle plate, I I, may be used to deflect some of the flames to the lower tiers of tubes, but this should be made removable until the exact requirements of the furnace are ascertained by trial. If the chimney blast does not draw sufficient air through the pipes, F, which furnish air to the cross-pipe, G, a small fan may be used to assist, or small steam jets may be fitted to the pipes, F, though this is objectionable, as steam thrown into a furnace robs it of heat.—F. C.

**Japanning.**—SOCRATES.—The reason your articles are tacky may proceed from various causes. You may have put the japan on too thickly, you may not have used the right kind of japan, your work may have been greasy when you put it on, or you may have baked the articles in an oven without ventilation. A great point depends on the oven being well ventilated to allow of the escape of the volatile solvents used in the manufacture of the japan, which are driven off by the heat. For a simple efficient oven, I should advise one made something like a gas cooking oven—square, open at the bottom; pipe running round the bottom with the ordinary pinhole jets, but instead of one outlet of air at the back, as is usual in these ovens, I should have about four 1½ in. or 2 in. holes on each side. With regard to the time to leave the articles in, that depends so much on circumstances, such as thickness of metal, size of work, etc., that I think a few experiments with pieces of tin, etc., using a thermometer and noting results, will give you more information than I could here. I am not aware of any particular method of cleaning the work; provided it is free from spirits of salts, grease, and moisture, that is enough. If in doubt as to the japans you are to use, apply to Messrs. Wilkinson, Heywood, & Clark, japan manufacturers, Caledonian Road, N., where you can get anything you require in that line. Glad to hear that you appreciate the articles on Sheet Metal Work; there are some more in hand that will probably be of still greater use to you.—R. A.

**Galvanising Brass Castings.**—J. D. (*Strabane*).—From the manner of your inquiries—viz., asking for the "receipt" for tinning nails and galvanising rivets, and the receipt for casting brass keys and "brasen"—by which I presume you mean brazing—it is very evident to me that you have not even an elementary knowledge of the things you inquire about. This being the ease, it would be useless to take up space with a lengthy reply such as your queries would involve. I can, however, give you a piece of good advice, which is this: As you are a new reader of WORK, get all the back numbers as soon as you can, and you will there find much that will be valuable to you, and possibly something on the subject you write about.—R. A.

**Cycle Parts.**—T. S. (*Morpeth*).—The St. George's Cycle Company is a reliable one. I have dealt with them for the last two years in cycle goods, and have always found them prompt in sending parcels, unless they were out of certain things, and waited for them, when two, or even three, weeks might elapse. I should never think of referring readers to any firm unless I had experience of it.—A. S. P.

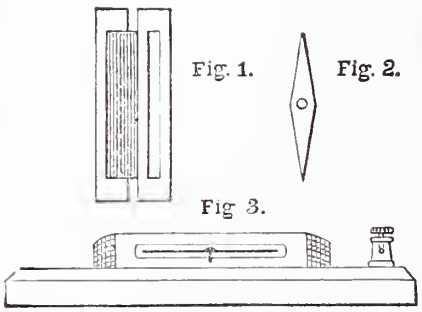
**Polish for Bookcase.**—T. F. (*Tamworth*).—As a means of keeping it clean and showing up the beauty of the wood, polishing is much preferable to varnish; but as you do not seem conversant with the *modus operandi*, I should strongly advise you to read carefully the articles, "How to French Polish" and "The Rubber in French Polishing," which appeared in Nos. 105 and 108 of WORK; also the hints on polishing constantly appearing in "Shop." Then try your 'prentice hand on something you prize less than the bookcase. You will then get an insight of what polish will do, and become possessed of rubbers that will be of great assistance when you come to the bookcase itself, which, in the meantime, might be kept clean by giving one or two coats of white polish applied with a camel-hair brush. Then, when you feel yourself more proficient, this can be rubbed smooth with fine glass-paper, and then French polished with far more satisfaction to yourself than if you take it for your maiden effort. If desired to be kept light-coloured, use white polish; if a darker or reddish shade, brown polish is used; but owing to the presence of so much carving, etc., I should advise you to use the white polish.—LIFEBOAT.

**Bicycle Parts.**—A. A. M. (*Lower Clapton*).—A. A. M. will get bicycle parts plated by numerous electro-platers in London. I may mention Brown Brothers, 7, Great Eastern Street, and St. George's Cycle Company, Islington. The latter firm will also supply him with a pneumatic saddle. I am not acquainted with the construction of such a saddle, but I know it would be a ticklish job to make by one not accustomed to such work. To enamel or paint a bicycle with enamel, scrape off all old paint. If it is difficult to remove, coat it well with methylated spirit: this will soften the paint or varnish, when it may be cleaned off, and the surface well rubbed down with sand-paper or emery-cloth. Wipe clean, and procure quick-drying *club black enamel*, 1s. per bottle, with brush. Float the enamel on quickly and evenly, as it dries very fast, taking care not to go over the same part twice. When dry, apply another coat, and you will have a good surface.—A. S. P.

**Piccolo Banjo.**—G. H. (*London, S.E.*).—The size of piccolo banjo that I generally make, and which gives the best results, is one with a 7 in. hoop and 8⅜ in. finger-board—that is, 8⅜ in. from nut to end of finger-board where it joins the hoop. This size you can tune to concert pitch one octave higher than a full-sized banjo. You could make the hoop smaller, adding to length of finger-board what you take off hoop. You will get a more powerful tone by using the sized hoop I have given. If you want to swing it about when playing, fix a piece of string or a strap on end, and long enough to slip over the wrist. Number of brackets, twelve or sixteen; width at nut, 1¼ in.; ditto at end of finger-board, 1⅝ in. The sizes given you will find comfortable to play on. If you have thin finger-tips, you might make it a shade narrower; better rather wide than having the strings too close, and not being able to stop one string without touching the next one to it. My own "Jo" is 1 in. at nut, and a little longer finger-board. If you make it longer than the size I have given, you will find the strings will not stand when tuned up to concert pitch. Size of hoop for this banjo, 9 in., and 16 in. finger-board; or 8 in. hoop, 17 in. finger-board; widths at nut and end against hoop same as piccolo; number of brackets, eighteen or twenty. You could put on more brackets, but, providing those you use are well made, you will only be adding to the weight of them without any additional advantage being derived from putting more on than the number I have given.—J. G. W.

### IV.—QUESTION ANSWERED BY A CORRESPONDENT.

**Galvanometer.**—M. (*Bishop Auckland*) writes, in reply to GALVANIC (see page 206, No. 117):—"Make a bobbin of cardboard, by gluing a strip of card on a piece of wood 2½ in. wide and ⅜ in. thick. Make the strip 1 in. wide, and fix two ends or flanges projecting ¾ in. all round. These can be fixed by gluing a strip of paper round the inside. (See Fig. 1, which shows bobbin ready for wire.) Wind three coils of No. 36 S.C. wire on the bobbin, keeping the wood in while winding, and leaving two ends 6 in. long. Also wind one coil of No. 22 S.C. wire, leaving 6 in. ends. Make a base-board 6 in. square, and fix in the centre a needle projecting upwards ¼ in., and pass this through the wire in the centre, and fix the bobbin to the base-board by a small wooden block at each end. Fix three small binding screws at one side of base-board, and fix a thick and thin wire to one, and a thin wire to one of the remaining screws, and a thick wire to the other. Make the needle 2½ in. long, as shown in Fig. 2, from a piece of steel spring, which must be heated blood-red and allowed to cool. Cut and file to shape, and drill a hole in




Galvanometer. Fig. 1.—Cardboard Bottom. Fig. 2.—Needle. Fig. 3.—Section of Galvanometer.

centre, and rivet a piece of brass in it, and drill nearly through the brass a fine conical hole. Then harden the needle by heating blood-red and cooling in cold water. Lay it across the poles of a large permanent magnet for twenty minutes to magnetise it, or insert in a coil of wire and send a quantity of jerky charges through it from a strong battery. It is now to be fixed on the needle point inside the bobbin. If it does not hang level, put a little sealing-wax on the light end to balance it. In use, the bobbin must be set N. and S.; and by using the fine wire you can test for intensity, and by the thick wire for quantity. Fig. 3 is a section of bobbin and needle. You can make the bobbin longer than 1 in. if you want to put a larger quantity of wire on. You will find this a very useful instrument; and if there is anything you do not understand, if you write again I will give you further particulars."

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—SOMERSET; A WEEKLY SUBSCRIBER; W. N. (*Lyndhurst*); R. H. (*Notting Hill*); F. H. B. (*Manchester*); C. G. (*Putney*); ELECTRICAL COMPANY; D. H. (*Glasgow*); H. C. (*Lancaster*); E. C. W. (*London, E.C.*); PLUCK DEVON; F. J. P. (*West Bromwich*); H. H. (*No Address*); E. G. P. (*Kingsland*); J. E. B. (*Birmingham*); G. R. (*New Seaton*); T. W. V. (*Leicester*); J. D. (*Hull*); BOWTON LAD; D. S. (*Glasgow*); J. T. H. (*Bacup*); R. W. (*Barnsley*); R. W. (*Blaina*); E. W. G. (*No Address*); J. A. (*Wandsworth*); AMATEUR; C. D. (*Corfe*); SHOTTS; W. C. (*Shrewsbury*); L. B. (*Wells*); W. B. (*Manchester*); K. (*Keighley*); HARDWORK; R. E. D. (*London, E.C.*); E. W. (*London, N.*); H. B. S. (*Liverpool*); R. P. (*Islington, N.*).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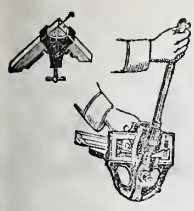

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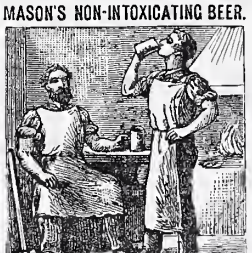

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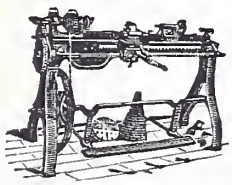

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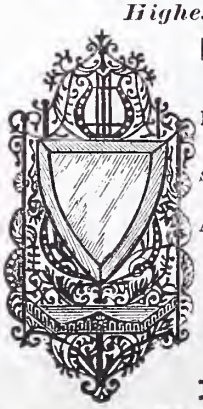

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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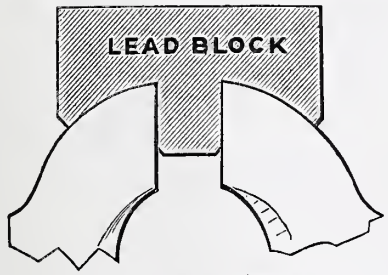



Fig. 11.—Lead Block.

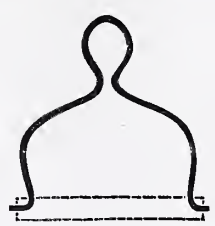


Fig. 12.—Arrangement for Hanging (4 in. to 1 ft.).

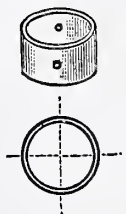


Fig. 5. — Sketch and Plan of 1¼ in. Ring (4 in. to 1 ft.).

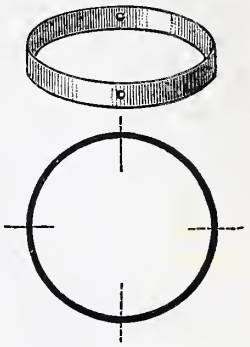


Fig. 4.—Sketch and Plan of 3 in. Ring (4 in. to 1 ft.).

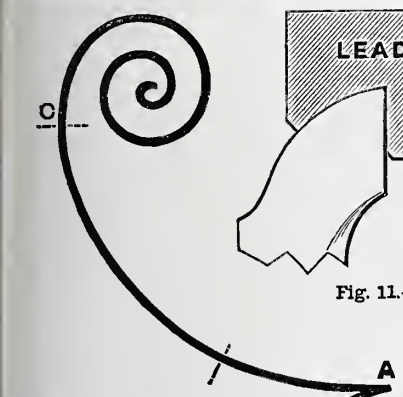



Fig. 2.—One of Four Side Pieces (4 in. to 1 ft.).

Fig. 3.—Small Scroll (4 in. to 1 ft.).

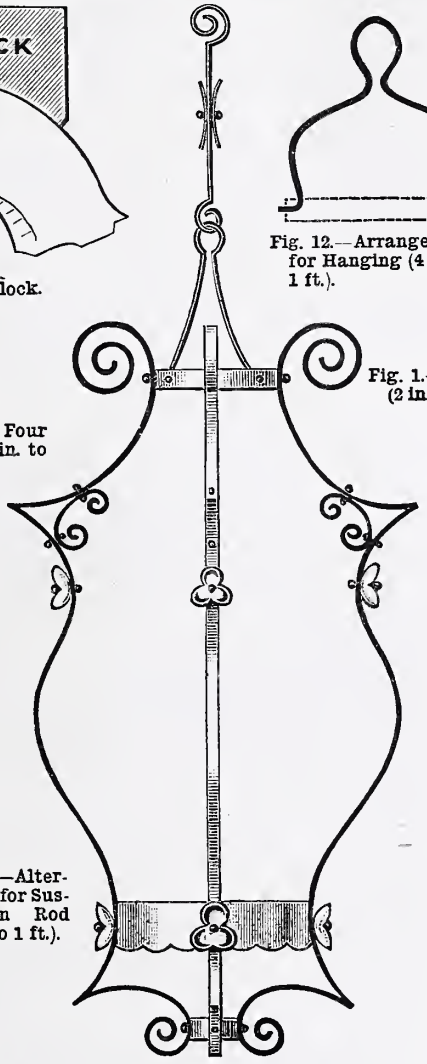


Fig. 1.—Elevation (2 in. to 1 ft.).

Fig. 6.—Ball Bolts (full size).

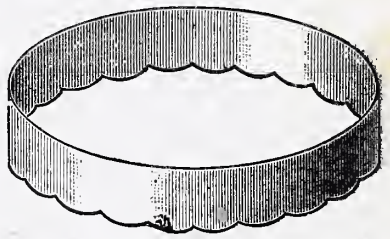


Fig. 7.—Sketch of Lamp-Tray (4 in. to 1 ft.).

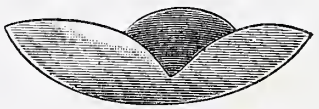


Fig. 10.—Trefoil (full size).

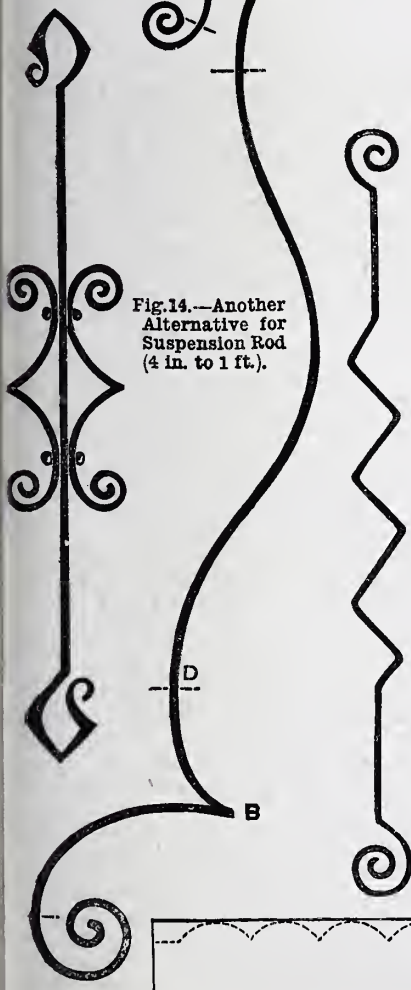



Fig. 14.—Another Alternative for Suspension Rod (4 in. to 1 ft.).

Fig. 13.—Alternative for Suspension Rod (4 in. to 1 ft.).

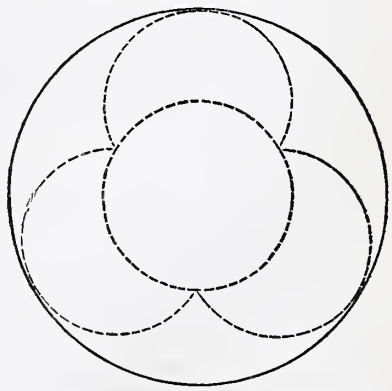


Fig. 9.—Method of cutting Trefoils (full size).

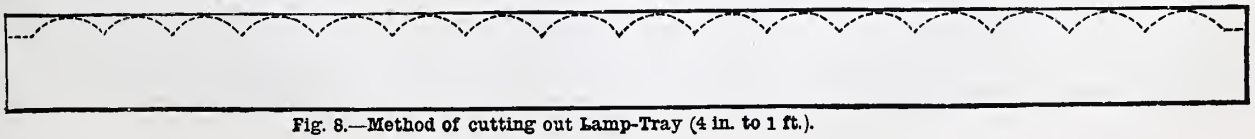


Fig. 8.—Method of cutting out Lamp-Tray (4 in. to 1 ft.).

## A HALL LANTERN IN BENT IRON.

BY OPIFEX.

INTRODUCTION—MATERIALS—DETAILS OF CONSTRUCTION—BENT IRON SIDES—SMALL SCROLLS—PUTTING FRAMEWORK TOGETHER—LAMP-TRAY—DIPPING AND LACQUERING LAMP-TRAY—COPPER ORNAMENTS—FIXING LAMP-TRAY—METHOD OF HANGING LANTERN—SUSPENSION CHAINS OR RODS—BERLIN BLACK.

I HAVE endeavoured in this paper to describe, for the benefit of amateur workers in iron or those who desire to "try their hands" at the same, how a fairly presentable article

may be manufactured at home; and if the processes and methods employed are not "up to the mark" from the professional standpoint, yet they may be found more suited to the amateur, who does not always possess the appliances necessary to carry out the work as, strictly speaking, it ought to be done.

I believe that we should always do work, of whatever kind, in the *correct* way when we know how, and when we *can*, but I do not hold with those who will not make the attempt to produce a result merely because they may not possess the most suitable means of arriving at it. After all, the *result* is the main thing, and if we achieve a good result, then all the more credit to him who achieves it under the most unfavourable circumstances.

I make these remarks in the interest of my fellow amateurs, as I know of cases where work proposed has been unattempted and work begun abandoned, the workers being disheartened because they had not *everything* to their hands. By all means be thorough, but do not imagine that thoroughness in work depends upon the possession of every possible facility by the worker.

For example, let no reader suppose that in order to make the lantern represented at Fig. 1 a smith's forge is a *sine quâ non*, or that a complete outfit of smith's tools is indispensable, for, as a matter of fact, a good ordinary fire and a few simple tools only are required, especially if supplemented by a pair of strong hands and a fair amount of skill in using them.

It is surprising how much may be accomplished in the way of artistic iron-work with the aid of a hammer, a strong pair of pliers, a vice, a smoothing-iron, and the kitchen fire—provided always that one is on friendly terms with the *queen* of the region just mentioned.

Of course, it goes without saying that if we possess a good workshop and all those things which I have said are *not* necessary, we will be saved some trouble, and ought to be able to accomplish better results; and I am not to be understood as advocating "hole-in-corner" methods, or slovenly short cuts, but only the motto, *Nil desperandum*.

*Materials.*—This lantern is composed of iron, brass, and copper—a combination which is highly effective, and which possesses the further recommendation that it is fashionable. The main portions are of flat ribbon or hoop iron. The lamp-tray is sheet brass, and the trefoil ornaments are copper.

For the iron-work we shall require not less than 20 ft. of ribbon iron, $\frac{1}{2}$ in. by $\frac{3}{32}$ in. (or No. 14 B.W.G.), with round edges. This should be of good quality, and may be obtained at almost any ironmonger's, or of Messrs. Pfeil & Stedall, Broad Street, Bloomsbury, London, W.C.

For the lamp-tray we require one piece of sheet brass 19 in. by $1\frac{1}{2}$ in., and No. 22 B.W.G.; also a piece of the same thickness sufficiently large to form a disc—say, $6\frac{1}{4}$ in. diameter. For the ornaments we must have sheet copper of the same thickness as the brass—or No. 24 B.W.G. will do—sufficient for eight discs 2 in. in diameter, or, say, a piece 8 in. by 4 in.

We also need a supply of ball bolts. Twelve of the size shown at Fig. 6 and twelve of a size smaller will be used, but it will be well to have more than the actual number. It is not always easy to obtain these bolts, and I am unable to give any address where they can be got, except the above-named Messrs. Pfeil & Stedall.

*Details of Construction.*—Having given some idea of the kind and quantity of materials necessary to make a start, I now proceed with the details of construction.

*Bent Iron Side Pieces.*—We commence by cutting four lengths of the ribbon iron, each 3 ft. 6 in. long, for the sides of the lantern, and having an exact full-size working drawing of Fig. 2 upon some suitable surface—I always use a large roofing slate, and draw with hard chalk—we are ready to begin the work of bending the scrolls, etc.

For this we need a good clear fire and a strong pair of wire, or round-nose, pliers. Place the iron in the fire so that about five or six inches may be made red hot, and be careful not to exceed a good bright red, as if there be a strong draught in the grate the iron may be burned and spoiled.

When bright red, grasp the *extreme* end of the iron in the pliers and form the small innermost turn of the spiral; then, by gradual bending, work the iron to the required shape—applying it from time to time to the working drawing—until the point A, Fig. 2, is reached. This point should now be marked with chalk upon the iron, or if the metal is of very good quality it will bear marking with a centre-punch. Heat to bright red as before, and double the iron so that the marked point may lie upon the centre of the bend. Now grasp this bend in the vice and screw up very tightly, which operation, if carried out quickly and dexterously, will be found sufficient to form the pointed portion of the scroll A, Fig. 2. A little "humouring" of the iron, however, and perhaps re-heating, may be necessary.

The further shaping until the point B, Fig. 2, is reached, will be comparatively easy, and may be done altogether with the hands, but the reader is advised to be very careful to follow the working drawing exactly, as the whole success of the work depends upon this.

To turn the point B, repeat the operation as at A, and so on to the final scroll.

The other side pieces are now bent in the same way, applying each one to the drawing and *also to the others* as the work progresses. In this way all four will be *precisely* the same both in size and shape, which is absolutely essential.

*The Small Scrolls* (Fig. 3), which are meant to give strength and rigidity to the sides, come next.

For these, cut four lengths of iron, each 9 in. long. The spirals are turned in the same way as already described, but a pair of flat pliers will now be necessary to hold the iron with the left hand, while the shaping is carried on with the right.

See that all four are exactly the same, and in agreement with the drawing. Now place them in position as indicated at Fig. 2, and mark off the points of contact with the side pieces. Draw lines with a red pencil, etc., across the flat of the iron at each of these points, and mark decidedly in the centre with a centre-punch and hammer.

The next step is to drill the sixteen holes which are required for fixing these scrolls. This may be done with any drill available, and if the worker possesses a lathe, so much the easier will the work be to him. These holes are for the smaller, or $\frac{3}{16}$ in., ball bolts.

Insert the bolts from the inside of the small scrolls, and screw up nuts as tightly as possible on outside of sides; cut off over lengths with a pair of "nippers," etc., and rivet.

In the operation just described, care must be taken not to interfere with the shape of the side pieces, which during the fitting of the scrolls should be placed upon the working drawing.

*Putting Framework of Lantern together.*—For this purpose we require two small hoops or rings, one 3 in. in diameter (Fig. 4) for the top, and the other $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. diameter (Fig. 5) for the lower part of the lantern. For the former, it will be necessary to bend a piece of iron 10 in. long into a small hoop, scarfing and lapping $\frac{1}{2}$ in. at each end, which, if the worker is sufficiently skilled, may be welded; or they may be neatly joined by a rivet, and if the holes be slightly countersunk at each side the ends of the rivet may be filed flush, and if well done the joining will not be noticeable, and the job will be quite strong enough for the purpose in view.

The other and smaller ring may be cut from a gun-barrel pipe of the required diameter, and should be about $\frac{3}{4}$ in. wide.

Having formed these rings, mark off four equidistant points upon the centre of the outer circumference, and drill holes to suit the larger ball bolts in the larger ring, and for the smaller bolts in the ring of gun-barrel. Next drill corresponding holes in the side pieces at the points C and D (Fig. 2), or exactly at the points of contact with the rings when placed in position.

Now insert the respective bolts and screw up. Cut over-lengths and rivet as before directed, and we have the framework of the lantern complete.

*The Lamp-Tray.*—If the work already described has been carried out in accordance with the working drawings, and made upon the scale indicated, the lamp-tray will be 6 in. in diameter, or thereabouts. This is composed of a hoop of sheet brass, $1\frac{1}{2}$ in. wide, and mitred on the lower edge (Fig. 7).

Having ascertained, by exact measurement of the distance between opposite side pieces, the size of the required tray (which we shall assume to be 6 in.), cut the strip of brass 19 in. long and $1\frac{1}{2}$ in. wide; with a pair of compasses mark out the mitring in the manner indicated at Fig. 8, and cut carefully with a pair of shears—or snips, as I believe the correct term is—and finish the edges, sharp and regular, with a fine file.

To give a suitable finish to the surface of the hoop, fix a common smoothing-iron, face upwards, firmly in the vice, and using this as an anvil, hold the hoop, right side up, flatly upon it, and with the round end of a riveting hammer go over the whole surface of the brass so that the indentations shall touch each other, and striking with uniform force and even distribution of blows, a mottled appearance will be imparted, which is most effective.

Now bend the strip into a *perfect hoop*; lap the ends to a depth of $\frac{1}{2}$ in., having scarfed them with a file, and solder neatly, being careful not to allow any solder to run upon the outside of the joint.

Next cut out a disc of brass which shall fit tightly within the hoop, and fix it in position about $1\frac{1}{4}$ in. from the straight edge, or just above the mitring, of the hoop, and having well cleansed the brass with fine emery-cloth, and applied "killed" spirit in the *inside* angle of the tray, and using a very hot pointed copper bit, cause a thin stream of solder to run all round, and if the parts of the tray have been accurately fitted, a neat and strong job will be the result.

*Dipping and Lacquering.*—The appearance of the tray will be much improved by "dipping" or "colouring," and it *must* be lacquered. The former process is to impart lustre, the latter is to preserve it.

A quart of nitric and a pint of sulphuric acid, with a "pinch" of common salt, makes a good dipping bath for brasses such as the subject in hand. Mix in a glazed earthenware vessel, and when cool the bath is ready for use. Wash the brass in a strong solution of washing soda and hot water to remove all grease, and using a hard nail-brush and finest ground pumice-stone, brush the whole surface of the brass, rinse in warm water, and allow to dry. Now run a piece of *brass* wire round the tray and across it, so that it may be firmly held, and having warmed it slightly, dip it completely into the acid bath; move it rapidly with a twisting motion for a few seconds, and then rinse immediately and thoroughly in clean cold water. It should now be dried in a box containing hot box-wood or beech-wood sawdust, moving or shaking it about until all the moisture is absorbed, and being careful not to handle it without placing a piece of chamois or old silk handkerchief, etc., between the fingers and the brass. When all sawdust is brushed off the tray is ready for lacquering.

*Lacquering.*—For directions on this subject I must refer the reader to page 346, Volume I. (No. 22), directing his attention especially to the last paragraph of the article under this head.

*Copper Ornaments.*—To make these, cut out eight discs of sheet copper, 2 in. in diameter, and with a pair of compasses mark out the trefoil pattern as shown at Fig. 9. Cut out with snips, and finish edges with file and emery-cloth. To shape these as indicated at Fig. 10, we need a small block of lead—an article which is indispensable to the worker in artistic metal work. This may be about 5 in. by 6 in. by 2 in.; and if made of the shape suggested at Fig. 11 (in section), so that it may be firmly fitted in a vice, it will be all the better.

With the round end of a riveting hammer make a slight circular hollow about the size of a sixpence near the edge of the lead block, and holding the leaf portion of the copper trefoil over this indentation, beat it down with the round end of a hammer. In this way the trefoil may be easily "knocked into shape," and by slight hammering over a larger, but *shallow*, concavity in the lead, the whole may be evenly hollowed as shown.

Having prepared the eight trefoils, a $\frac{3}{16}$ in. hole should be drilled in the centre of each, when they must be dipped and lacquered as before directed; the only point of difference in the treatment of brass and copper being that the latter should have a colourless lacquer, if available, but if not, the palest gold lacquer will do almost as well.

*Fixing Lamp-Tray.* — The lamp-tray should now be placed in position, and holes having been drilled for its attachment to the four side pieces, it may be fastened up with the larger-sized ball bolts, placing a trefoil upon each, as shown in the sketch, etc.; next attach the four upper copper ornaments, and we come to the last item in the construction of the lantern: viz., the arrangement (Fig. 12) for hanging.

*Method of Hanging Lantern.* — This should be of $\frac{1}{4}$ in. round rod-iron—of some such shape as suggested—and should be carefully bent so that the "legs" may be exactly the same length and shape. The ends are turned outwards at right angles, and need not be more than $\frac{1}{4}$ in. long. These are meant to pass through two holes in the upper ring, which holes should be drilled of a suitable size at exactly opposite points in the ring.

If accurately made and fitted as shown at Fig. 12, there will be sufficient spring to allow of the ends being inserted from the inside, when the lantern should hang true upon the pivoted bearings.

*Suspension Chain, etc.*—With regard to the suspension of the lantern, a very light iron chain may be used, or a sufficient number of suspension rods made to hook into each other may be made. For the latter I give two alternative suggestions at Figs. 13 and 14.

*Berlin Black.*—All the iron portions should be treated with two coats of Berlin black, to be applied *before* joining the parts together—a direction which it might have been better to give at the outset, but which, to avoid complication, I have left to the last.

## MASONS' WORK.

BY MUNIO.

WORKSHOP — DRAWING INSTRUMENTS — GETTING OUT MOULDS — NUMBERING AND ORDERING STONES—SETTING—DOWELS, JOGGLES, CRAMPS —WINDOW-SILLS—YORKSHIRE PAVING AND KERB.

*Workshop.*—When a building is to be erected, containing a quantity of dressed stones, it is customary to build a shed, in which the stones are worked. This is generally open at the front, about 8 ft. or 10 ft. wide, and of sufficient length to accommodate the number of workmen which will be required. Bankers formed of large stones, or piles of bricks with a stone on the top, are erected on which the stones are laid while being worked. The shed should be as near the building as convenient, and there should be sufficient space near it on which to lay the stones as they come from the quarry.

A workshop should also be provided, in which a table or large drawing-board is fixed, on which the working drawings are made. These drawings are made full size generally, and as they should be thoroughly accurate, it is very important that a mason should be a practical draughtsman.

*Drawing Instruments.*—The instruments required for making the working drawings are a large square, set-square, straight-edge, chalk line, strong needle pointers, joiner's compasses, with guide and screw for fixing the legs, and beam compasses. For any drawings which may have to be made on paper, a large drawing-board, T-square, set-squares, and a set of mathematical drawing instruments will be required.

*Getting out Moulds.*—When the plans and detail drawings for the building have been received from the architect, a full-size drawing of such stones as require a mould for working them is made on the drawing-board, and from this the moulds are made. The best material for the moulds is thin sheet zinc. This must be tacked down over the drawing, and the lines marked upon it. The straight lines can then be cut by a steel scriber, and the circular lines by the point of the compasses. Figs. 40, 41, and 42 are detail drawings of a doorway, a ventilator, and roof corbels, from actual work, and from which the mason would make the working drawings and get out the moulds. Four moulds would be required for the doorway: one for the ventilator, one for each corbel, and one for the gable coping.

*Ordering and Numbering Stones.*—After the working drawings and moulds have been made, a list of the stones required in the building should be made out and sent to the quarry. Each stone, or group of stones, should have a number or mark set opposite to them. This should be marked on the stones before they leave the quarry, and if the same mark is put on the mould, there will be no trouble, when the stones arrive on the works, in selecting them for their place in the building. They should be numbered in such order that the stones which are required first should be sent in first, and this should also be attended to in working them, as it is much preferable to take them direct from the bankers to the building, than to have them lying about and liable to be damaged. The list should have the length, breadth, and depth entered in separate columns, marked at the top, as it is essential for the quarryman to know which is the bed of the stone, in order that he may cut it properly in the quarry. A copy of the list must be kept on the works for reference. When any stones are required of irregular form, a mould is sent to the quarry, to which they are roughly shaped, in order to save unnecessary carriage and extra labour in working.

*Setting.*—The setting or fixing of dressed stones is an operation requiring great care and skill. The stones are set with fine mortar, and in some cases oil putty is used, but as the pores of the stones sometimes absorb the oil, it discolours them. It should not be used for Bath stone; the best material for setting this stone is washed putty mixed with the stone dust. The stones should be plumbed on two faces and set straight on the outside face by means of a rule or line. In setting copings, cornices, etc., they should be raked or lined to each other by means of a long rule, and the top beds levelled. All stones should be solidly packed up at the tails with pieces of slates; they should be beaten down with a wooden mallet. The mallet for Bath stone should be of soft wood, or the stone will be bruised or stunned.

The joints should be thin, but there should be sufficient mortar between them to form a bed. In setting detached columns or pillars, a sheet of 4 lb. lead should be laid on the joint to within an inch of the edge, and the remainder formed of putty. This will prevent the edges of the stones being chipped when the weight comes upon them. Dowels should also be inserted between the stones.

In setting short piers between openings, where the inside is walled with rubble or bricks, the inside joints should be made as thin as possible, to prevent any settlement inwards, and it will sometimes be necessary to stay them till the heads are on, in order to obviate this.

In setting thresholds, window-sills, etc., they should be bedded solidly at the ends, and left hollow in the centre, or they will be liable to be broken when the work settles. When window-sills cannot be got in one stone, they should be in three stones; and if there are mullions in the window, the joints should be under a mullion.

In fixing mullions, tracery, etc., which require supporting till the whole are set, strong pieces of wood should be fixed across the openings to which they are temporarily fixed, till the whole window is set.

As the work is carried up, all projecting stones, angles of doorways, etc., should be cased with wood, to protect them from injury while the work is going on; and should any portion of a stone be broken off, it may be fixed by a solution of shellac dissolved in naphtha (by heat) till of the consistency of treacle.

For preserving a Bath stone front from

dirt, stains, etc., while being built, it is recommended to coat it with Bath stone dust, mixed with sufficient lime to make it adhere, and water, as it is built.

In setting spires, chimneys, and other objects built in courses at a high elevation, each course is fitted together on a level surface before being sent up, so that no cutting or paring is required after they are hoisted.

Bond stones should be laid on the tops of door- and window-heads after the walls are levelled up to them. There should also be bond stones under the ends of window-sills.

*Dowels, Joggles, and Cramps.*—Dowels are tenons fixed in the beds of stones to prevent them sliding upon each other; they are made of copper, bronze, wood, iron, and slate. Iron is not a suitable material for them, as if any dampness gets to them, it causes the iron to oxidise, and sometimes splits the stone. When iron is used, it should be tinned or galvanised. The dowels should be accurately fitted into the mortises cut to receive them, and to ensure their fitting properly the mortise hole should be cut in the mould, when it can be accurately marked and cut in as the stones are dressed. They are used in mullions, pinnacles, etc. Joggles are tenons formed on one joint of a stone, with a corresponding mortise formed on the adjoining stone; but as this causes a great waste of stone, joggle dowels are often used, a mortise being cut in each stone. They are used in jointing stone work of copings, parapets, etc.

Weather or weathered joints are those in which the under bed of the stone is notched upwards, leaving a piece of the stone projecting over the joint below, to protect it from the weather. They are used in gable copings, buttress slopes, etc.

Cramps are used for securing stones firmly together; they are made of copper and iron. When iron is used, it ought to be galvanised or tinned to prevent corrosive action. They are formed of flat bars turned down at the ends, and fixed in grooves or mortises cut in the stones; they are sometimes run in with melted lead, and sometimes with Portland cement. They are used for fixing the top stones of parapets, copings, etc.

Copper chain cramps are used in spires, chimneys, etc.; they are fixed in grooves cut in the beds of the stones.

*Window-Sills.*— Window-sills should be chamfered, or sloped from the front of the frames, to throw the water off, and the top bed on which the frame rests should be checked or rebated at the outside to prevent wet being driven in, the wood frame being correspondingly rebated at the back. In large windows with lead or iron lights a hole should be drilled through the sill from the inside, and a copper pipe brought through the wall to carry off the condensed moisture which forms on the glass. When the sills project in front of the face of the wall, a throating should be cut in the under

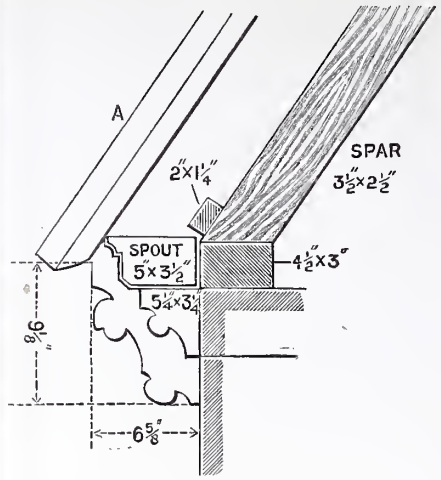



Fig. 42.—Section of Corbels, etc.—A, Corbel Coping.

bed to prevent the wet from running down the wall. The throating is a semicircular groove about ¼ in. in diameter.

Projecting string courses, copings, and all other stone work which projects from the face of the wall should be throated.

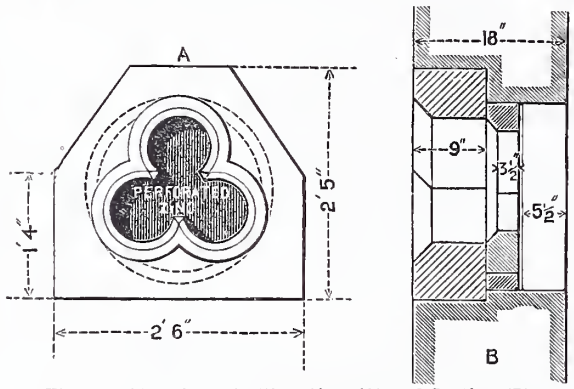



Fig. 41.—Ventilator in Elevation (A) and Section (B).

*Yorkshire Paving and Kerb.*—Yorkshire paving or flagging is of three kinds: self-faced, tooled, and polished flagging. Self-faced flagging is natural or quarry-faced; tooled flagging is tooled on the face; and polished flagging is boasted level on the face and rubbed or polished. The flags are from 2 in. to 4 in. thick, according to their size; they are selected into courses, and the edges jointed and squared. The joints should be kept square from the face for 1½ in. or more in large-sized flags; they should be bedded down solidly on dry sand, with a trowelful of mortar at each corner; they are jointed with fine mortar, and when laid outside for footpaths, etc., the joints should be pointed with Portland cement. They are laid level on the surface by means of a long rule, and raked to level pegs driven in at each side of the floor.

Paving is sometimes laid hollow on sleeper walls; it is then bedded in mortar and levelled on the surface.

Kerb is used at the side of a footpath and round area gratings, etc.; it is tooled or boasted on the top side and edge, and bedded and jointed. The joints are sometimes dowelled; it is bedded down solidly on mortar, and the joints made with fine mortar or cement. Where there is much traffic, granite kerb is sometimes used. The kerbs round area gratings are rebated for the grate to lie in.

Dressed kerbs are also fixed under iron palisadings and railings; they are tooled on both faces, and the top bed is chamfered or rounded. The holes for the rails are drilled after the kerb is fixed, and the rails run in with melted lead. Hearths are from 1 in. to 2 in. thick, boasted on the face, and polished; the edges are squared and jointed, and they are laid on the ground floor on solid foundations of brick or rubble work, and on trimmer arches on upper floors; they are made from 16 in. to 20 in. wide, and should be at least 6 in. longer than the width of the stove grate. Back hearths are laid behind hearths for the stove grate to stand upon.

Thus far the principal points and details in the manual work that is done by masons have been described and placed before the readers of WORK, briefly, it is true, but at sufficient length to afford assistance to the young professional, and also to give amateurs a fair insight into it if they are interested in it. I have, however, yet to deal with staircases and the various arches used in masonry, but the consideration of these must be left for my next and last paper.

It is not to be supposed that the amateur workman at home will find much attraction in masonry, but on the principle that all knowledge of a practical kind is useful, it is desirable to have a tolerably correct notion of the way in which every kind of handiwork is done, that if any particular kind of work is being done at one's own place, the person for whom the work is being executed may be able to form some idea as to the manner in which the work is being carried out, whether well or badly. The amateur in the colonies, however, will sometimes have to do a little stone-working for himself, if it is to be done at all, and he, at all events, will find the papers useful.

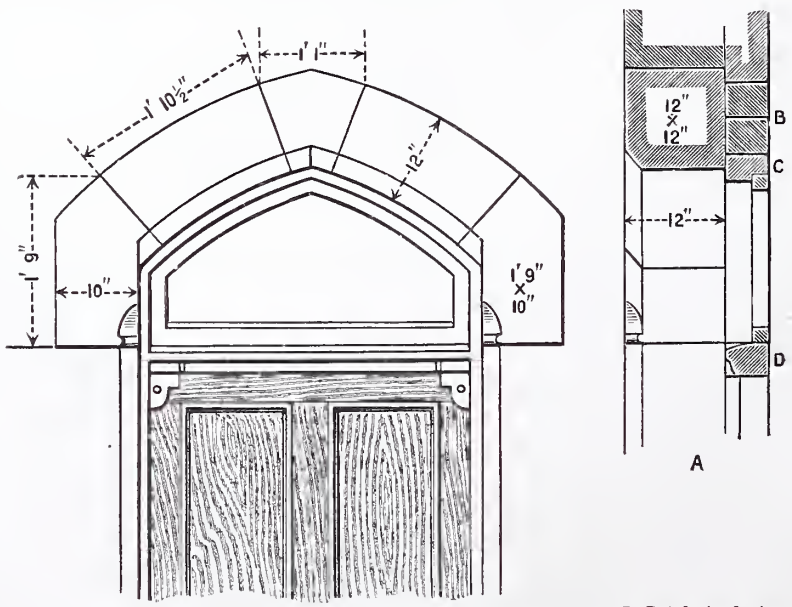



Fig. 40.—Sketch of Door with Section through Door, etc., at A; B, Brick Arch, two Rims; C, Door Frame, 5½ in. by 3 in.; D, Transome, 5½ in. by 4 in.

## A CONTINUOUS-MOTION DRILL-STOCK.

BY FRANCIS CAMPIN, C.E.

Action of Reciprocating Drills — Ratchet-Drills—Conversion of Reciprocating Circular and Continuous Circular Motion.

Every mechanic, amateur or professional, has experienced the inconveniences that are inseparable from the use of reciprocating drills, whether used with the bow or in an archimedean stock. To obtain anything like a true hole is impossible, and yet no work can be put together without holes, and sometimes a great many of them. Holes untruly bored are also often responsible for the breakage of screwing taps, and thus the reciprocating drill is the cause of much damage, loss of time, and disappointment. With this form of drill there is no real cutting of the material; it is merely a matter of scraping, and most frequently with the scraping edge at a very bad angle for working.

A drill with a true cutting edge will, of course, only run in one direction, and, therefore, what is required for small purposes is a hand-stock that is capable of converting alternate rotary motion into continuous rotary motion. Of course, continuous motion can always be obtained for drilling where a lathe is accessible, but this is cumbrous for small work of the charaeter we now have in view. A ratchet brace also is not suitable for small work, and is, moreover, too slow in its action, especiallywhere very light cuts have to be taken. What is required, then, is a stock which will give continuous motion in one direction, and any rapidity that may be required, and to attain these ends the apparatus shown in the annexed illustrations has been designed. Fig. 1 shows a section taken just behind the driving ratchet-wheel, and Fig. 2 a longitudinal section along the centre line of the drill shaft.

The drill shaft, A, is made with an ordinary socket, cut away at *i*, as shown, to receive the back end of the drill at one extremity, and at the other it is fitted with a handle, G. The handle is shown broken off to save space, and its posterior end is shown in longitudinal section at H. Upon the shaft, A, a fly-wheel of disc form, B, is secured by screws, *k*, *k*, the points of which enter holes drilled in the shaft to receive them, and thus cause the wheel to revolve with the shaft. The weight of wheel, B, will, of course, depend upon the heaviest class of work for which it is proposed to use the tool.

A ratchet-wheel, C C, is fastened to the fly-wheel, B, by means of screws, *d*, *d*, etc., and turns when driven by pawls, *c*, *c*, carrying the fly-wheel round with it. The pawls, *c*, *c*, are hung upon pins, *m*, *m*, screwed into the division *o o* in a spring barrel, D D. It is important that the pawls, *c*, *c*, should be set diametrically opposite each other, to prevent inequality of bearing of the drum, D D, on the sleeve, F, upon which it is mounted, to revolve freely. It will be obvious that, so long as the two pawls act together, there is no pressure on the sleeve, F (except the nominal weight of the spring barrel, D D), and, therefore, no noticeable wear on the barrel at its bearings. The barrel is kept up to the fly-wheel and ratchet-wheel by a collar, E E, brazed, or otherwise firmly fixed, to the sleeve, F, while the sleeve itself—which runs easily upon the drill shaft, A—is longitudinally secured by a nut, *n n*, screwed on to shaft, A, and contained in a cavity in the end, H, of the handle, which is screwed on to the handle body at *g*.

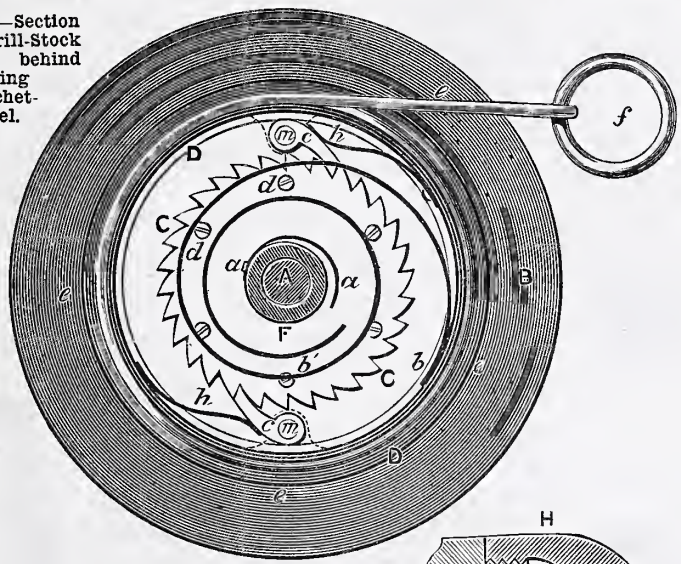



Fig. 1.—Section of Drill-Stock just behind Driving Ratchet-Wheel.

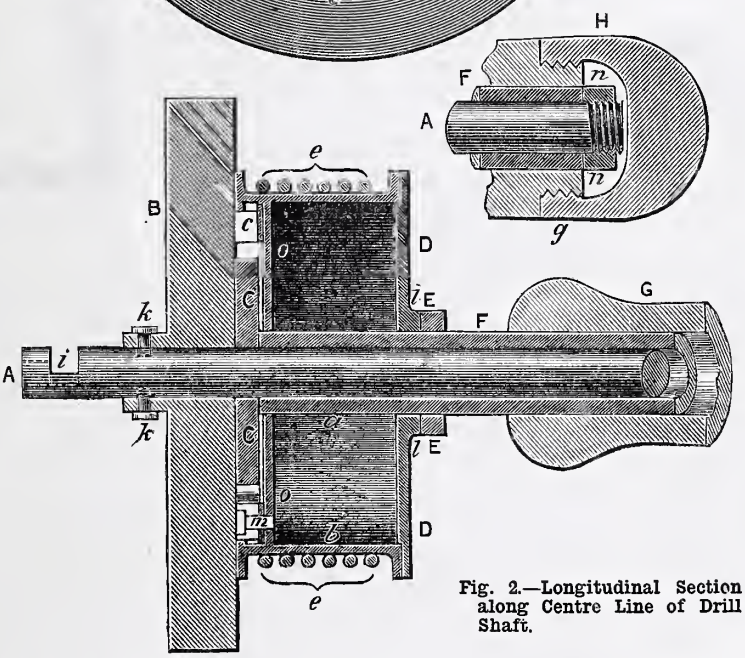



Fig. 2.—Longitudinal Section along Centre Line of Drill Shaft.

The barrel, D D, contains a strong clock spring fastened to the sleeve, F, at *a*, and to the periphery of the barrel at *b*. In Fig. 1, only the ends of the spring are shown, in order to allow the parts beyond to be clearly seen. To the barrel are also attached light springs, *h*, *h*, to hold the pawls, *c*, *c*, in contact with the teeth of the ratchet-wheel, C C. One end of a piece of catgut, *e e e*, is fixed to the exterior of the spring barrel, round which it is coiled for a few turns, its end being attached to a finger ring, *f*.

The apparatus is easily taken to pieces, if required, for cleaning or other purposes. When the screws, *k*, *k*, have been withdrawn and the nut, *n n*, all the parts will come asunder. The collar, E E, instead of being brazed on to the sleeve, F, may be cast in one piece with it. In order to adapt the stock to different kinds of work, several fly-wheels of different weight may be made to fit it, so that they will be interchangeable on the same drill shaft.

In use, the handle, G H, of the stock is held in the left hand, then on pulling the catgut, *e*, by finger ring, *f*, with the right hand, the barrel, D, is caused to revolve, and by the pawls, *c*, *c*, carry the fly-wheel and drill shaft round with it; at the same time, the spring, *a b*, is wound up. On letting the catgut loose, the spring re-winds it on the barrel for another pull, and during the re-winding the momentum of the fly-wheel, B, maintains the forward revolution of the drill, the pawls, *c*, *c*, passing meanwhile backwards over the teeth of the ratchet-wheel, C C, and thus a constant rotation of the drill in one direction is maintained. The drum and ratchet arrangements, drill shaft, etc., are shown about natural size. If a very high velocity of revolution is required, higher than can conveniently be obtained with the catgut coiled on barrel, D, the boss, *l*, of its back-plate may be made longer, and used as a barrel on which to wind it, which, for a given velocity of hand, will increase the number of revolutions three times. If it is desired, this contrivance may be fixed in a frame and clamped to a bench, to leave the left hand at liberty to manipulate work which is being drilled.

I am inclined to think that the advantages to be derived from a drill-stock of this kind will be obvious to every mechanic who is in the habit of using drills, and that the old hand-stocks will eventually be superseded by this new form. It is never safe, however, to speculate with any particular degree of confidence on what may happen with regard to new tools and appliances, which are departures from the beaten track, and it is often some time before a good thing is taken into favour.

## A CHEAP CAMERA LUCIDA FOR MICROSCOPIC SKETCHING.

BY H. B. S.

Two Methods of Making: In Sheet Zinc—Materials Required—Method of Making. In Brass: Materials Required—Method of Making—Adjustment to Eye-Piece of Microscope.

Those readers of Work who have a microscope will know what a camera lucida is used for. It is similar to an ordinary camera lucida, but on a small scale, and is fitted to the eye-piece of a microscope to reflect the image, and thus allow of its being sketched. There are many kinds of camera

lucida sold, and the price varies from six shillings to thirty shillings. The two I describe will cost not more than a few pence.

There are two methods of making a camera lucida which I have tried: first, in sheet zinc. Materials and appliances required:—Piece of thin sheet zinc 3 in. by 1¾ in., a pair of scissors, a pair of compasses, and one thin glass circle, same as used for covering objects.

Mark out a circle on the sheet zinc of about ¾ in. diameter, and within this a circle of ½ in. Cut out inner circle. Connect it as shown (Fig. 1) to the strip 3 in. by ½ in.; cut out with scissors. Take a ruler or any cylindrical object a trifle smaller than eye-piece of microscope, and bend the strip around it; it will then form a ring which will fit on to eye-piece. Now bend up the connecting bit slightly, touch around the circle with gum or glue, and having cleaned the cover glass, drop it on; if thought necessary, a ring of black paper may be put on over cover glass to keep it in its place (Fig. 2). Now allow

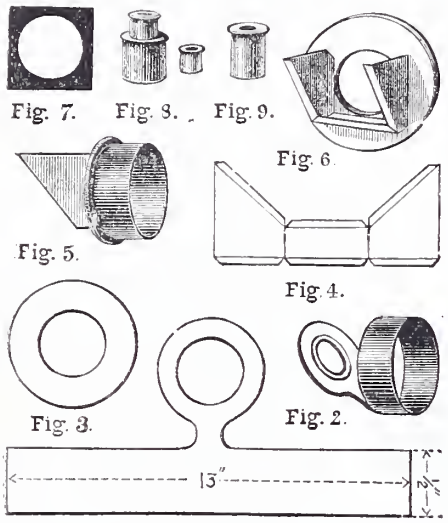



Fig. 1.

Fig. 1.—Plan of Camera Lucida in Zinc. Fig. 2.—Zinc bent into shape. Fig. 3.—Brass Ring. Fig. 4.—Pattern for Camera Lucida. Fig. 5.—Material bent into Box Form. Fig. 6.—End View. Fig. 7.—Cover Glass. Figs. 8, 9.—Eye-Pieces.

to dry, then place it on eye-piece of microscope, place the microscope horizontal, and having an object at stage of microscope, look down at cover glass, and see if the object is visible; if not, move the circle upwards or downwards until the object is visible, when the glass will then be at an angle of 45 degrees with tube of microscope. This adjustment and the sketching which may be done must be done in a dark room, when the lamp is used for direct illumination. Sketching cannot be done in daylight.

The second method is a little more difficult. A little thin sheet brass, shears, a soldering-bit, solder, brace and bit, and file will be required.

Measure diameter of eye-piece, and cut out a strip of brass long enough to make a ring that will just slide on to eye-piece; bend it round and solder, or maybe you can get a bit of tubing to fit; it must fit tight, and may be ½ in. or ¾ in. wide. Next cut a circle a trifle larger than the ring, drill a ½ in. hole in it (Fig. 3), and solder on to the face of the ring. Next prepare a piece of the sheet, and cut out as shown in Fig. 4, the angles exactly at 45 degrees, and bend up into the shape of a box, open at top and ends; turn down pieces for soldering inwards, also pieces on other side intended to hold glass, and solder it directly on to the face of the metallic cap you have made (Figs. 5 and 6).

All that is now required is a cover glass mounted between two pieces of black paper (Fig. 7). Let it rest in the box.

The first described will fit any eye-piece, but the second one will only fit the eye-pieces in which the front part may be detached (Fig. 8). It will not fit those having a milled edge larger than the rest of the eye-piece (Fig. 9).

I have made both kinds of camera lucida, and they are as good as any to be bought. The cover glass being so very thin, there is no double reflection, as you see in a thicker piece of glass.

## MEANS, MODES, AND METHODS.

### To make Lime in Small Quantities.

Few who live in the country have not felt the difficulty of procuring small quantities of quicklime. In my own case, for instance, I have to send seven miles for it, which takes a man and horse the best part of a day, when I want, perhaps, but sixpennyworth of lime. I was bemoaning this fact to a lady friend of much practical common sense, when she astonished me by saying that when they wanted to whitewash the kitchen or any small piece of work, they put limestones in the kitchen fire and burned their own lime. On my return home I put the matter to a practical test, and lo! it was so. To use the words of my man, "I won't be without lime now when I want it." J. L. D.

### Substitutes for a Short Screw.

Any of my readers who have observed a properly mounted grindstone will see that the stone is clamped between two flanges, one of which abuts against a shoulder in the shaft, whilst the other is pressed against the stone by means of a nut threaded on to a screw cut on the axle.

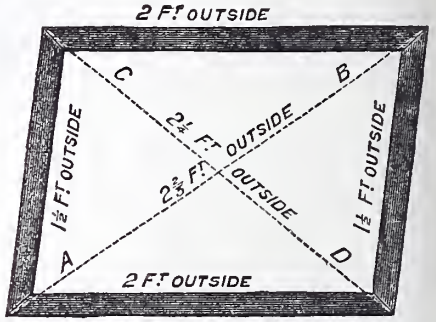
I wanted to mount a stone in this way, but had not dies of the exact fit for the axle. I consequently designed an efficient substitute for the screw as follows: I first put the stone on the axle, and marked the outside of the outer flange; then, a ¼ in. outside that I drilled a hole across the axle to take a ¼ in. steel pin. I next procured, as a washer, a back nut used by gas-fitters, which was ⅜ in. thick, and fitted nicely over the axle. I then filed nicks on the opposite sides of the washer ⅛ in. deep, and sloped the washer from the bottom of one nick to the top of the other. When the stone, flanges, washer, and pin were put in place, the washer, thus treated, acted as two half-threads of a double-threaded screw, and held the stone quite securely. J. L. D.

### A Simple Way of Testing the Accuracy of Framework.

If there is one thing more tantalising than another to an observant person, I really believe it is to notice any such article as a picture-frame made out of the square. A certain picture-frame in my possession tormented me by its apparently bad workmanship, and I set about testing the angular accuracy of its four corners, in order to settle all doubts and ease my mind; and while doing so, was told by a looker-on of a simple means of acquiring the object in view. The advice was to measure the distance between two opposite corners of the frame crossways, allowing the string to pass over the centre of it, as per dotted line A B or C D, and then to place the string or measure between the two remaining corners. If this course is adopted, and both distances coincide in measurement, all is well; if not, it will thereby be discovered that something is wrong somewhere.

In the diagram an imaginary frame is drawn to a degree of inaccuracy so decidedly exaggerated that the most unfortunate possessor of distorted vision would hardly find it needful to resort to any mechanical method for the object of obtaining the truth as to the irregularity of its angles; but the sketch is so delineated in order to convey a better and clearer understanding of the means of testing, and a comparison of the variations of distances between the opposite points of the several parts.

It will be readily understood that in the case of a careless apprentice or workman making the mitre on any particular rail of the job wrongly, it would be a comparatively easy matter for him to mitre the adjacent rail in such a manner that it would perfectly fit it, although, however, the result would be the formation of an improper angle by the unison of the two rails.




Badly-made Frame with Faults exaggerated.

I am not aware whether this method is used among wood-workers—one must be a curiously well-informed being to not be ignorant of some things in this busy and knowing world—but it is a common practice among wire-workers when they wish to discover whether the squareness of their work is correct; and probably I may have to allude to this note during the course of my papers on Wire-work.

It must be obvious to all who have the intelligence to perceive the simplicity and efficiency of this method—and who has not?—that the application of the same would answer in every respect equally well for the determination of the accuracy of any kind of framed work, such as doors, etc., by either measuring within or outside the frame; in the case of a four-styled door, adopting the latter course, and in the instance of a door with one or more cross rails between the upper and lower styles, using the former.

If half of the difference between the two distances across the frame upon the lines A B and C D respectively be taken and added to the shorter measurement, that will give the correct length the work should be diagonally across from corner to corner either way—that is to say, supposing A B is 2 ft. 6 in. long, and C D 3 ft., the difference will be 6 in., one half of which, if added to the shorter distance (2 ft. 6 in.), will give the correct measurement, viz., 2 ft. 9 in. J. S.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### The Piston, Slide-Valve, Ports, and Cylinder Covers.

The Piston Rings—Piston Cover and Body—The Piston-Rod and Nut—The Valve-Face—Valve-Box and Cover—The Ports—Screwing the Parts together—Turning and Threading the Stuffing-Box—The Slide-Valve and its Rod—Screws for Securing the Cylinder Covers.

We may now undertake the piston and rod, shown in detail in Fig. 5 (page 260). Begin with the casting for the brass packing rings; chuck this by the outside, and bore it out. It measures $1\frac{3}{8}$ in. diameter inside on the drawing, but, as it will have to be compressed, we will bore it out $\frac{1}{16}$ in. larger than this. Drive it on to a mandrel, and turn the outside to $2\frac{1}{16}$ in. diameter; turn the edges and part it in two, so that each ring shall be $\frac{1}{4}$ in. wide. By turning the edges of the rings at one chucking, you ensure their being parallel. Now take them to the vice, the jaws of which must be protected with lead "clams"—*i.e.*, sheet lead about $\frac{1}{8}$ in. thick, bent over the jaws, to prevent them from marking brass or other work. We have now to file and scrape the edges of these rings till they are perfectly flat, and that without destroying their parallelism. We shall require a perfectly flat surface of some kind; perhaps the scraped surface of the lathe-bed might do, though it will not be very correct, or a piece of plate-glass is sometimes used. Much better would it be to obtain a reliable face-plate or surface-plate—one 3 in. by 5 in. will do for the work we have in hand; if of this size, it will do to correct the bed-plate facing on which the slipper guide works, as a 3 in. plate will go between the flanges. Get some Venetian red, and mix with machine oil in a little flat tin box, which you will keep ready at hand. Smear a very little of this "marking" on the face-plate, equally, all over it; then, when the rings are rubbed upon it, you can see those points which touch the surface, and at the same time you can feel on which parts it rocks. To hold the rings while being filed or scraped, take one of them, and, laying it upon a bit of wood, draw round it with a pencil, and hammer a few small nails into the wood upon the line, so that you can replace the ring on the wood between the nails, that they may prevent its slipping while you file it; the heads of the nails will be knocked down a little lower than the upper edge of the ring, that they may not interfere with the file. Callipers are sure to spring slightly, and, as the rings must be perfectly parallel, make a solid calliper by filing a notch in a bit of sheet iron to act as a gauge of width. File up and scrape one edge of each of the rings till they bear well all over on the face-plate; then file the notch for the gauge, trying it on the rings all round till it will almost go on at the smallest place; then bring up the other surface of each ring true, so that the gauge will go on equally tight all round. Handle the rings tenderly, as they are very easily bent and bruised; you could probably squeeze them flat with the grasp of the hand, and if they are dropped on a piece of iron, or a tool thrown down on one, it will get a nasty bruise, and require to be tried on the face-plate again. Screw a ring gently in the vice in the lead clams, one edge projecting about $\frac{1}{4}$ in., and take the hack saw to cut it across; the cut should not be straight across, but oblique, because then the edges of the ring are not so likely to wear grooves in the cylinder. The rings must be cut twice, about $\frac{3}{16}$ in. apart, so as to remove about $\frac{1}{4}$ in., leaving an oblique gap $\frac{1}{4}$ in. wide; this is necessary to enable us to close the rings to get them into the cylinder. Now take the cover of the piston; chuck it, face one side, and bore a $\frac{5}{16}$ in. hole through the middle. Chuck the body of the piston, hollow side out; true that side, and bore a $\frac{5}{16}$ in. hole through. Lay aside these two parts, and take a piece of round mild steel (such as Bessemer), $8\frac{1}{2}$ in. long and $\frac{1}{2}$ in. diameter; centre this, and turn it down to $\frac{3}{8}$ in. full. Turn down one end to fit tightly into the body of the piston; cut a $\frac{5}{16}$ in. Whitworth thread on the end of this part, and make the brass nut which goes on there. Now drive this end of the piston-rod into the body of the piston, and put on the nut, screwing it hard up to secure the piston body on the rod; put all between the centres, and turn up the piston body. Take the piston cover and scrape up the inner surface; take off the nut from the end of the piston-rod, put the piston cover on in its place, and put the nut on again to secure it, screwing it on tightly. Now take the brass packing rings, and try whether they will fit into the groove; if too tight, turn off a little from the side of the groove which is part of the piston; if too loose, take off the nut and piston cover, and turn away a little from the face of the piston against which the cover fits. The width of the groove must be such that when the rings are in position, and the nuts screwed hard up upon the piston cover, the rings will be held tightly enough to stand turning; we must turn the outside of the rings again, because when they are compressed into the cylinder they will no longer be exactly round. First, turn the outside diameter of the piston body and cover to exactly fit into the cylinder; when trying it into the cylinder, be careful to wipe the turning dust off and have the bore of the cylinder quite clean, or you may be deceived. It is better to pass the piston-rod through the stuffing-box in the cylinder cover when trying the fit of the piston, because that will keep it from getting askew in the cylinder; therefore, at this stage it will be well to finish the piston-rod to size. Use the brass gland as a gauge of size, and, putting in a very sharp tool, with a light cut reduce the piston-rod till the gland will almost go over it; then take a worn, smooth file, and use that on the rod as it turns in the lathe till the gland can be pushed over it with some difficulty. Now take a smooth file and "draw-file" the rod, rubbing lengthways from end to end, whilst the lathe is at rest, so as to lay the grain of the scratches longways of the rod, and remove all circular scratches, which would rapidly wear out the packing, besides greatly increasing the friction. The gland should now slide freely over the rod from end to end, and in trying the fit of the piston in the cylinder the cover would be put on, and the piston-rod, with piston on it, would be passed in from the back end. The piston-rod, passing through the cover, would keep the piston true and level, so that the fit can be observed. When the fit of the piston in the cylinder has been adjusted so that it will pass freely up and down in the cylinder, take off the nut and cover from the piston, and put it just inside the cylinder, the rod passing, as before, through the stuffing-box in the front cover. Now take one of the packing rings, and, compressing it slightly with the fingers, press it into the coned-out mouth of the cylinder and over the body of the piston; now the other ring; now the piston cover and nut (but do not screw up the nut). On pressing, or gently driving, the piston forward, the rings will gradually close till they come to the parallel part of the cylinder. Try drawing the piston up and down, tighten the nut, and take out piston and rod. Now you will see the rings were not bearing very equally all round; there will be bright spots showing where they rubbed hard on the cylinder. Put the piston as it is in the lathe, and take a light cut over the rings; put piston in the cylinder, loosen the nut, and pull it up and down; fix nut, take out, and examine. The bright marks should now show all round the rings. If, however, the piston rubs hard in the cylinder, turn a little more off the rings, till there is only enough spring left in them to hold up tight without causing too much friction. One thing more remains to be done to the piston. The surface of the piston cover against which the rings rest is scraped, but the corresponding surface on the body of the piston is left from the lathe tool. This surface must now be got up with the scraper, taking off so much metal that the rings shall be released and able to move, even when the nut is tightened upon the piston cover; yet too much must not be taken off, for the rings must touch both sides of the groove in which they lie, and still not be pinched so tightly that they cannot expand. The shape of the piston body makes it impossible to use the surface-plate to try this last annular surface, but one of the rings can be used. Rub the edge of one of the rings with the marking, and rub the ring on the piston surface: thus you will be enabled to scrape it up. A little reflection will show that it would not have been sufficient to prevent leakage between the packing rings and cylinder, if we allowed the steam to get between the edge of the rings into the groove of the piston, and so out the other side; moreover, we must take care that, when we put in the rings, the two cuts do not come together. The cut place on one ring should be at an angle of 90 degrees (at right angles) with the other; then the steam cannot pass, and the rings will press equally all round the inside of the cylinder. The piston being now finished, all but the cross-head end of the rod, it should be oiled and put away.

Let us now undertake the valve-face of the cylinder, valve-box, etc. File up the valve-face, keeping it parallel with the bore of the cylinder by means of callipers, measuring from inside the bore to the valve-face, or laying this face on the surface-plate, and trying with a square whether the flanges of the cylinder stand square up from the plate; when this is the case, finish the face by filing and scraping to the face-plate. File up also the edges of the valve-box which make the steam-tight joint, keeping the sides parallel by trying all round with callipers; scrape and finish these surfaces. File up also the oblong cover or lid on its flat sides, scraping up the inner surface to make a steam-tight joint. Lay the valve-box on the valve-face, in position, and the cover on that, and observe whether the outside edges correspond; if not, they must be made to do so by the file. It is not, however, advisable to file up the outside of the box, but only to make the edges come fairly even. The inside of the box should be filed out square and true, that its walls may form a

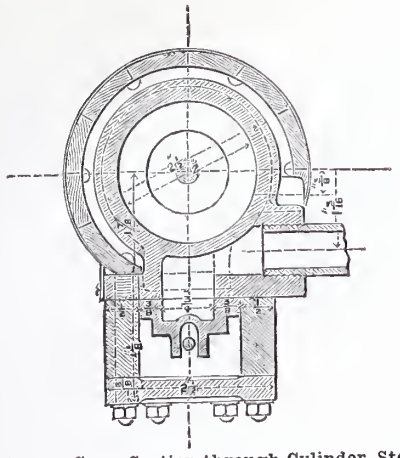


Fig. 7.—Cross Section through Cylinder, Steam-Chest, and Slide-Valve.

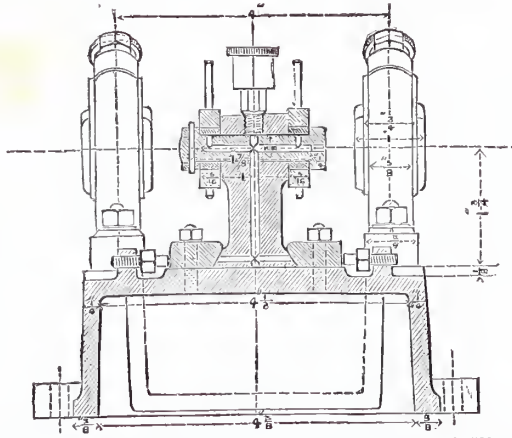


Fig. 8.—Cross Section through Bed-Plate, Cross-Head, Slipper-Guide, and Guide-Plates.

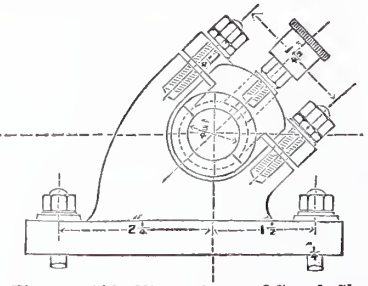


Fig. 9.—Side View of one of Crank-Shaft Journals.

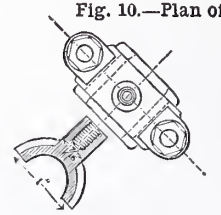


Fig. 10.—Plan of Cap.

Fig. 11.—Section through upper half of Brass.

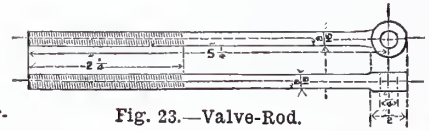


Fig. 23.—Valve-Rod.

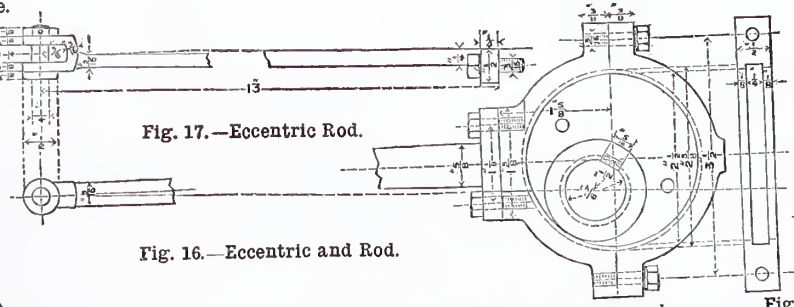


Fig. 17.—Eccentric Rod.

Fig. 16.—Eccentric and Rod.

Fig. 18.—Eccentric Strap.

Fig. 20.—Pump Eccentric.

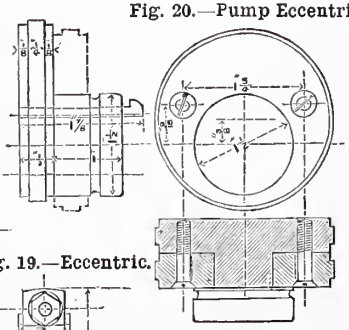


Fig. 19.—Eccentric.

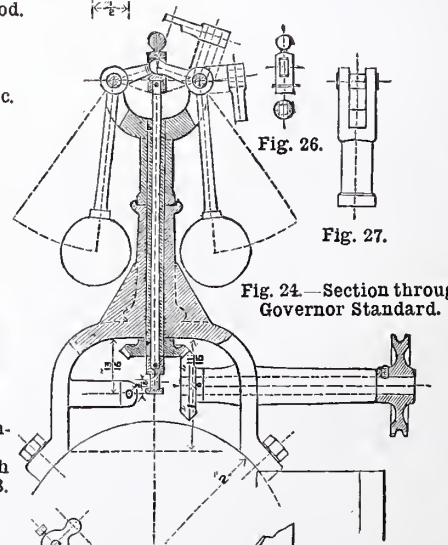
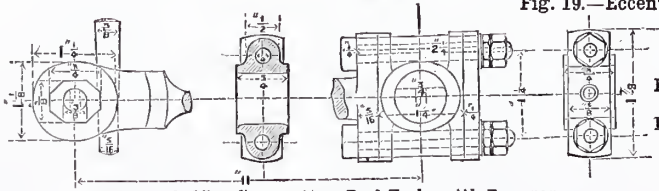


Fig. 26.

Fig. 27.

Fig. 24.—Section through Governor Standard.



Figs. 12, 13, 14, 15.—Connecting Rod Ends with Brasses.

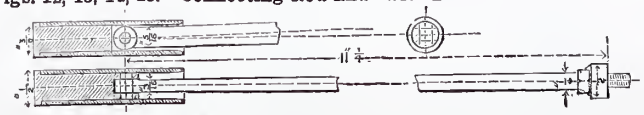


Fig. 22.—Pump Plunger and Eccentric Rod.

Fig. 21.—Method of attaching Eccentric to Strap.

Fig. 28.—Section through Throttle-Valve on line A B.

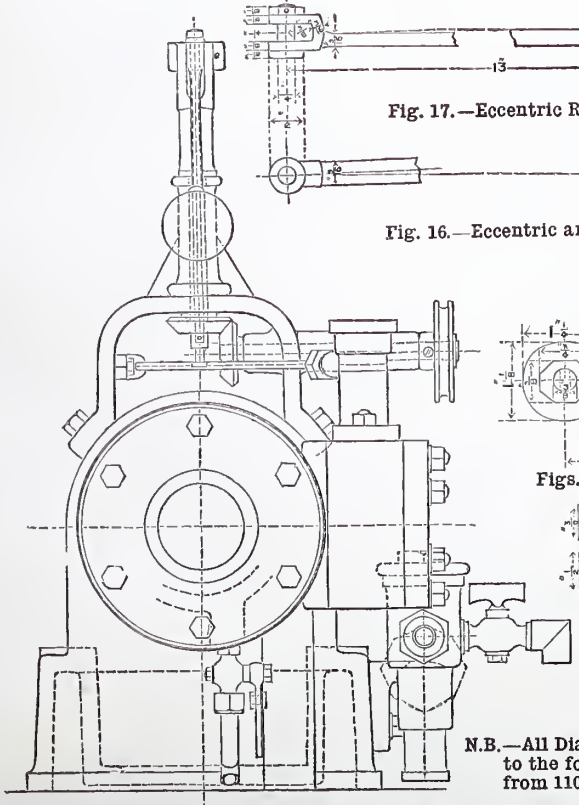


Fig. 6.—End Elevation of Engine as seen from Back.

VARIOUS DETAILS OF QUARTER HORSE-POWER STEAM ENGINE.

N.B.—All Diagrams in this Plate are on a scale of one-third size, or four inches to the foot. Extreme Movement of Governor Arms (Fig. 24) gives variation from 110 Revolutions to about 90 Revolutions.

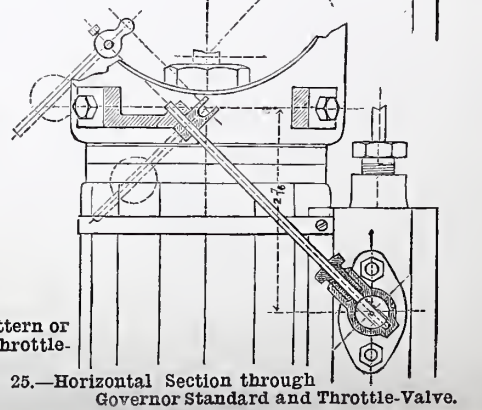


Fig. 29.—Pattern or Casting of Throttle-Valve.

Fig. 25.—Horizontal Section through Governor Standard and Throttle-Valve.

guide to the slide-valve. (See Fig. 7.) As they come from the foundry, the ports in the cylinder will not have their edges perfectly straight and square. Those who have studied the introduction to these papers will know how important it is that the exact dimensions here should be adhered to; it will not do to depart by even $\frac{1}{64}$ in. from the dimensions written on the ports and valve in Fig. 5. Take a piece of stiff card, the size of the valve-face of the cylinder, and draw upon it very accurately, with a hard and sharp pencil, the exact shape and position of the three ports from the views and dimensions given in Figs. 5 and 7; cut out the ports in the card with a penknife, and lay it upon the valve-face, so as most nearly to correspond with the three holes cast in it; take a sharp scriber point, mark off the holes on the iron, and file the edges of the ports to these marks. We will now proceed to screw the parts together. Eight long studs are required of $\frac{3}{16}$ in. diameter (screwed with $\frac{3}{16}$ in. Whitworth thread by preference), and these may be made from iron wire; the eight nuts should be of steel, and should be hardened. The washers are not necessary, though they look well. First mark out the positions of the eight holes on both sides of the valve-box, squaring across carefully from one side to the other; or, better still, take the card again, mark the holes on that, and then, after cutting out the holes, lay the card on the four surfaces and mark them with the scriber, taking care to keep the same side of the card always to the positions of the same studs: thus, the card might be laid first on the valve-face, and, after marking there the eight holes, then on the inside of the valve-face, then on the outer face of it, and lastly, on the cover. It is not at all an easy matter to get these holes exactly opposite, and great care must be exercised. How annoying it would be, let my readers imagine, to find, after screwing in the eight studs, that the valve-box could not be threaded over them. The amateur who can place his holes so correctly that the box will go on at the first trial may congratulate himself; if it will not, he will have to use a small "rat-tail" file in the holes through the sides of the box, filing away towards whichever side of the hole binds against the stud. So much then by way of frightening my readers into taking care at this point. Having marked, by means of the card template, all the eight holes as accurately as possible upon the four surfaces, drill the valve-box first from both sides with a $\frac{1}{8}$ in. drill, to meet in the middle; the drill will revolve in the lathe, and the work be pressed forward by the boring-flange, which should present it squarely and true to the drill. Watch the drill as it starts, to see that it does not "run" to one side at all, and you may hope the holes will meet fairly in so short a distance; if they do not perfectly meet, rub them out inside a little with a rat-tail file, used all round, equally, so as not to alter their position. Now take a $\frac{5}{32}$ in. drill, and put it straight through the holes from one side: $\frac{5}{32}$ in. is the tapping size for $\frac{3}{16}$ in., therefore it is the size to be used upon the cylinder-face. Choose any two of these holes, far apart, and drill and tap these first; they are already marked on the cylinder-face. Take their distance apart in the compasses, and try whether it corresponds with the distance apart of the corresponding holes in the valve-box. If it does, drill and tap them, keeping the tap very upright; screw in the long studs; enlarge the two corresponding holes in the valve-box to $\frac{3}{16}$ in. full; and put it on over these two studs. Leaving the cover for the present, screw on two nuts, and so fix the valve-box firmly up to the cylinder-face. Now take the cylinder as it is to the lathe, pass the $\frac{5}{32}$ in. drill through the six remaining holes, and drill into the cylinder-face; by this means the drill will be so guided that it will be, of necessity, both upright and in correct position. Take off valve-chest, enlarge the six $\frac{5}{32}$ in. holes to $\frac{3}{16}$ in., tap the six untapped holes in the cylinder-face, screw in the six remaining studs, and try on the valve-chest. You can easily bend the long studs a little if they are not perfectly upright, and the holes in the valve-box might be a trifle over $\frac{3}{16}$ in., say, $\frac{7}{32}$ in., allowing $\frac{1}{32}$ in. for clearance, errors, etc. The holes in the cover may be drilled $\frac{5}{32}$ in. first, and then it should be tried on the valve-box, when it will be seen whether they all come opposite; if any of them appear to be to one side, correct them with a rat-tail file, and then bore them all $\frac{7}{32}$ in., when it will go on. Mark the cover and the valve-box with the centre-punch, so that you may put the parts together always the same way. Now take all apart, except the studs, and slightly countersink the holes on both sides of the valve-box and cover, so

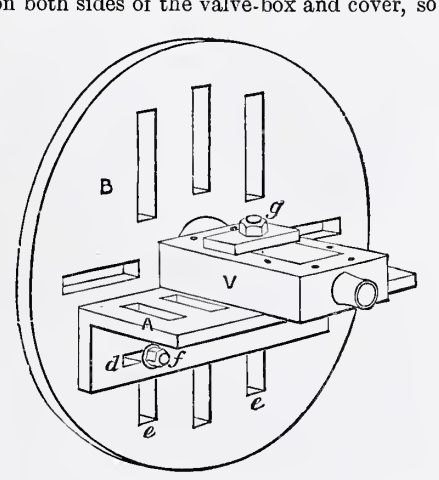



**Fig. 37.—Valve-Box chucked for turning Stuffing-Box.**

as to remove any rough edge that may have been raised up by the drilling, trying them on the surface-plate again to make sure the surfaces are still true. We will now turn our attention to the stuffing-box, which requires to be turned. To chuck this we shall require an angle-plate. An angle-plate is probably not often used by amateurs, but it is a very useful thing, and we shall want it again before we have done; it may cost to buy from five to six shillings, and is well worth the money. Fig. 37 shows how the valve-box, V, would be chucked upon the angle-plate, A; B is the face-plate, with its slots arranged rather differently to those in Fig. 36 (page 261); the parallel slots, *e*, *e*, are useful in connection with the long slot, *d*, in the angle-plate; two bolts, one of which is seen at *f*, pass through these slots, and thus the angle-plate can be moved in any position, up or down, by means of *e*, *e*, and sideways by means of *d*; this could not be managed by the radial slots shown at Fig. 36. The valve-box is secured upon the angle-plate by the bolt and oblong washer, *g*; and then the stuffing-box would be centred by moving the angle-plate on the face-plate, and fixed by *f* and its fellow, which is hidden. The two surfaces of the angle-plate must be strictly at right angles, and then the work done by its means will be true. The valve-box being fixed so that the stuffing-box is properly centred, $\frac{5}{8}$ in. from the inner face and $\frac{1}{2}$ in. from the other, start a $\frac{3}{16}$ in. drill very truly, and send it straight through the boss, to make a hole for the valve-rod; enlarge this with a $\frac{3}{8}$ in. drill for the gland to within $\frac{3}{16}$ in. of passing through; true out the hole with a slide-rest tool, and enlarge to $\frac{7}{16}$ in. Then screw it with the screwing lathe, or, failing that, use a gas-thread tap for "brass gas," $\frac{1}{2}$ in. diameter, and twenty-six threads to the inch: twenty threads would have been better, but twenty-six will do. The outside of the stuffing-box should be turned, and then the valve-box is finished.

*Slide-Valve and Rod.*—Take in hand next the casting of the slide-valve; file and scrape up the flat face, and then file the side edges square with the face, and parallel to each other, making the valve $1\frac{1}{2}$ in. wide, so that it will fit between the sides of the valve-box, as seen in Fig. 7. Now take the square and scriber, and draw four lines squarely across the face, and file to these, so as to make the flat edges $\frac{1}{2}$ in. wide, and the hollow space $1\frac{1}{8}$ in. wide, as shown in Fig. 5. The valve-rod is shown at Figs. 5 and 23; it might be turned down from a piece of round steel bar $\frac{9}{16}$ in. in diameter and $5\frac{1}{2}$ in. long. A piece of malleable cast iron is provided to make this rod. It must be turned down to $\frac{3}{16}$ in. and draw-filed, like the piston-rod, to prevent its wearing out the packing in its stuffing-box. A backstay will be required to support the rod against the lathe tool; a $\frac{3}{16}$ in. thread will be cut on the end of the rod for $2\frac{1}{4}$ in., and the four little nuts, for which castings are provided, would be chucked in a three-jaw chuck, which will hold them true by alternate sides. Then each nut would be drilled and partly tapped; then chucked on the tap while they are turned true (the tap being used as a mandrel) between the centres of the lathe. File the sides of the valve-rod joint flat, leaving a thickness of $\frac{1}{4}$ in. between two parallel planes, and bore a $\frac{1}{4}$ in. hole through for the pin, which hole must be strictly at right angles with the rod. The nuts upon the rod hold the valve between them—they are of brass, because otherwise they might rust fast to the rod; and they are in pairs, because then they can be locked together, turning one nut hard against its fellow, so as to prevent their working loose; besides, they enable us to adjust the position of the valve upon the rod, as we shall see further on.

*Screws for Cylinder Covers.* — At this stage, it may be well to fit the screws into the covers of the cylinder, and so complete that part of the engine. The screw-holes have already been bored in the two covers, six thoroughfare holes in each, $\frac{3}{16}$ in. full, to pass the six $\frac{3}{16}$ in. screws; place the bottom cover in position on the cylinder, taking care to put the two holes which are furthest apart opposite the port side; pass the scriber point through the holes in the cover, and mark their position on the flange of the cylinder. Drill these with a $\frac{5}{32}$ in. drill, and tap them with a $\frac{3}{16}$ in. thread. Make six screws of steel, $\frac{3}{16}$ in. diameter and $\frac{1}{2}$ in. long in the body, to secure this cover, and it would be well to harden their heads; make six more, $\frac{7}{8}$ in. long, for the top cover, since these have to go through three thicknesses of metal into the bed-plate. It is tedious, but very good practice, to file up the heads of these screws. The spanner would be made first to act as a gauge, then two opposite sides of the hexagon would be filed, holding the body of the screw in an universal chuck in the lathe, filing a little

off each side alternately till the spanners will just go on. The spanner, if correctly shaped, will show whether the sides are parallel; the four remaining sides are done by making the two consecutive ones of equal size, and trying as before with the spanner. The screws would be made of soft steel that will not harden of itself. Their heads would be heated in a blowpipe flame, then rolled in powdered prussiate of potash, again heated full red, and plunged in water, when they will have a hard skin without being brittle and liable to twist off. It is only the heads of the screws that require to be hardened, to prevent their being bruised by the spanner. It is not necessary to do it, but it is better, and they need not be cleaned up bright after the hardening, but only well oiled, as the blackened appearance looks well, and forms a contrast to the bright work. The bottom cover can now be put in. The top cover is secured in a different way, the screws going through the cylinder flange first, then through the cover, and finally screwing into the bed-plate. It is not quite orthodox to secure two joints with one set of screws, because one cannot be separated without the other, but it may do well enough on this occasion. Use the top cover, as before directed, to mark the screw-holes on the cylinder flange, but drill these holes $\frac{3}{16}$ in. full; and now we must lay aside the cylinder, and undertake the bed-plate

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 51.—Merrick's "Express" Gas-Heated Soldering Iron.

I have received from Mr. W. H. Merrick, 2, Summerfield Crescent, Birmingham, a specimen of his newly-invented "Express" Gas-Heated Soldering Iron. The appliance is in three parts, namely—a wooden handle, through which runs a tube, terminating at the lower end in a brass stop-cock, the end of which is shaped to receive an indiarubber tube communicating with the nearest gas-burner, the other end being screw-cut to take the lower end of the second part, through which runs a continuation of the pipe carried through the handle. This pipe terminates in a nozzle which enters the interior of the bit, which is hollow and pierced with two holes, by means of which the gas is ignited. The bit, which may be of any required shape, and which forms the third part, is about $1\frac{1}{2}$ inches in diameter at its widest part, and assumes a four-sided pyramidal form at its furthest end. The other end fits into a cup surrounding the gas-pipe that runs through it, and is held in place by a small set-screw. A portion of the cup is cut away at the shoulder to admit the atmospheric air. From this description readers will be able to form some idea of the construction of the iron. The following are the advantages claimed by Mr. Merrick for his gas-heated soldering iron over all others now in use:—1. It is constructed on a very light and compact principle, and is so made (as I have already explained) that the burner is inside the copper bit, thus doing away altogether with the outside arrangement of burners. 2. There is no stove required, thus doing away with the unhealthy fumes which rise from the coke stove. 3. The iron is ready for use in a few minutes after the gas is lighted, a very small supply of which keeps it up to the required heat, thus doing away with the use of extra irons, and the overheating and burning of the face, by which the face of the iron is always maintained in working order and never wears out, and a great amount of time and labour is saved. 4. By removing the reducing socket and replacing it by an elbow and tube, hatchet, glaziers, or pointed bits can be used interchangeably to suit any class of work. The use of this iron, Mr. Merrick urges, will be attended with great advantage in large factories where irons are constantly in use. Extra bits of any shape are supplied, and a price-list giving price of iron and bits will be sent by the inventor to any applicant. In the directions for use, instructions are given to light the gas at the "round hole marked 1," and this I take to be the upper and smaller of the two holes in the bit, as I can detect no mark on the bit before me. "If a still greater heat is required, the set-screw must be eased and the copper bit drawn out. To alter shape, remove socket and replace by elbow and tube. When in use the iron must not be raised to a vertical position." I have had the iron tried by a practical man, who tested it under various conditions; but he says that he finds a quantity of gas escapes unconsumed, and that there is a tendency to light back.

### 52.—"The Teacher's Handbook of Slöjd."

This is a handsome and well-illustrated volume of 216 pages, published by Messrs. George Philip & Son, 32, Fleet Street, London, E.C., under the auspices of the Slöjd Association. Its full title is "The Teacher's Handbook of Slöjd, as practised and taught at Nääs, containing Explanations and Details of each Exercise." The original Swedish work was written by Otto Salomon, Director of the Nääs Seminarium, assisted by Carl Nordendahl and Alfred Johansson, and it has been translated and adapted for English teachers by Mary R. Walker, St. George's Training College, Edinburgh, and William Nelson, of the Manchester Schools for the Deaf and Dumb. It is somewhat costly, its price being 6s.; but as it is intended for teachers and is not a text-book for use in schools, this will not militate against its sale and circulation. The first chapter deals with introductory remarks, showing what Slöjd is and the nature of the instruction to be given to the children, with remarks on the workroom, the position of the body during work, and hints and rules for the guidance of the teacher. The second chapter is devoted to an explanation of the structure and composition of wood, and the nature and characteristics of wood of different kinds. In the third chapter, the various tools in use and the manner of using them is explained, and instructions are given respecting the grinding and sharpening of tools. The fourth chapter is devoted to an exposition of the various modes of jointing; and the fifth chapter, to the exercises. The book is furnished with a good index; and at the end is given a price-list of tools and requisites as used in Sweden, and as supplied by Messrs. Philip & Son, who have been appointed agents for the Union of Slöjd Teachers in England, and from whom all the necessary tools, benches, diagrams, etc., can be obtained. The illustrations throughout the work are good; but special notice must be taken of, and special praise awarded to, the eight full-page engravings setting forth various positions to be assumed by the worker when engaged on different kinds of work. Such illustrations are always most helpful and valuable in the extreme to amateurs. The benches used are those known here and in Germany as German benches. They have an additional screw or bench vice at the end of the bench, to the desirability and utility of which English professional workmen are beginning to be alive.

Those who have not yet seen a bench of this construction should endeavour to have a look at one. It is by no means a difficult matter to do so, for many, if not most, tool-dealers on a large scale import these benches from the continent in different sizes and supply them to their customers.

The Editor.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Conjuring Tricks.—Few people, not professionally interested in such matters, know how valuable is any really good invention in the way of conjuring tricks, optical stage illusions, etc. Large sums have been realised by the inventors of the Flying Birdcage, Pepper's Ghost, "Magneta," "Thauma," "She," and other clever illusions which teach the public how easily the eye can be deceived under certain circumstances. The inventor of a really new illusion may feel secure of a more certain and prompt reward than usually follows the production of a most meritorious patent in another direction.

Etching on Glass.—Amateurs often inquire whether there is any simple process for etching on glass, and it happens that both French and German journals have recently devoted some attention to the subject. The German process is to mix common salt, carbonate of soda, and ammonium fluoride in equal proportions, which is placed in a gutta-percha vessel containing fuming hydrofluoric acid and concentrated sulphuric acid. A small quantity of potassium fluoride and hydrochloric acid are then mixed in a leaden vessel, and a little of this mixture is added to the former, with a small quantity of sodium, silicate, and ammonia. The composition thus formed can be applied to the glass by damping it with an indiarubber pad, or it can, of course, be used as an ink. The French recipe is far more simple. Dissolve 0·14 oz. sulphate of potash with 0·72 oz. fluoride of soda in half a pint of water. To another half-pint add 0·28 oz. chloride of zinc and 1·30 oz. hydrochloric acid. Mix the two solutions, and apply with a brush or pin. In about an hour after application the drawing or writing should be sufficiently etched.

Knife and Spoon.—A combined knife and fork has already been devised, but a knife which can at the same time be used as a spoon is yet to be brought out. The combination is by no means so difficult as it may seem, and once manufactured, it would meet with a certain amount of patronage for picnics, eating-houses, etc.

An Insulating Material.—Just at the moment the principal want in manufacturing circles is a good insulating material, air- and waterproof, non-inflammable, perfectly supple, and not too dear. In spite of all reports to the contrary, such a material has not yet been artificially produced, while gutta-percha and indiarubber are becoming more scarce and dear every year. It is worth trying to discover, as a fortune would await the discoverer or inventor.

A Much-Needed Invention.—Readers given to devising new apparatus, will be glad of a hint as to a profitable direction in which to employ their ingenuity. About five months ago, Captain de Place, a French gentleman, exhibited an invention called the Sciseophone in London, which, he claimed, would enable engineers to discover whether a piece of welded or cast iron or steel was free from flaws. As such an apparatus would be invaluable, if reliable in its results, the announcement of the trial attracted considerable attention. Unfortunately, it by no means justified the high expectations raised as to its success, and the world is still waiting for a flaw-detector that will enable the engineering world to be on its guard against defective axles, tires, etc. etc. The problem is not an easy one to solve, but electricity will, in all probability, be the main aid to its solution. It is most desirable that nothing be left to the judgment of the experimenter. No two people, for instance, attach exactly the same value to sounds, while the success of the Sciseophone depended chiefly upon the distinction between sounds of greater or less pitch. The results, moreover, should be self-recording. Very likely the Sciseophone indicates the direction of future success, but, as hitherto exhibited, it leaves so much to be desired as to justify anybody possessed of sufficient patience and ingenuity in devoting a large amount of trouble to the subject.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—Questions Answered by Editor and Staff.

**Removing Oil Marks.**—Anxious.—Repeated applications of oxalic acid dissolved in hot water (1 oz. to one pint of water) should effectually remove these from white holly or any other wood. Benzoline spirit will answer the same purpose, but must be used with caution, by keeping it a reasonable distance from naked lights.—Lifeboat.

**Phonograph.**—G. H. (*Camberwell*).—An article is in the Editor's hands upon this subject. Fittings cannot be bought at present.—W. D.

**Marine Engineer.**—Grafton.—In reply to the question of our correspondent, under the "Merchant Shipping Act Amendment Act, 1862," the certificates of steamship engineers are of two descriptions: viz., certificates of competency and certificates of service; and of each description of certificate there are two grades: viz., first-class engineers and second-class engineers. There is also the honorary certificate of "extra first-class." A second-class engineer must be twenty-one years of age. He must have served an apprenticeship to an engineer for three years at least, and prove that during the period of his apprenticeship he has been employed in the making or repairing of engines; or if he has not served an apprenticeship, he must prove that for not less than three years he has been employed as a journeyman mechanic in some factory or workshop on the making or repairing of engines. In either case he must also have served one year at sea in the engine-room as an engineer on regular watch in the foreign, home, or coasting trade, or he must have served at least four years at sea in the engine-room as an engineer on regular watch in the foreign, home, or coasting trade. When the workshop service has been performed in a place where steam-engines are not made, and the class of work done is similar to that required in engine-making, the service may be accepted with an additional year in the engine-room—that is, three years' workshop service and two years in the engine-room, of which one year must have been at sea. The approval of the Board of Trade must be obtained in every such case before the authority to receive a certificate is issued by the examiner. Service in a capacity below that of fourth engineer cannot be accepted as qualifying for any class of certificate, unless the testimonials of the candidate explicitly certify that during such service he has been taking regular watch in the engine-room, and that the chief engineer or superintending engineer considers him properly qualified by that experience to act as chief engineer of a foreign-going steamer of 99 horse-power nominal. In any case, the applicant must prove that he has had responsible charge of the engines or boilers for at least twelve months of sea service, of which for not less than six months he must have been in charge of the propelling engines, and rated on the articles not lower than fourth engineer. Service in the capacity of fireman, stoker, donkeyman, greaser, winchman, labourer, engineer's steward, or any other capacity than that of engineer taking watch on engines and boilers for propelling, will not be accepted. It is of the highest importance, now that such high pressures and seientifically constructed engines are used at sea, that there should be duly qualified and high-class steady mechanics to be entrusted with the charge of them, and for this purpose the Act was passed; and all engineers in charge of steamships must hold a first- or second-class certificate—either of competency or service—under a severe penalty both on the engineer and the captain who ships him. These certificates are obtained by an examination by a Board of Trade engineer, who, at certain appointed times, holds his examinations at different ports in the kingdom, when each candidate has to answer a set of appointed questions, and give satisfactory proof of his fitness to receive the certificate he seeks. If he fails, he is turned back, and he may meantime strengthen himself for those points where he was found deficient, and try again. If our correspondent thinks he would be able to meet the conditions laid down in the Act, he might apply to a superintending engineer or manager of a steamship company or owner to give him a chance of an engine-room job afloat. If he does not know any, let him get into a shop—such as Blair's—make up his mind to stick to it, get a good reputation for sobriety, steadiness, regularity, and perseverance, and he will soon get a chance in helping to erect or put engines into a boat, and then he may soon be able to get afloat. Let him spend his leisure in learning all he can relating to marine engines and steam, its nature, mode of action, and all relating to the care and management of marine engines and boilers, and try to get on, and he need not fear but his exertions will be attended with success.—C. E.

**Detective Camera.**—F. R. H. (*Rochdale*).—A full reply to your questions would occupy several pages of Work if it was to be of any practical value, and consequently out of the question to be replied to in these columns. Why not get some elementary work on photography, of which there are many published, and make yourself acquainted with the requirements of the art before attempting to make the apparatus to use in it? The knowledge of what you want will be of great assistance. We may suggest that Abney's "Modern Photography" is a very reliable work on the subject.—D.

**Pump.**—W. G. C. (*Sierra Leone*).—You can get such a double-action pump as you require of Hayward, Tyler & Co., 90, Whitecross Street, London; or of S. Owens & Co., Whitefriars Street, E.C., both makers of good repute. Write them, stating requirements, and ask for prices. You will find it cheaper to purchase one complete than to make portions yourself.—J.

**Delicate Machinery Oil.**—Oily.—Rangoon oil, mixed with a little paraffin, is about the best lubricant for gun locks, etc.—T. W.

**Vapour Bath.**—New Reader.—To answer your query fully would occupy too much space in "Shop." It will, therefore, be treated as a short article, and appear as soon as space will permit.—Ed.

**Field of a Griscom Electro-Motor.**—A. F. (*Clapham*).—I give an illustration of the field-magnets and pole-pieces of the Griscom electro-motor. The fields and pole-pieces form a closed ring of soft iron (as shown at Fig. 2). The semi-circular cores are wound with wire (as shown at Fig. 1) in such a manner as to form a south pole of one of the pole-pieces (P), and a north pole of the other. This is ensured by winding both in one direction. You will see that the armature is of the

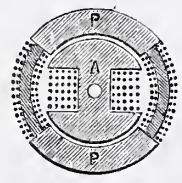



Fig. 1.

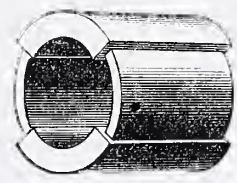


Fig. 2.

**Field of a Griscom Electro-Motor. Fig. 1.—Section through Field and Armature of a Griscom Electro-Motor—A, Armature; P, P, Pole-Pieces. Fig. 2.—Field of a Griscom Motor.**

solid H girder form. The ring should be 3 in. in length by 3 in. in diameter. The armature should be 3 in. in length by 1½ in. in diameter. Wind the armature with 3 oz. of No. 20 silk-covered copper wire, and the wire spaces on the fields with about 1 lb. of No. 18 silk-covered copper wire. If properly made and fitted, this motor will drive a sewing-machine when worked with current from six gallon size bichromate cells.—G. E. B.

**Moulding Plumbago.**—T. J. (*Somerset*).—Mix the finely-powdered plumbago with sufficient fine, well-washed clay to bind the material together without impairing its colour and polishing properties. Or you may well grind together two-thirds plumbago and one-third part of fire-clay until the whole has been reduced to a fine powder: then mould this, whilst wetted, with a solution of silicate of soda, commonly named water-glass. This composition will set very hard when dry, and stand almost any high temperature. If you write to Mr. T. Fletcher, gas-stove manufacturer, Warrington, I think he can supply you with prepared fire-clay for the purpose.—G. E. B.

**Composite Medical and Spark Coil.**—A. K. (*Aberdeen*).—In reply to your letter and questions: (1) It is not advisable to construct a spark coil according to the sketch sent by you, because this shows a coil more suitable for medical than for spark purposes. The sliding secondary, the draw tube, the brass regulator, and the break, are all unsuitable to a spark coil. You would only get a ⅛ in. spark from this coil even when worked with three pint bichromate cells. (2 and 3) Observe the same proportions as to length and diameter of core—viz., 6 in. by ½ in.; make the bobbin ends as shown in your sketch; leave out all arrangements for sliding the secondary coil; and, for a brass regulating tube, place the regulating screw for the break at the back instead of in front of the break-spring; wind on two layers of No. 20 silk-covered copper wire, well coated with paraffin, for the primary, and 8 oz. of No. 40 selected silk-covered copper wire, well coated with paraffin, for the secondary wire. With a condenser of fifty sheets of tinfoil (2½ in. by 2 in.) beneath the coil, and a current from two pint bichromate cells, you should now get a ⅜ in. spark, providing, of course, all parts have been well made and fitted, and the wire properly wound. (4) The coil cannot be employed to furnish current for driving a small motor to revolve the vacuum tubes. The current for driving the motor may be taken from the same battery as that employed to work the coil, but must be conveyed to the motor by a separate line of wire. The induced current from the coil above described will light up small vacuum tubes, but will not furnish current to revolve the tubes. (5) Composite coils are rarely satisfactory productions. They are like composite tools—inferior to those made for a given purpose. The beneficial uses of medical or shocking coils in the hands of amateurs are very doubtful. One may just as reasonably give children an unlimited supply of whisky to play with, as to play at giving shocks from a coil.—G. E. B.

**Moulding Compo.**—Sephton.—Moulding composition is prepared from French chalk and China clay; three parts of the former to one part of the latter makes a useful mixture when thoroughly kneaded with water to the consistence of stiff putty; but when the mess and labour of mixing are taken into account, I consider it cheaper to buy than to make in small quantities. This compo. is intended for use as detailed in the articles of Rubber Stamp Making; but if preferred, the dry materials may be mixed with an equal bulk of the finest plaster of Paris, and a sufficient quantity mixed with water immediately before the forme is moulded. —Qui Vive.

**Rounding Wood in Lathe.**—W. T. C. (*Derby*). —You will want a hollow mandrel with a chuck something like a pencil sharpener, except that the knife should not be arranged radially, as in the pencil sharpener, but the edge must slant somewhat spirally, so as not to tear up the fibres of the wood: only a slight obliquity will be sufficient to give a *slicing* cut. With this you can push in the squared wood, and have it come out round. The knife must, of course, be adjustable, and removable for sharpening.—F. A. M.

**Soap.**—Basso Profundo.—Very good soap can be made with olive-oil alone. The time during which the alkali will keep warm varies with the temperature of the surrounding air and the quantity of solution in question, but the solution may be re-warmed, if necessary, without injury. I have never observed any injurious result from the action of the caustic soda solution on either tinware or soldered joints.—Herbert Clark.

**Type.**—A. B. & Co. (*Belfast*).—Metal-bodied rubber types are imported by M. Lindner, 170, Fleet Street, London, E.C.—Qui Vive.

**Type.**—A. J. H. (*Hulme*).—Is there not some error in your description of the transfer process to which you allude? The final result of the process as described by you would be a *reverse* impression identical in appearance with that of ordinary type viewed direct. Are the figures transferred to the *back* of a *transparent* dial?—Qui Vive.

**Clock Bracket.**—F. H. M. (*Manchester*).—There is a design of a very pretty bracket for a clock in Vol. I. of Work, which might meet with your taste. The index says, "Clock Case and Brackets," pages 241 and 264. If it does not suit you, however, place your query in our hands again. Refer to Indexes of Vols. I. and II. for brackets in fretwork, suitable for the same requirements. Have you examined all the fretwork designs in the available catalogues of the various firms advertised from time to time in this Magazine? If not, do so.—J. S.

**Carpenter's Bench.**—J. O. H. (*Wandsworth Common*).—Many allusions to carpenters' benches have been made in Vols. I. and II. of Work. Refer to the Indexes. This subject is one which cannot be conveniently dealt with in the confined space of "Shop." Continue clamouring, ye carpenters, and if much demand is exhibited, rest assured our Editor will, as soon as possible, find a corner for the above article. I have retained your address privately, and if you will enclose the necessary stamps to the Editor, with query repeated, I will forward you the address of a professional bench maker who supplies "Curtain-Road" men. It would be out of place to print it here.—J. S.

**Camera.**—J. T. (*Rawtenstall*).—In the first volume of Work will be found instructions and working drawings for making a camera according to the plan of George Hare, of 26, Calthorpe Street, London: a design that has been, more or less, adopted by many camera makers of repute as a convenient and thoroughly useful pattern, and up to the present time no better is in the market. Most of the material and brass work for constructing one may be purchased at H. Park's, 1, Orchard Buildings, Acton Street, Kingsland Road, London, N. With regard to coupons, we will give them our consideration. Any special form of apparatus sold by one firm only had better be procured for a pattern, as it is impossible for us to assist you in this matter and these columns otherwise than in a general way.—D.

**Banjo.**—Banjo Slogger.—If your banjo wants improving in tone, you will not be able to improve it by fixing a sounding-bell to it. There is a banjo made in London with a piece of metal across the inside of hoop very similar in appearance to a shallow dish, with a large hole in the centre. The edges of metal lay on the top edge of hoop underneath the vellum. I suppose it is a matter of taste, but to my mind this is not an improvement, as far as tone is concerned. Of course, the opinions of various individuals differ in regard to banjo matters as they do to various other things; we cannot all think alike. This banjo is patented, so you would not be able to make it. There is a banjo known as Dobson's bell model. The top edge of metal hoop is not spun over a wire, but is bent over in the shape of half a circle, about ¾ in. in diameter, from which the banjo takes its name of bell model. The tone of this is very poor; instead of being an improvement it is just the opposite. Then

there are banjos with metal backs to them, double rims, solid metal rims, and a host of other so-called improvements; but I have yet to see the *improved* banjo that will *equal* one with German silver hoop, edges of hoop spun over steel wires, the vellum put on properly, and everything about it being well made. There has been a great number of so-called improvements made in connection with the violin, but they soon die a natural death; and I think it will be so with the banjo: the double-spun-edge hoop will hold its own against all comers. You should look up your back numbers of WORK, and read my replies to correspondents. If your banjo can be improved, you will there find all the information you require. Please understand that I write this as my own individual opinion. I do not pretend to be infallible. If at any time I am wrong, I am always open to be corrected.—J. G. W.

**Electric Light Materials.**—NOVICE.—What power is driving your belt-wheel? Much will depend upon your reply to this question. Supposing you had a small machine with a driving pulley on it 1 in. in diameter. This, when driven from a wheel 1 ft. in diameter making 90 revolutions per minute, will only develop a speed of 1,080 revolutions per minute. As small electric light machines require to be driven at a speed of 3,000 revolutions per minute, you would not be able to drive the machine fast enough to get any light from it. It is possible to make a large machine to be driven at a very slow speed, but the cost would be something considerable.—G. E. B.

**Water Motor.**—M. G. H. (*Smethwick*).—Your 12 in. circular saw may be driven by your water motor in cutting soft wood up to 3 in. deep, and to greater advantage than if driven by hand. Any power that may be devised and maintained is far better than hand power, as it is impossible for a man to drive a circular saw by hand, even for a short time, near its standard speed. I cannot see that your suggestion in reference to pumping the waste water into the upper tank would be advisable. It will require all the power to drive the saw, and if the water was pumped up into the tank by the same motor while the saw is at work, the power required to drive the saw would be so diminished that it would be a failure. No power is so economical as water power. If you can so fix your motor as to have a regular stream of water equal to the power stated, you may drive your saw to advantage. As to a windmill to raise the water to the top tank, unless there is a certain pressure of wind it is impossible to raise the water; and should there be enough wind to drive the mill, it may stop at any moment, when the whole concern will come to a standstill: therefore I can say nothing in support of it.—A. R.

**Engines.**—A. T. (*Dublin*).—I replied to this question, or to one identical with it, some time since, saying that such engines could not be described properly except in a short series of articles.—J.

**Workshop Agreement.**—AN AMATEUR MECHANIC.—We do not undertake to answer legal questions.

**Papier-Mâché.**—GOOD IRON.—There are articles on Papier-Mâché in Vol. I., pp. 33, 87, 182, 265, 348, 387 (Nos. 3, 6, 12, 17, 22, 25); and in that and Vol. II. are also many answers on points connected with it in the "Shop" column.—S. W.

**Photography.**—J. M. (*Kilmarnock*).—(1) You can obtain the tools you require at many cutlers. Buck, of Tottenham Court Road, and Moseley, of New Oxford Street, supply them. (2) Coat the block with a mixture of twenty grains of chloride of ammonium, five grains of gelatine, and thirty grains of zinc oxide to one ounce of water. Let this be brushed equally over the surface, and dry. To sensitise it, brush over it a solution consisting of ninety grains of silver nitrate and five grains of citric acid in one ounce of water; dry, and print under a negative in the usual manner. Wash the surface with warm water, and fix with a solution of hyposulphite of soda, one part in four of water. Wash again, and dry carefully in a cool current of air, the block standing on its side. The application of moisture must be confined as much as possible to the surface, to avoid warping the wood. On no account attempt to dry by artificial heat, as over a stove or before a fire. The block must be allowed to dry spontaneously, as any curvature of the surface will totally unfit it for printing purposes.—D.

**Steamboat.**—O. M. (*Barrow-in-Furness*).—I presume you want to make a copper hull for your model steamboat, but imagining, from the tone of your letter, that you know very little about sheet-metal working, I should advise you, if you want a nice job made of it, to place the order in the hands of a competent coppersmith. I can recommend Stevens & Son, Whitecross Place, Wilson Street, Finsbury Pavement, London, who have given me the greatest satisfaction in sheet copper work, and at a very reasonable figure. Instructions for doing this are somewhat difficult to put on paper, but after cutting your plates roughly to size, they will have to be shaped by hammering on a suitable "stake," using a hammer with a slightly rounded fall. This causes the copper to expand at the point struck, and thus by judicious hammering on either side, according to shape required, the plates can be given the necessary curvature. Half an hour's practical illustration will do more good than a whole page of written instructions. You will want a deal of practice before you will be able to turn out a good job; but before you commence in earnest, practise on a few waste pieces. You will also do well to look up "Hints on Hollow Work in Sheet Metal" on page 282, No. 18, Vol. I. There were also, I believe, some articles on Sheet Metal Working in Vol. II., but as I have not my copy by me at present, I cannot give you the Nos. of the parts containing them.—H. E.

**Wood Engraving.**—T. M. (*Kilmarnock, N.B.*).—A wood engraver in London capable of producing work similar to that of the proof sent by T. M. would command about 10d. per hour. Of course, the time he mentions—seventy-five hours—would be considered extreme, as division of labour is carried out to great advantage here. We should not think of employing one man only to carry out the three operations of photographing, drawing, and engraving. A professional would take the original photograph: that would be passed on to a photographer on wood; a mechanical draughtsman would do the necessary working-up of same before it was passed on to the machine-ruler, who would engrave all tints and cylinders, leaving the engraver to "back up" tints and finish up all details.—T. P. C.

**Ebony Stain.**—A. C. (*Leicester*).—If only a small quantity is required, it will be better to buy the French black stain, as sold at most places where veneers are sold, at about 1s. per pint—sufficient to stain about eight square yards. I have had some very good from Kingston, Veneer Merchant, Pershore Street, Birmingham; but as the question is frequently asked how to make these stains, I append a few recipes, a glance at the composition of which will show you what is meant by saying it is cheaper to buy small quantities ready-made; besides, in the majority of recipes two distinct operations are required, using different substances, whereas in the French stain one application will give a satisfactory result; subsequent coats will increase the intensity of the blackness. You only ask for a dull black stain. I presume you can polish; if not, my advice is, don't take your first lessons on black work, or you may finish up by saying it's a failure. If, on the other hand, you have a fair insight into the art of polishing, it may be well to remind you to use a little vegetable or common black mixed with your "filling in," and a little ivory drop black, or Frankfort black, mixed in your polish, which latter should be what is called white or transparent: not the brown, as made from common shellac. Ebony stains:—(1) 2 oz. logwood chips, 1½ oz. copperas, one quart of water. Apply hot, giving several applications; then one or more coats of vinegar in which has been steeped 2 oz. steel filings to the half-pint of vinegar. (2) one gallon vinegar, 2 lbs. extract of logwood, ½ lb. green copperas, ¼ lb. China blue, 2 oz. nut-galls; boil in an open pot till dissolved, then add half-pint of iron solution, made by steel filings and vinegar, as in No. 1. (3) 1¼ oz. gall apple, 3½ oz. logwood extract, 2 oz. vitriol, 2 oz. verdigris, one gallon water, half-pint iron solution. (4) ½ lb. of logwood, three quarts of water, one handful of walnut peelings; boil for about three hours, then add one pint of boiling vinegar. Give several applications of this, allowing each coat to nearly dry before the next is applied; then give one or more coats of copperas solution—half-pint of copperas dissolved in one pint of water. It will be noticed that for the iron solutions steel filings are advised. Should any difficulty be experienced in getting these, old rusty nails—a handful to the pint of vinegar—will do.—LIFEBOAT.

**Combe Down Stone.**—E. L. (*Bath*).—I am obliged by your note referring to the omission of the mention of Combe Down Stone in the list of Bath stones in my article on Masons' Work on page 99. When I wrote the article I was quite aware of the name and qualities of the stone; but from information I had received some years ago, I was under the impression that very little, if any, of this stone could now be produced; and although I made inquiries, I could not hear of any firm which supplied it, and therefore omitted mentioning it. I am now, however, informed that it is supplied by Mr. Edwin Love, Odd Down, Bath. I have also been informed that there is another stone, named Monk's Park (not named by me), which is of similar quality to Corsham Down, and also that Bath stones are supplied by other firms than those named.—MUNIO.

**Materials for Painting on Pottery.**—NOVICE will, doubtless, be able to get what he wants by post from Brodie & Middleton, Long Acre, London, W.C.; or probably from Lechertier, Barbe & Co., Regent Quadrant, London, W.C.—S. W.

**Calcined Bones.**—RAYNOR.—The required article is, we believe, used in china-making, and could doubtless be got at china works; but surely, as so small a quantity is needed, it might more readily be made at home. There can be no difficulty in burning a few bones in the grate, pounding, and sifting through a piece of muslin to ensure the required fineness.—M. M.

**Oil Canvas.**—J. M. (*Grangetown*).—It would be much better to buy the canvas prepared, as you never would be able to prepare it so well. It is not expensive, as you can buy a canvas already fixed on stretcher for use—15 in. by 12 in.—for a shilling. However, should you not be able to get it, and so have to prepare it, you must get some white-lead, make it up with boiled linseed oil and a little patent driers, and cover the canvas evenly over, and as thick as possible. Let the colour be as round as you can get it on. Let it thoroughly dry, then paper it smoothly. Give it another coat of colour, with a little thinning of turps in it, and stain it with a little umber, making it a very pale stone colour—it is better to work on than white.—W. C.

**Saws and Lathes.**—A. C. (*No Address*).—By the time this meets your gaze, information in reference to saw hammering, fully answering your question, should appear in WORK. Lathes for the work you mention may be had from Thomas Robinson & Co., Rochdale, and from A. Ransome & Co., Chelsea, or from almost any maker of wood-working machinery. There is an automatic lathe made by an Ohio Company, for whom J. Sagar & Co., Halifax, England, are agents. This machine, I hear, will turn out 1,000 spokes per day. But as you want a cheap machine, I am afraid these will be too expensive for you; but you will find all cheap machines dear in the long run. I saw recently a rough-made copying lathe made by a maker of Exeter, whose address I have not to hand; price £15. It must be understood that the work when taken from these machines is not ready for painting; a buffing machine is required to remove the ridges caused by the cutters. The machine consists of two endless belts (or even one will do), covered with ground glass, which run at a very high speed over pulleys. The article, after being turned, is pressed tightly on the belt by hand, and the ridges left by the cutters removed. A machine with two belts will clean up from fifty to sixty spokes per minute. The first-named makers make a machine called the "Wheelwright," which will plane boards up to 13 in., and will square and joint scantlings up to 12 in. by 9 in.; also face up felloes; it will plane shafts and poles to any template; will mortise naves up to 14 in.; cut grooves from ¼ in. to 1½ in.; tang spokes of wheels up to 6 ft. diameter after driven in stock; mould, bead, and rebate, and bore holes up to 6 in. deep up to 2½ in. diameter. It is claimed to do the work of at least twenty men.—A. R.

**Soap Making.**—S. (*Derbyshire*).—The water used for dissolving the alkali need not be boiled. Clean cold water is all that is required, but this will become very hot as the alkali dissolves.—HERBERT CLARK.

**Soap.**—BARBER.—I exceedingly regret that I am unable to give a satisfactory reply to your query as to shaving soap. Whether or not a lather made from the soap described in my article on Domestic Soap Making would "creep" I am unable to say, but I can safely assert that it will not irritate the skin if properly made according to my directions. A small proportion—say, one-eighth—of pearlash to the alkali would make the soap lather better, but I do not know whether or not the soap so formed would be too irritating for your use.—HERBERT CLARK.

**Meaning of Voltage and E.M.F.**—OBLONG.—E.M.F. are the three letters commencing the three words Electro-Motive Force, and are used instead of these three words to save time and space. This term means the pushing force or pressure of an electric current as expressed in *volts*, and this leads to the use of the other term "voltage," which is sometimes employed instead of the three letters E.M.F.—G. E. B.

**Keeping Rubber Soft.**—J. G. (*Rochdale*).—I know of no reliable means whereby rubber may be kept soft, as the softness depends very much on its purity and amount of exposure to atmospheric influences. Even pure rubber hardens on exposure to the air for some time, especially in cold weather, and much of the so-called rubber becomes quite brittle under such circumstances. The better descriptions of rubber, whether raw or vulcanised, may be considerably softened by being well kneaded at a temperature of eighty or ninety degrees Fahrenheit. Rubber articles retain their softness and pliability best when kept in use; and when out of use, preserved as much as possible from exposure to the air.—QUI VIVE.

**Soldering Jewellery.**—T. N. (*Halifax*).—This gentleman must dismiss from his mind all previous ideas that soldering means the use of lead or pewter solders. Soldering, when spoken of by jewellers or silversmiths, means the melting by heat of an alloy of gold or silver, such alloy being specially prepared for different qualities of gold or silver, and in many cases from the gold actually being used to make the article. The principle that governs the making of the solder is that the better the quality of the gold or silver the greater the heat that is required to melt it; and conversely, the lower the quality the easier it is to melt. For example, a writer gives the melting point of 18 carat gold at 1995 Fahrenheit, of 15 carat at 1992, and 9 carat, 1979, while easy silver solder melts at about 1802 Fahrenheit. This, I think, makes clear that, although one could use 9 or 15 carat gold to solder 18 carat, it is not possible to use 18 carat to solder 15 carat. The same principle applies to silver and brass: and the quality of the solder has to be known before any attempt should be made to carry out the actual soldering of an article. Another important matter to bear in mind is that thin gold articles, like brooches, will not bear so hard a solder as the same quality of gold will do when made up solid, as in the case of a bangle ring. Solder for 18 carat and 15 carat: take 1 dwt. of the gold, and add 2 grs. fine silver and 1 gr. fine copper; melt well together, and flat to size 6 or 7 Shakespeare gauge. For 12 carat, the addition of 3 grs. fine silver and 1 of fine copper to the dwt. is advisable; while for 9 carat the most useful solder is made from 1 part fine gold, 1 part fine copper, and 2 parts fine silver. For silver, a hard solder can be made by adding to 5 dwt. fine silver, 1 dwt. 8 grs. fine copper and 8 grs. of spelter; or else to

the 5 dwt. of silver, add 1 dwt. 16 grs. of good quality brass wire or pins. These and the next alloy have a volatile metal—viz., zinc—and must have the silver melted first before the brass is put in, plenty of borax being used all through the operation. For easy silver solder, take 10 dwt. fine silver and 5 dwt. brass wire or pins, and melt and flat to size 6 or 7. For solder easier still, use spelter in place of brass wire. All these solders can be bought at any refiner's or jewellers' material shops, of which there are plenty in Birmingham and London. Once the proper solder is obtained, it is easy to do the actual soldering of plain, solid articles. All that is required is that the parts to be joined are held firmly in contact, iron wire being the usual means. These contact surfaces are scraped perfectly clean, all hurr being removed as well. Next charge the join with a paste made from lump borax rubbed up with water on a piece of clean slate. This paste is used of a milk-like consistency for gold solders, but for silver soldering it should be quite as thick as cream. Next charge the seam with pallions of solder, and blow a jet of flame from gas or spirit on to it until the solder runs. The heat should be applied gently at first, for the horax will swell up, and is likely to move the pallions of solder away from the places they are meant to remain in until flushed. Pallions of solder is a name given to the square or oblong pieces produced by cutting a piece of flat solder into a row of parallel teeth, then by cutting again direct across these; their size heing larger or smaller, according to the work in hand. Better that three or four small pieces be put on the work than one large one. The solder should be scraped before being ent, for on the perfect cleanliness of all the details the success of the soldering will now depend—that is, if the heat is correctly applied. And one fact to remember is that solder will run towards the place where the greatest heat is. I hardly know where to leave off, for soldering —a very simple process in itself—becomes a most difficult art to practise with success in the numerous and varied conditions of jewellery making and repairing. This, however, it will be well to hear in mind: no lead or pewter must be in work that is to be hard-soldered, else the portion covered hy it will he destroyed. Look up in Vol. I., No. 14, p. 220; No. 19, p. 301; No. 38, p. 588; No. 46, p. 732; and in Vol. II., No. 76, p. 388; No. 104, p. 828, for replies bearing on soldering and jewellery repairing.—H. S. G.

**Brazing.**—A. E. (*Blackburn*).—You would have done well to have specified the particular kind of work or material that you wish to braze. The information then would be more likely to be of service to you; as it is, I can only answer you in a general way. Brazing is a method of uniting metals with a material called spelter, also called hard solder, to distinguish it from soft or tinman's solder. Requiring, as it does, a far greater degree of heat to melt it, the ordinary means used for soldering are of no use in this case. We must, therefore, look for some means whereby a great heat can conveniently and quickly be applied to the work. These means are found in the forge, the aëro-hydrogen blowpipe, and the self-acting blowpipe. The first named you are, no doubt, familiar with; the second is a means of producing a very powerful heat by means of ordinary hydrogen or coal-gas mixed with air under pressure. If you will write to Messrs. T. Fletcher & Co., gas engineers, Thynne Street, Warrington, for a list of their gas appliances for the workshop and laboratory, you will there find several of these blowpipes illustrated and explained. The third has been fully described in various Nos. of WORK (consult Index to Vol. I.), and need not be enlarged upon again here; suffice it to say that they are only suitahle for small work, such as key-brazing, etc. The mode of preparing the work is varied, but in this, as in all other ways of uniting metal, the parts must be elean and free from grease. They must also he well fitted. Say, for example, you wish to braze a bicycle neck into the backbone. It is of the greatest importance to get a good fit. I remember a querist asking how much room he should leave for the spelter to run in. If any such thought as that is in your mind, I say none at all. Fit them together as neatly, as elosely, and as firmly as if there were nothing else to be done to it. Next make a strong clear fire of small coke, and while the hoy is blowing this clear, powder up some borax. Take a teaspoonful of this, and mix with a teaspoonful of spelter, and make it into a paste with a little water. You will also require, to put this paste on to the work, a small tool called a spatula; it is simply a piece of ¼ in. rod flattened out about the size and shape of a small mustard-spoon, and about 18 in. long. Having got the fire perfectly clear and free from smoke, place the work upon it for half a minute to get warm; then with the spatula pack round it some of the paste of spelter and horax; have close at hand some powdered borax without spelter. Now replace the work on the fire, and blow steadily, gradually increasing the pressure. At first the mixture will rise off the work as the heat is applied; it must then be pressed down with the spatula. This must always be dipped in cold water every time it is applied to the work, or it will drag the spelter off. As the heat increases, sprinkle some powdered borax on the work as it commences to run, add more spelter, and rub round with the spatula, keeping up a gentle blast till you see that the metal has run well in all round. Remove gently from the fire, and stand it hy to cool gradually. I have not space to go into particulars as to brazing copper and brass, except to say that greater care is required, and spelter of a quicker fusibility than is required for iron. If you require more information, write again; we are always willing to help you.—R. A.

**Wiped Joint.**—BLOWPIPE.—A wiped joint is prepared in the same way as for a hlowpipe or copper hit joint, as far as fitting and cleaning are concerned, but after that it is very different. (See Fig. 1, which represents two pipes fitted together.) The parts shaded are coated with a composition of lampblack and weak glue water, and a little stale heer or a little sugar. This is called "soil" or "smudge," and its object is to prevent the melted solder from adhering to the pipe where not required. The parts from A to B are scraped clean and ruhhed with "touch" (tallow); the metal is then applied to the joint, either by splashing it on from a ladle with a splash stick, or hy pouring over it with a small ladle metal dipped out of the metal pot, or by using sticks of solder and a hlowlamp such as the Paquelin, which is very useful indeed for these joints, as the iron can he dispensed with. The metal is then wiped round to the proper shape (shown hy the dotted lines). To do this, proper wiping cloths

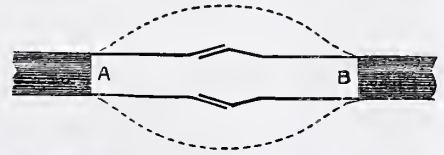



Fig. 1.

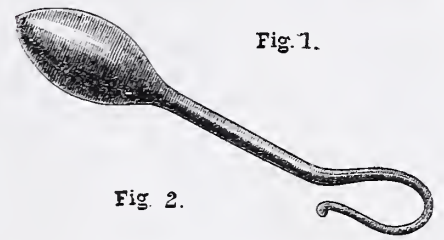
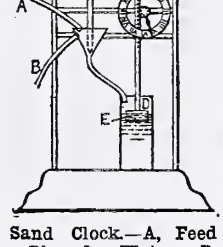


Fig. 2.

Fig. 1.—Plumbers' Joint. Fig. 2.—Iron.

must be used; they are made of several thicknesses of fustian or ticking stitched together, and should be well ruhhed with tallow before using. Various sized cloths are required, from 2 in. square up to 5 or 6 in., according to the size of the work. The metal must be kept at just such a heat with either blowlamp or iron (Fig. 2) that is soft and plastic, but not liquid enough to run. Burnt fingers are usually the result of first attempts, hut once the knack is attained it is easy enough—that is, simple joints such as you speak of. Proper plumhers' solder must be used.—R. A.

**Sand Clock.**—H. K. D. (*No Address*).—I have never seen a sand clock, and, I should think, it would be too bulky if you made one to go even thirty hours; hut you could make a simple one, no douht—say a tnhe of wood three sides, the fourth side of glass. Make a metal funnel with a small hole, and fix at the bottom, and have a box underneath to catch the sand. Fill your tube with dry sand, and having pasted a strip of paper outside on the glass, mark the hours, as the sand is falling, with your watch or clock. The tube could easily he fixed to the wall, and hy experimenting you would be able to find the length and size of tube and hole in funnel at bottom, where it has nearly run out. Pick up the box and refill the tube; but I am afraid your tube would have to be large and long to get it to run even twelve hours without attention. You might use water instead of sand; let it drop in a glass vessel, with a paper with the hours pasted on its outside; or let it raise a float—say, a large cork with a wooden or metal upright fixed to it. On the upper part it can have teeth working in a wheel that shall have a hand fixed to it, and so revolve as the water rises, and show the hours. This is an old Egyptian style of clock, in use about 200 years B.C. This sketch may suit you; it explains itself.—A. B. C.




Sand Clock.—A, Feed Pipe for Water; B, Overflow; C, Conical Stopper to regulate Flow into the Cistern; D, Cistern; E, Float with Arm to work the Wheel carrying Hand.

**Colouring House.**—H. L. (*Higher Bebington*).—I am glad to find that your incuhator promises so well, and hope you will derive great pleasure and profit from its use. With regard to colouring "the apiary," any colour can be ohtained by first preparing a wash of whiting or lime as for ordinary whitewashing, and then mixing in colouring matter until the desired tint is ohtained. For *pink*, use rose-pink; for *salmon*, Venetian red; for *lilac*, a little indigo and rose-pink; for *grey*, lamp-black; for *French grey*, Prussian blue and lake; for *blue*, Prussian hlue, indigo, or cobalt; for *green*, emerald green; for *buff*, yellow ochre; for *drab*, burnt or raw umher. To fix the colours, size should be used. I would advise you to mix a small qnantity at first, and apply it to a patch of the hack of the house. When it is dry, an estimate can be made of the effect. These colours usually dry lighter. I would advise you to get *Every Man his Own Mechanic*, which contains a world of useful information.—APIS.

**Chemicals.**—W. W. (*Chelsea*).—You can get the chemicals you require of Burgoyne, Burbidges & Co., 16, Coleman Street, E.C.; Townson and Mercer, Bishopsgate Street Within; or Orme & Co., 65, Barbican. The prices vary a lttle, bnt are about as follows:—Ferric oxalate, 1s. per oz.; ferric oxide, 8d. per lh.; ammonium oxalate, 3d. per oz.; hydrated peroxide of iron, 1s. per lh.; perchloride of iron, 9d. per lb.; protochloride of iron, 1s. 6d. per lb.; potassium ferrocyanide, common, 1s.; pure, 2s. 6d. per lb.; and potassium ferricyanide, common, 2s. 4d.; pure, 5s. per lh. These last two salts vary a good deal in price, different chemists charging differently according to which manufacturer they obtain it from. Oxide of iron is the same as ferric oxide, and chloride of iron as perchloride of iron. Ammonio-citrate of iron is *not* the same as peroxide of iron, it heing a compound, consisting of ammonia, citric acid, and iron, whereas peroxide of iron consists of iron and oxygen. I do not know the price of it, but you can get it from the above firms.—F. B. C.

**Penholder.**—J. W. H. (*Chesterfield*).—The two samples sent are for an apparatus and arrangement to be applied to a particular purpose. Now, as the *second* consists of precisely identical parts, acting in an identically similar manner, and producing precisely similar effects, there is consequently no novelty in the *second* arrangement, for which any exclusive legal right could he ohtained, nor which the law could support, as it would fail in not possessing the novelty required by law to make it a valid grant. If the *second* arrangement were manufactured and put on the market, the owner of the *first* could institute proceedings for infringement, and would, if the invention were novel, and his claims, title, and specification properly drawn, so that the law could support his right, be sure to win, with damages for the infringement of his exclusive rights by the *second* party. The use of the spring seems to he the only novelty, hut to use the plan the *second* would have to obtain a licence from the *first*, always supposing that the first possesses a legal right to the invention.—C. E.

**Thicknessing Gauge.**—J. A. (*Peterhead*).—The gauge shown on page 85, No. 110 of WORK. is not on sale, hut if you write me, through the Editor, I will make one for you.—B.

**Violin Bass Bar.**—B. F. E. (*Carlisle*).—To show you that the bar performs both functions, you need only string up to concert-pitch an otherwise properly constructed instrument, *minus the bass bar*. The pressure will cause the inner side of the bass sound-hole to become depressed helow its normal position, and as this is not the case when the bar is in position, correct in size, etc., it is evident that it has a "mechanical" function: viz., to support the helly. The paucity of penetration and the decidedly nasal quality of tone will convince you that it has also an "acoustic" function. In both letters you state that you have formed a theory, after many years of study, as to the construction of the bar, and wish to know whether or not it is erroneous. How can I express an opinion without first knowing what your theory is? I imagine that a person who entertains a theory, and, putting the theory to a practical test, finds the result precisely that which he anticipated it would be, may fairly claim that the theory is correct. You say, in regard to the sound-post, that you found the best place for it, and left it there, but I do not gather from your letter that you worked out the *reason why* it was the best. Should you encounter any difficulty regarding the practical part of fiddle building, I will do my best to assist you; but I cannot undertake a correspondence the end of which cannot be foreseen respecting the theories of either one or another.—B.

**Decanter Stains.**—CONSTANT READER.—To remove old stains from decanters, several different articles may be used, such as egg-shells, shot, coke; but what perhaps answers better than anything else are small pieces of coal. Put some into the bottle, and shake well for some little time, when I think you will find it will be perfectly cleaned. What was used to dry the bottle in the case you mention I do not know; but if heat is too slow a process, methylated spirits of wine will almost immediately evaporate the moisture from anything. Whether you would care to use it in the case you mention, I must leave you to decide.—W. E. D., JR.

**Slide Rule.**—A. (*Preston*).—Slide rules are of several different kinds, and may be ohtained at most mathematical instrument makers. We do not know who makes the rule our correspondent refers to, though we recollect some twenty-five years ago the person named having shown us some made in wood. Routledge's slide rule seems as good as any for ordinary all-round work; but we should advise our correspondent next time he is in Liverpool just to look in at the mathematical instrument makers, and see if he cannot find amongst the different kinds something approaching what he requires. He might also see what he can find at the engineers' tool makers either at Preston, Liverpool, or Manchester.—C. E.

**Scrap Tin.**—Tin.—Do you mean the cuttings such as are made by tinplate workers in the manufacture of goods, or do you really mean scrap tin, which I should understand to be scraps and oddments of the pure metal? If it is the latter, your possession of "some tons" of it is indeed a valuable one, as the price quoted for English ingot tin last month was £94 10s. per ton; and if you have several tons of this, it would be the best plan to send it to a metal merchant as it is. They could run it down cheaper than you could, and they would give you a fair price for it. Even if you went to the expense of running it into ingots, it is very doubtful whether you would find a sale for it at anything like tin price, as it would have no brand of guarantee upon it. All Cornish ingots have the mark of the Duchy of Cornwall on them—the lamb and flag. Now for the other case. If your treasure is only tin cuttings—that is, iron coated with tin—it is, comparatively speaking, of very little value, and you can soon calculate whether it will pay you to try and re-cover the tin. I estimate that you might get 2 lbs. of tin per cwt. of scrap. This would be 40 lbs. per ton; more likely less than more. The utmost value of this would be 35s., so that you might expect from four tons about £7. Deduct from this, say, 25s. for fuel, and take your time into account, and you will see that it is not a very profitable speculation, and that it would not be a very wise thing to buy bellows, or such like expensive appliances, to melt it down. I know it has been tried, but I think the only people who make it pay are the gipsies. They build up a big wood fire (which costs them nothing), throw a heap of cuttings and old kitchen utensils upon it, set it alight, and let the metal run on the ground, and when cold, dispose of it at the nearest marine store dealer's. If you treat your scrap in a similar way, it may pay you—that is, if your time is not of much value; but if it is, my advice is, have nothing to do with it.—R. A.

**Camera.**—A. W. (*Paisley*).—So far as we can make out by your post-card, there is nothing particularly new in the design; revolving backs have been some time in the market. You do not say what the intended improvement is to effect, or what mechanical movements are to be superseded. The diagrams are not sufficiently clear to enable us to form an opinion. Under any circumstances, we should hesitate to recommend taking out a patent. —D.

**Back Parts of Work.**—A Lover of "Work."—You can get any back monthly part or weekly number of Work by ordering it through your bookseller or newsagent. Failing him, write to the publishers, Messrs. Cassell & Company, London, E.C.

**Wardrobe.**—Dykehouse.—In No. 116 of Work a writer deals briefly with wardrobes. You might gather sufficient instruction from his remarks serviceable to you. If you do not, however, a reference to Indexes of Vols. I. and II. will bring to your notice several details of wardrobes in "Shop" and elsewhere.—J. S.

**Colouring Clays.**—Workite.—The chalks are ordinary soft chalk. The depression made by a flat rose-cutter in a lathe, or a brace and bit, would answer. The cubing of the chalk may be done at a table with a circular saw or band-saw, a gauge, and two sides of a square; determine the cuts. Your experience of clays must show you how different clay is from chalk in its action under the effect of mixing with water, etc.—one, when dry, becomes hard and stony, the other remains soft still. There is no clay, such as pipe-clay, or very little, used in crayon making; the less the better. For black crayons, proceed as follows:—Take yellow wax, 32 oz.; curd soap, 24 oz.; washing soda, 1 oz. dissolved in water; Paris black, 7 oz. Mix gradually, adding to the heated mass as it burns the soda, and the black is stirred into it by degrees. Crayon making is a fine craft; many of the metals are blended with the chalk or calcium carbonate, as also, with some pipe-clays and china clays, gypsum, talc magnesium, bismuth, etc. The alcoholic solution of shellac, liquid gum, or turpentine are used for mixing. The best black for crayons is made from camphor into black; ivory black is also used. In working earths, chalk, or clays for crayons, reduce them to fine powder by triturating in water, and decant the liquor into a vessel for evaporating the water from the substances held in suspension. This is collected, and mixed with weak gum or other adhesive liquid into a stiff paste. It is then forced through dies, just as drain-pipes are made, on to an endless belt, a wire being used to cut them into lengths at the face of the die. For mixing to make coloured clays, use any coloured earths suitable, as umber, ochre, chalk, sienna, raw and burnt. For other colours use lakes. This is the name for almost every colour having chalk for its base—blue, green, yellow, purple, rose-pink, etc. These can be bought cheaper than they can be made, unless you have whiting, etc., to hand of which to make lake colours by staining them. I can meet with no clay-mixing books. Writers are so intent upon displaying their theoretical intelligence in chemical jargon that they omit the word clay from their writing about it. It is not in the "Encyclopædia Britannica," and the learned dunce constantly shows through the veneer of pseudo-scientific terms. A good English work on "Colours and Dyewares" is by J. W. Salter (Crosby Lockwood & Co., 7, Stationers' Hall Court, E.C.). Another, "The Dyer and Colour-Makers' Companion," by H. Carey Baird & Co. (810, Walnut Street, Philadelphia, U.S.A.); both low-priced works, I should think.—J. C. K.

**"Safety" Gear.**—J. P. A. (*Walthamstow*).—The gear of the Safety at present is 67½ in.—much too high for practical use. With ten teeth on the hub, the gear would be reduced to 54 in. The simplest method of lowering the gear would be to key on a lower chain wheel on the pedal shaft, say, fifteen teeth, which would gear with the present hub down to 56¼ in., or a chain wheel of fourteen teeth, which would gear down to 52½ in. To alter the hub cog-wheel would require a repairer, and a cog-wheel might not be got that would fit, in which case one would have to be made for it. Chain wheels can be had, any number of teeth, from 1s. 6d. to 2s., of the St. George's Cycle Co., Islington, London; or Brown Bros., 7, Great Eastern Street, London. There is no really practical arrangement for gearing while going.—A. S. P.

**Re-touching Medium.**—G.B. (*Edinburgh*).—An excellent re-touching medium is thus made:—Take 120 grains of gum dammar, and dissolve it in one ounce and a half of benzole, then add half an ounce of turpentine. When it begins to get thick by reason of evaporation, it may be thinned down by adding a little benzole and turpentine in the same proportions. There is seldom any necessity for filtering if the dammar is good. It may be broken up into a rough powder, put in a bottle, and the solvent poured over it.—D.

**Cleaning Silver Plate.**—F. W. J. (*Fulham*).—All silver is liable to discoloration on exposure to the smoke, fog, and gas-charged atmosphere of London. Pure silver is more liable to tarnish than alloyed silver. Electro-plated goods, being coated with pure silver, are more difficult to keep clean than goods made of sterling silver, but I do not know of any kind of plating which will resist the bad effects of an impure moist atmosphere. Silver-plated articles in show-cases in shops where gas is burnt soon go off colour, and show a number of dark specks where the gas-charged damp air has condensed on the cold metal. Wash the tarnished silver in soapy water, containing hartshorn, carbonate of ammonia, or liquid ammonia, then dry with soft linen rags. Brush engraved parts with a soft brush whilst in the liquor. This will clean tarnished plate with less wear than the use of plate-powder. Electro-plated articles dipped in kristaline will keep their colour for a longer time than those not coated with this preservative varnish. See "Our Guide to Good Things" on p. 202, Vol. III., of Work. —G. E. B.

III.—Questions Submitted to Correspondents.

**Printing on Tin.**—Curious will be glad to know the process or preparations used.

**Silk Weaving.**—Curious writes:—"How are silk-woven mantle or coat hangers made—*i.e.*, by what process and out of what material? And what is the name of the material used for 'stamped hat tips'?"

**Paper Wheels.**—W. H. K. (*Accrington*) writes:—"Can any reader give me information about the process of making boards and railway-carriage wheels, etc., from paper, or where I could get the information?"

**Fret Machine.**—Lancashire writes:—"In Work, No. 58, Vol. II., page 91, North Jack has sent drawings for a fret machine. I am making one, but don't understand how the saw frame is fastened at the back of machine so as to work. Will North Jack kindly tell how it is done? I want as perpendicular stroke as possible."

**Mining Engineering.**—S. H. M. (*Liverpool*) writes:—"Will anyone kindly send me all particulars of the profession of mining engineering? What is the course for it? what age does one enter? and what is the length of its course? Can certain kinds of mines be taken up *exclusively?* What number of examinations are there, and what are the colleges for it—at home or abroad? and any other particulars about it."

**Electric Gas-Lights.**—Strikalite will be grateful for instructions how to make an electric gas-lighter worked by frictional electricity; a diagram showing connections and dimensions will be useful. Also where the necessary clock-work may be obtained.

**Rifle Rack.**—A. S. (*London, S.E.*) writes:—"Will any kind reader of Work give me a few hints as to making a rifle rack, to take eight rifles, to fix to the pole of a bell tent, the same as one sees at Aldershot Camp in August?"—[A Gun Rack was given on page 60, No. 108. Why not convert it for your purpose?—Ed.]

**Gold Blocking (Cards).**—Curious asks:—"Is there any process (dry) whereby the gold can be made to adhere to the card until blocked, same as in the case of books? But the process must be such as won't soil the card; glair would not do."

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—Excelsior; R. K. (*Brockley, S.E.*); R. P. C. (*Sunderland*); H. & R. (*Birmingham*); H. P. (*Bristol*); D. B. D. (*Glasgow*); W. F. (*Salisbury Square*); D. B. T. (*Dalbeattie*); J. S. (*Preston*); Ancona; W. G. (*Manchester*); E. A. (*Salisbury*); C. H. C. (*Hornsey*); Mercury; H. J. H. (*South Hackney*); J. A. (*Southport Lane*); Kinning Park; S. T. (*No Address*); J. T. (*London*); C. T. (*Edinburgh*); S. F. R. (*Edinburgh*); C. Bros. (*Leeds*); B. J. B. (*Boddington*); J. M. P. (*Preston*); Puzzled; L. G. (*Falmouth*); Adia; J. H. (*No Address*); G. W. S. (*Tufnell Park*); F. G. (*Paddington, W.*); Dundee; W. C. (*Shrewsbury*); Nemo; J. A. J. (*No Address*); J. W. H. (*Nottingham*); J. G. (*Sunderland*); T. S. (*Pendleton*); W. A. (*Faversham*); J. H. (*Holloway*); H. B. (*Disley*); L. C. (*Ealing Dean*); E. J. A. (*Southampton*); G. F. R. (*Redditch*); C. B. H. (*London, W.*); F. B. J. (*Liverpool*); A. C. (*Langton*); E. W. C. (*Leicester*); J. R. (*Douglas*); A Reader of "Work;" J. B. (*Manchester*); W. W. (*Elswick*); H. L. (*Urmston*); Kiln Burner; Pattern Maker.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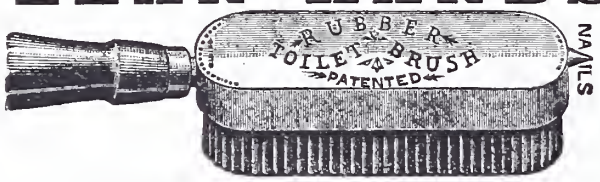


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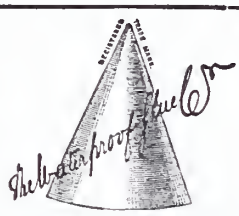


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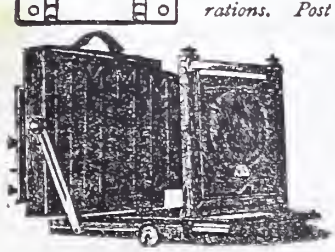

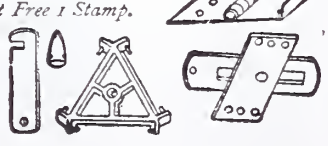

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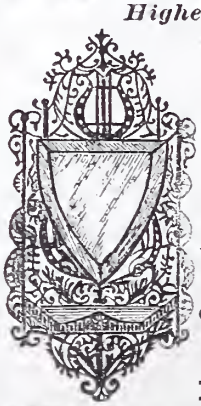

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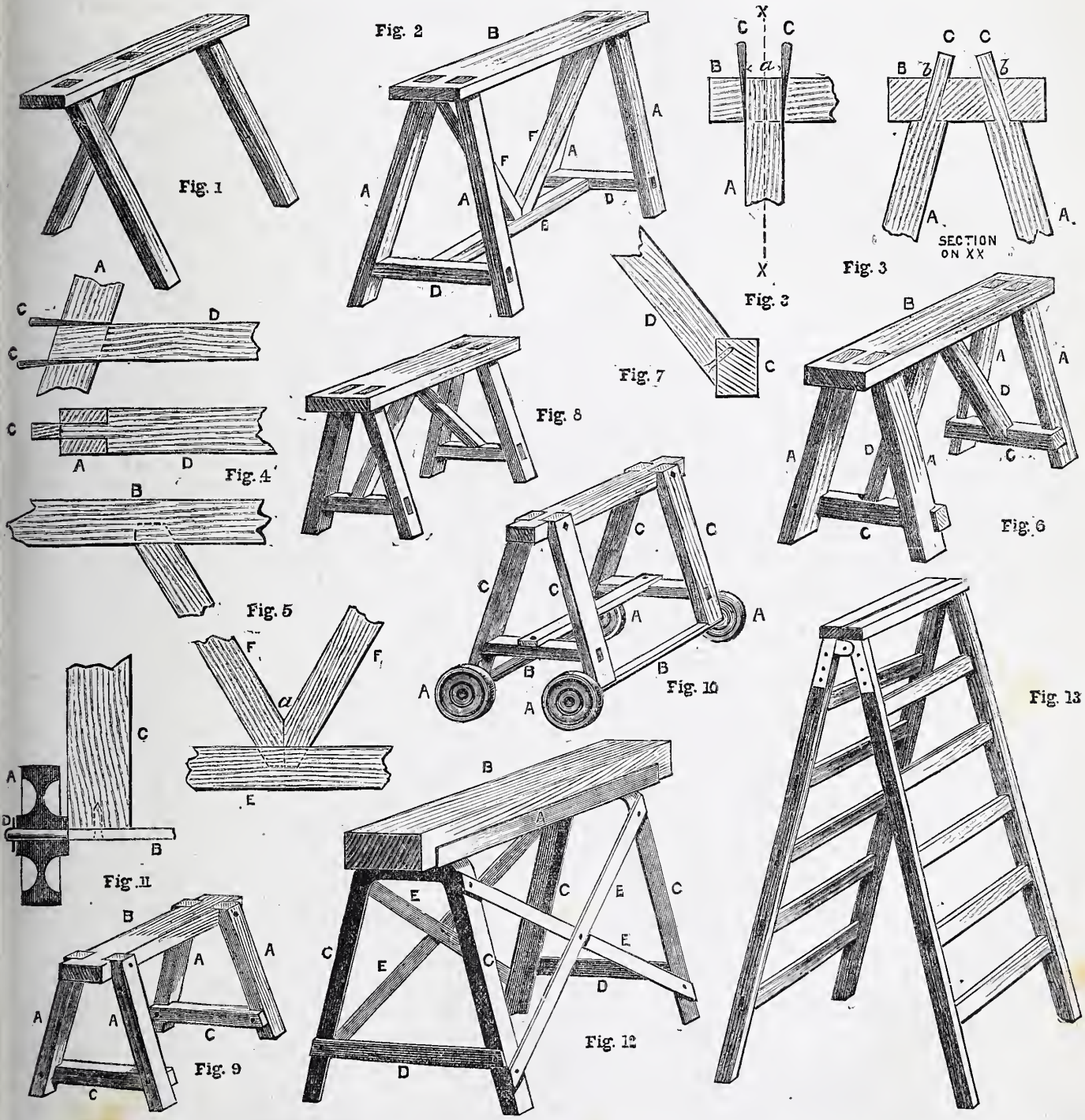
VOL. III.—No. 126.] SATURDAY, AUGUST 15, 1891. [PRICE ONE PENNY.




ABOUT TRESTLES. Fig. 1.—Three-Legged Trestle. Fig. 2.—Typical Form of Trestle used for General Purposes. Figs. 3, 4, 5.—Details of Jointing. Fig. 6.—Trestle with New Mortised and Tenoned Joints. Fig. 7.—Detail of End of Strut. Figs. 8, 9.—Sawing Trestles. Fig. 10.—Trestle on Wheels. Fig. 11.—Detail of Wheel and Axle. Fig. 12.—Boiler-Maker's Trestle. Fig. 13.—Builder's Trestle.

## ABOUT TRESTLES.

BY J. H.

DIVERS FORMS OF TRESTLES—THREE-LEGGED FORM—TRESTLE FOR GENERAL PURPOSES—METHOD OF JOINTING—A SIMPLIFIED FORM—SAWING TRESTLES—TRESTLE ON WHEELS—IRON TRESTLE—TALL BUILDER'S TRESTLE.

*Divers Forms of Trestles.*—These occur in divers sizes, forms, and proportions. They are used by paper-hangers, carpenters and joiners, pattern-makers, boiler-makers and platers, and in many other handicrafts. An article on their forms and modes of construction may therefore be of service.

*Three-Legged Trestle.*—Fig. 1 shows the simplest and also the most unsteady trestle that can be made. It has but a limited use, being employed chiefly by paper-hangers and glaziers, who lay boards across two such trestles, and cut their paper or glass upon the boards. These must be used in pairs. A single three-legged trestle would be too unsteady to be of any service.

*Trestle for General Purposes.*—A very generally serviceable form of trestle is shown in Fig. 2. Quartering of light or heavy scantling may be used, according to the purpose for which such a trestle is required, and the method of framing together may vary, but the type is useful for supporting almost all kinds of work, from a common washing-tub to a piece of joinery or pattern-work in course of construction.

*Method of Jointing.*—The trestle in Fig. 2 is framed together with mortises and tenons in a workmanlike manner as follows.

The four legs, A, A, A, A, are mortised into the top, B. The detail of the method is shown in Fig. 3. The mortise in B is cut longer than the width, *a*, of the tenon of A, to allow of the driving in of wedges, C. The complete joint thus assumes a dovetailed form, wider at top than at bottom, and the legs, therefore, cannot fall out. The wedges must be driven in as shown, against the *ends* of the tenon and the *end grain* of the top, B, and not against the flanks, *b*, of the tenons. If they were driven against the flanks, *b*, they would split the top, B.

The stretchers, D, Fig. 2, are mortised into the legs, A, as shown in Fig. 4, with wedges, C, driven against end grain, as in the previous instance. The longitudinal stretcher, E, Fig. 2, between these short stretchers, D, is also mortised in the same fashion.

A trestle made thus with close joints will stand a considerable amount of rough usage. If the legs were short and the scantling of large section, as in the case of a sawing stool, strutting would not really be necessary. But it is always advisable to strut high trestles made of slight scantling, say not exceeding 2 in. by 2 in., or 2 in. by 2½ in. cross section. In Fig. 2, struts are shown at F, F. Though it is necessary that these struts be mortised into B and E, the tenons will not pass through nor be wedged.

It is quite enough to stump tenon the ends of F, F, Fig. 5, at top and bottom. Note the abutting of the two struts at *a*—a further steadiment to the framing. If these shoulders are all fitted closely, and if the tenons make a tight driving fit, the trestle, when glued together, will be as firm as a rock.

*A Simplified Form.*—There is, however, a simpler method of framing trestles of this type together. It is shown in Fig. 6. The only members that are mortised are the legs, A, into the top, B. The cross stretchers, C, are simply let for about ½ in. into the legs, and screwed, or, preferably, secured with small bolts. The struts, D, are stump tenoned into the top, but at the other end they are merely shouldered back to fit over the stretchers, C, Fig. 7, and screwed or bolted. For a trestle of somewhat heavy scantling, like that shown in Fig. 6, this simpler method of jointing is quite good enough; but for a lighter trestle, like that in Fig. 2, the method of framing together with longitudinal bottom stretchers, E, and mortised joints throughout, makes a more steady job.

*Sawing Trestles.*—Figs. 8 and 9 show the low form of stool used chiefly for sawing boards upon. These are about 20 inches in height, and firm and stiffly made. In Fig. 8 all the parts are mortised, and tenoned, and strutted in workmanlike fashion, as in Fig. 2. But in Fig. 9 nothing of this kind is done. Here the legs, A, A, A, A, are simply shouldered into the sides of the top, B, and a single bolt passes through each pair of legs and the top. The cross stretchers, C, are slightly shouldered back, and screwed or bolted to the legs.

*Trestle on Wheels.*—A form of trestle that I have used for several years, and found very handy for heavy pattern work whose position in the shop sometimes requires to be shifted, is shown in Fig. 10. It is useful also for pushing heavy timber along to the circular saw. It is simply a strongly-made trestle mounted upon small iron rollers or wheels, A. The detail of the latter, with their axles, is shown in Fig. 11. The axles, B, are rectangular bars of iron of oblong section. These are screwed to the bottoms of the legs, C. The ends are forged or turned down to circular section to receive the wheels, which are kept on with a pin, D. The wheels are castings, about 6 in. in diameter, and dished or hollowed out on each side for diminution of weight.

*Boiler-Maker's Trestle.*—Fig. 12 shows an iron trestle, used by boiler-makers and platers, fitters, fettlers, and others in the engineering trade. This also is made in different sizes and scantlings, but the figure gives a good idea of what we may call a standard type. In this, A is a piece of channel iron of suitable section. Into this is fitted a length of a deal, B, somewhat longer and deeper than the iron. Pieces of bent angle iron, C, form the legs; they are riveted underneath to the channel iron. For light work pieces of flat bar iron may be used instead of angles, but of course they are not nearly so rigid as the angles; but then the trouble of bending angles is saved. The angles, C, are rendered rigid in one direction by riveting the stretchers, D, across, and in the other direction by riveting the diagonals, E, both to the angles and to each other where they cross at the centre. The result is a perfect trestle, strong, rigid, and everlasting. In an engineer's yard the cost of making these is but slight.

*Builders' Trestles.*—Fig. 13 shows tall trestles used in pairs by builders, carpenters, engineers, and others, for laying planks upon for the building up and the erection of work. The uprights are hinged at the top, and planks are laid along upon any of the cross-bars whose height happens to be most conveniently situated for the work in hand.

Thus I have endeavoured to group together the various kinds of trestles that are chiefly in use in the building and other trades, and describe their construction in the hope that this little monograph on the subject will not be without its use to the readers of WORK, professional and amateur.

## FRENCH POLISHING: GLAZING.

BY DAVID DENNING.

DIFFERENCE BETWEEN SPIRIT AND GLAZE FINISHES—REAL OBJECTION TO GLAZING—LESS PRACTICE REQUIRED—GLAZING OF ADVANTAGE IN INLAID WORK—OTHER CASES IN WHICH IT MAY BE USED WITH ADVANTAGE—GLAZE TO BE BOUGHT READY-MADE—HOW TO MAKE IT—GUM BENZOIN—HOW TO APPLY GLAZE—REVIVAL OF OLD FRENCH POLISH WORK.

AT the close of the article on Spiriting-Off in French polishing, one on finishing by means of glazing was promised to readers, and it will be of special use to those who are unable, through want of time, to learn the better process, or who want to finish any polished article with the smallest amount of labour.

The difference between the spirit and glaze finishes may be described as being in the one case by friction, and the other by the addition of a thin fine varnish to the surface of the body of polish. In the former case the polish itself is polished; in the latter it is varnished with a mixture known commonly as glaze, but to which other names, such as slake finish, are sometimes given. As may readily be surmised, finishing by means of glaze is not so good as the legitimate method by spiriting, and can hardly be considered as being anything more meritorious than a means of getting the same effect easily and quickly—an imitation, in fact, of the real thing.

Why, then, it may be asked, should space be devoted to telling people how to imitate good French polish? And it is more than likely that some professional polishers may object to an explanation of what may almost be called one of the "tricks of the trade."

Even if it be granted that glazing is an imitation, it has such a recognised acceptance among polishers, is so remarkably convenient occasionally, and in some cases possesses an advantage over spiriting, that it may fairly be classed among the ordinary processes of polishing. When done in moderation, I, for one, can find no fault with glazing, which I hold to be just as useful as, say, the application of spirit varnish on the carving of a piece of work said to be, and justly considered as being, French polished. These remarks, I think, are sufficient justification to those members of the trade—were any justification necessary to such people—who do not believe in letting the public know too much. The only thing in connection with glaze that may be reprehended is the finishing of whole pieces of carcase work with it, to delude purchasers into the notion that it is French polished; or, if this is too much to say—for the work is really French polished—that it is finished in the best manner. The real objection to glaze finish is that it is not so durable as the other, for at first the appearance is equal to that got by any other process. It may even be said to be superior to badly spirited finish, and herein consists the chief claim it has for notice by amateurs. With all due respect for their skill, it is seldom that any of this class of worker can manage to do spiriting thoroughly, for the simple reason that they have not sufficient opportunity of acquiring practical experience.

Glazing does not require so much practice, so that, comparing it with finishing by spiriting off, results certainly equal to the latter, and probably superior, will be got with the former by inexperienced people. The practical polisher, of course, will learn glazing in the ordinary routine of his work, and must judge for himself when its use is

legitimate or not. Without putting myself up as a commercial moralist, I should unhesitatingly say that when a customer will not pay more than a sovereign for polishing a job on which good polishing might fairly cost double, the polisher is fully justified in using as much glaze as he likes. Perhaps it would be just as well to explain the difference to the customer, in order to give him an opportunity of having the work done well.

As any one who has had any experience in the furniture trade knows, though, there are some buyers or customers who always want to get work done for half its value. Knowing any one to be such, I do not think it would be worth the polisher's while to explain to him—or, more probably, her—anything about different methods. Perhaps the most delicate way of giving the information would be to send the number of WORK in which this appears to the "other party" in the transaction. I am a believer in letting people know what they are getting for their money, and if they are content to have a glazed finish, the onus of supplying it is off the polisher's shoulders. I therefore do not see why any unprejudiced polisher should object to easy processes being told any more than to those which are more difficult. Any way, my duty to the publishers of WORK and the readers who look to it for information impels me to tell all that is likely to be useful.

Among respectable polishers who can command a reasonable price for their work, glaze is of comparatively limited application, and is confined to those parts of a job where the spirit rubber cannot be conveniently used, or where its use is not necessary. Instances of such may be found in chair rails and various parts of the frame. This, as is no doubt well known to all engaged in the furniture trade, is usually polished to a greater or smaller degree before it is upholstered, or at any rate, before the outer covering is put on, the finishing being almost necessarily done last of all. The less the chair is handled then by the polisher the better, especially if the covering is a delicate one, for it does not require any practical experience to perceive that there is less risk of injury with one or two wipes over with the glaze rubber than with the more prolonged spiriting.

Another instance where glaze may be used with advantage is in inlaid work, where the inlay is slightly, though perhaps not intentionally, a trifle higher than the surrounding wood. In such a case I think most polishers will agree with me that it is better to resort to glaze than to finish with the spirit rubber. On fretwork also glaze may often be used with advantage, but remarks about this must be reserved till later on, when I shall have something to say specially applicable to fret-polishing.

As a rough guide to those who do not know when glaze may be used without risk, I may say generally that it is unobjectionable on parts which are not subject to wear and tear. It will stand a moderate amount of handling, but not so much as good hard spirited off polish; and even when left alone the lustre is not so durable. Beyond this it is almost impossible to define the extent to which glaze may be used on work which is intended to be really of the highest character, and every one must use his own discretion as to its application.

Glaze under one or other of its different names, some of which are specially given to their own preparations by manufacturers, may be bought ready made, but for similar reasons to those given in connection with French polish, the home-made article is to be recommended. The preparation of glaze is equally simple, the ingredients being gum benzoin and methylated spirit. The proportions may vary, but those given for polish will do very well, and with the substitution of benzoin, which should be crushed, for shellac, the process is exactly the same. After the benzoin is dissolved, the solution should be strained through muslin to free it from impurities in the shape of pieces of twig and similar foreign matter.

Gum benzoin—or, as it is sometimes called, gum benjamin—differs greatly in quality, and it is almost needless to say that the best should be used by the polisher. Compared with lac, it is expensive, so that the saving which is attributed to its use is mainly in time, which readers need hardly be reminded is, from a trade point of view, money.

As some guide to quality, it may be said that the whitest sample should be chosen; and I have been given to undertand that, as the light benzoin is better than the other, white lead is used as an adulterant. White lead, it need hardly be said, is not a recognised ingredient in any of the French polisher's preparations, so that benzoin containing it cannot be considered fit for his use.

Certainly cheap benzoin is not be relied on, and in a strange place I would look with suspicion on any offered to be sold in ordinary retail quantities at much under 2s. 6d. per lb., however satisfactory its appearance. In this, as in other cases where anything is liable to adulteration, the best way to avoid imposition is to go to a reliable dealer and to pay a fair price.

As "patent" benzoins are sold at a very much lower price—one kind, I believe, as low as 6d. per lb.—some may be tempted to buy them. That they are much used there can be no doubt, so it may be presumed some polishers find them satisfactory. I can only say that personally I do not recommend them, unless perhaps when extreme cheapness is the main consideration.

They—I refer to the only two "patent" benzoins which have come under my notice—form glazes which are liable to crack, and one of them especially is such a bad colour that its use on light wood is not beneficial. There may be more patent benzoins than those I have alluded to, and if I meet with a satisfactory one I shall have no hesitation in speaking favourably of any good qualities it may possess. Meanwhile, I prefer the genuine article.

Glaze may be applied with rubber, sponge, or brush, and in the majority of cases the first named medium is the most suitable and that most commonly used. It is made in the ordinary way as if for polish, but if anything softer, as glaze, must not be applied with pressure. It is rather painted on than rubbed into the work, which, to prevent any misapprehension, I repeat must have been previously bodied in. I am particular about this, as there seems to be a sort of idea prevalent among amateurs that glaze or "something" can be put on bare wood and cause a gloss right off. Let me say that there is nothing of the kind, and that a polish cannot be got on wood, except by varnish, by any other means than one of those indicated.

When using glaze, the rubber should be made wetter than when polish or spirit is used; but still, there should not be sufficient to drip from it. What is wanted is to glaze or wet the wood when the rubber is very lightly pressed on it. One or two wipes over, always in the direction of the grain of the wood, with a somewhat quick motion, though not by any means a "slap-dash" one, will put the glaze on, and on no account should the rubber be passed over a wet surface. Always let the previous one be dry before applying the rubber again to the same place. The defect that will be caused if care in this respect is not taken will be so obvious to anyone who makes the attempt—which he may as well do on a piece of waste wood, by way of experiment—that nothing need be said about it further. The coats may be repeated till the gloss is satisfactory, but the film of glaze should never be a thick one.

If a sponge is preferred, it is used exactly as a rubber would be, and on the whole it is questionable if there is any advantage gained by using sponge. Like a good many other details in connection with polishing, it is a matter of fancy.

When a brush is used the glaze may be regarded as a varnish pure and simple. With a brush a mixture of glaze and French polish, either white or brown according to the work, in equal quantities may be used with advantage, though on this point there are differences of opinion, chiefly, as far as I have been able to observe, arising from the nature of the work the polisher is most accustomed to.

If the glaze is not quite so satisfactory in appearance as it should be, it may sometimes be improved by passing a spirit rubber lightly over it, though this should only be done with great caution, to avoid washing the glaze away. When carefully and skilfully done, there can be little doubt that a glazed surface may be often, if not always, improved by slightly spiriting it.

It may be a useful bit of information to many that old French polished work may often be "revived" by being lightly gone over with glaze after the surface has been washed and cleaned with warm water. This treatment is at least as beneficial and often considerably better than that so commonly adopted with furniture pastes, polishes, creams, and revivers of various kinds, all of which will be dealt with in due course.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### SCROLL IRONS—"GOTHICS."

Now I must make it my business in this paper to refer to and explain the use of what are called "scroll irons." On the top of fencing, baskets, etc., it will be observed that some of the wires often terminate in a scroll. In instances where they are practicable the remarks which here follow will be applicable.

To the bench are secured, by means of fasteners, irons of the shape shown in Fig. 64, or of any pattern desired. The inside point of the irons (A in Fig. 65) must terminate sharply, for to this point will be hooked, as it were, the end of the wire to be bent. Then the wire is drawn tightly along the outside edge of the scroll iron, and pressed evenly and firmly against the latter. All the fasteners, let me say, must be brought on the inside edge of the scroll iron, in order that the outside edge may be quite level.

Wire-workers who have had much practice do not require the aid of scroll irons for performing this kind of work; and I

have seen my practical friend bend small and large scrolls in clean nice lines with the humble assistance of only the pliers, and, indeed, in some cases by merely using the fingers. But it is hardly reasonable to expect that any of my numerous readers, other than those who are or have been accustomed to wire-working, shall possess sufficient ability to accomplish the completion of wire scrolls by the help of only the fingers or pliers.

As it is possible that many who read these lines may be interested in practical fretwork, and as it is also probable that many of them may wish to try their hand at a bit of wire-working, I think it may be as well to say that, in the place of scroll *irons*, scrolls of hard wood of sufficient thickness *screwed* to the bench could be used with almost the same facility.

For the purpose of bending wire any curved shape, other than that of a scroll, it is also serviceable to have irons or fretwork of the line required.

If a rather large piece of work is in hand, and it is considered inconvenient to make the scroll terminals at the commencement, sufficient length of wire should be left for the purpose until the remainder is completed. The job can then be held against the side of the bench vertically, and the wires finally bent round the scroll irons; but in this case it is, of course, necessary that the latter be near the edge of the bench, whereas, if the scrolls are always to be made at the beginning of a job, it matters little upon what part of the bench the irons are situated, provided they are handily within reach.

It will be understood that this alternative of leaving the scroll work until the completion of the remainder is only necessary when the scrolls are in a position cross-wise to the length of the job, but that when they follow the length of the work the scrolls can be made at the beginning.

"Gothics" is the name given to wires when bent after the shape of Fig. 68. Those who have the smallest knowledge of architectural styles will notice that the title is an apt one.

This kind of ornamentation is largely introduced amongst articles in wire, embellishing the tops of them, although they are capable of being treated in what might be termed an artistic manner in adapting them as panels, by securing four or more in a geometric position, after that represented in Fig. 66.

In a piece of work along which a series of gothics are required, there is no need whatever that each gothic shall be separately made from the remainder. Of course, irons or fretwork may be used in the same way as scroll irons. Supposing separate gothics are required, the best course will be to cut up a number of wires, each of sufficient length to make one gothic and permit of its ends being bent round the work which it is to ornament; but where a series are required the wire need not be so cut: all that needs to be done is to proceed as in Fig. 65, bending the wires in consecutive gothics, afterwards bringing their tops and bottoms into a straight line.

It frequently happens that it is preferable to have the gothics slightly bent instead of being perfectly upright. This is nearly always the case when any circular piece of work is in hand. When this is so, it is only necessary that the gothics, thus far complete, are placed upon or below a cylindrical surface, and bent to the shape of it. It is best to do this while the whole of the gothics are in a straight line, for then it is more probable that each of them will be bent to the same degree as the remainder, and the two ends of the whole can be brought together and secured, if a circular piece of work is required.

For this secondary bending it is preferable to have metal tubes or rods, but, as a makeshift, wooden or other substitutes could be appropriately utilised. The sweep of the curve obtainable will depend upon the diameter of the article around which the gothics are bent; thus, if worked over something which is but one or two inches in diameter, the curve will be a sharp one, but if the diameter be about six or seven inches, the result will be but a very slight curve.

The above remarks apply where the whole of each gothic is bent from the straight; but now and again it may be considered preferable to merely bend the top over. In such cases as these the same particulars will hold good, excepting that only that portion required to be bent must be placed over the cylindrical surface.

There are other ways of obtaining these gothics. One of them is to bend each portion of wire which is to compose one of them round a half-circular block instead of a gothic-shaped one. Each half circle should then be bent at the point A (Fig. 68), bringing each half closer together, and at the same time frontwards.

The other method is to bend the whole length of the wire to be "gothicked," as shown in Fig. 69, in which diagram the wire is supposed to be laying flat. If each of the upper projections is then bent upwards or outwards, it will be found that when they are drawn apart at A, A the result is precisely the same as that gained by proceeding by means of either of the other two modes.

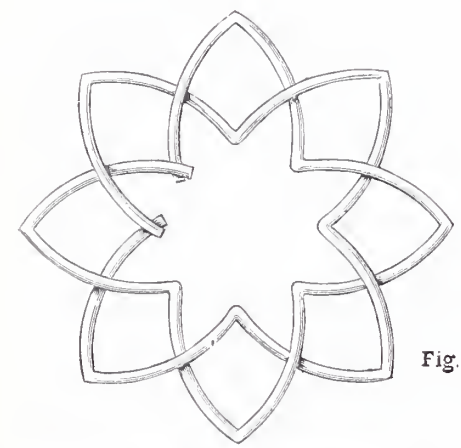


Fig. 66.

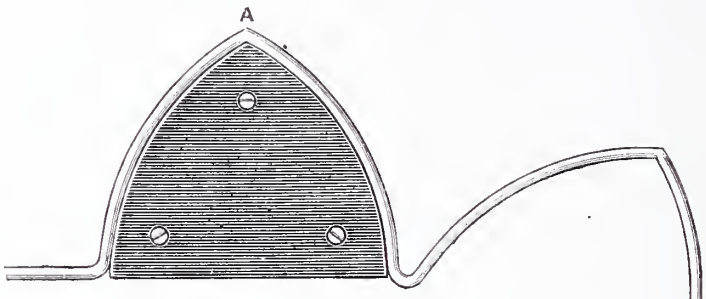



Fig. 65.

Fig. 67.

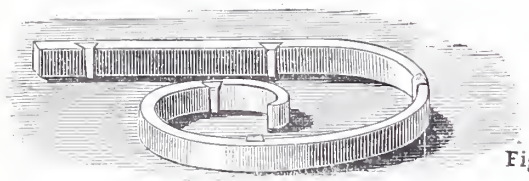


Fig. 64.

Fig. 68.

Fig. 69.

**Fig. 64.—A Scroll Iron for forming Scroll Terminals. Fig. 65.—One Method of bending "Gothics." Fig. 66.—"Gothics" treated ornamentally. Fig. 67.—End View of a "Gothic" when completed. Fig. 68, 69.—Two Additional Methods of proceeding to form "Gothics."**

## A USEFUL COMBINATION BEDROOM SUITE.

BY CLERICUS SECUNDUS.

Nature of Suite—Its Prototype—Length of Table-Bed—Material—Legs—Cross Pieces—Putting Skeleton Together—Panels and Panel Framework—Planks for Head and Foot—Flooring for Mattress—Side Planks—Finishing Cupboards—Floor—Top—Desk Top—Frames—Sections and Leather—Completion.

In Vol. I. of Work a description and design are given of one of the most ingenious articles of furniture I have seen for some time, and one which should "come as a boon and a blessing to men," or such of them as by duty or necessity are cramped in the matter of living room. Looking over the design, and thinking of those whom it was

chiefly intended to benefit, the idea flashed across me: But what of the sleeping accommodation?—for among its multifarious uses this combination does *not*

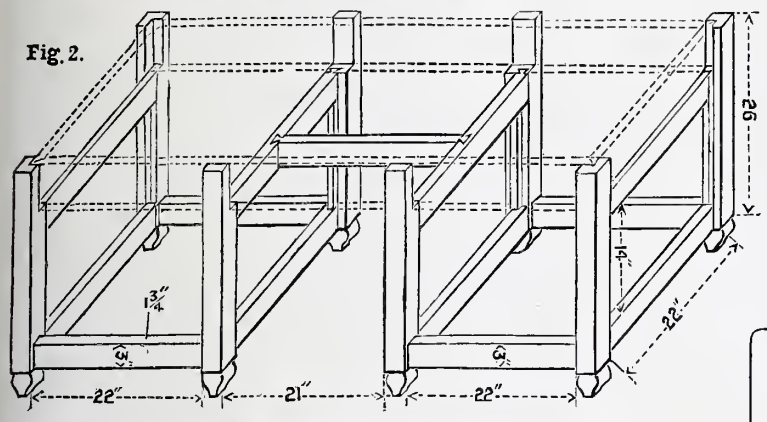
> "Contrive a double debt to pay:
> A bed by night—a chest of drawers by day."

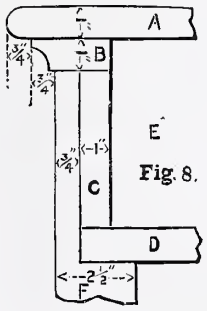
True, the possessor thereof may have a separate sleeping apartment, but in that case the contrivance is hardly necessary; and if not, to be able to stow away one's brush and comb—even including the et-ceteras—when one's bed is exposed to the public gaze, is a rather doubtful advantage.

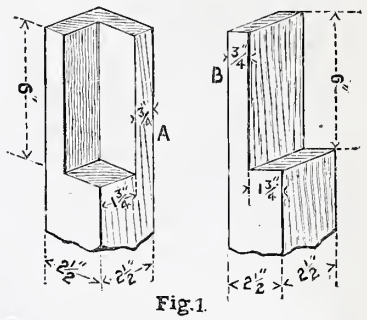
It was whilst cogitating on this knotty point that I remembered having heard of, or seen advertised, a combination of library-table and bedstead, which seemed to me to exactly meet the needs of the case.

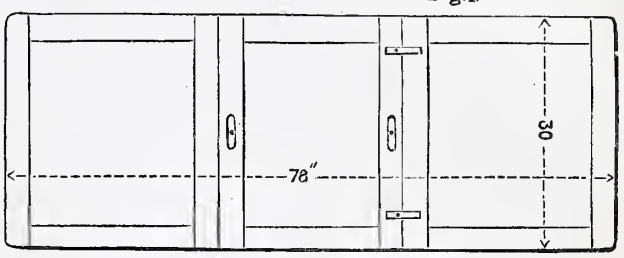
The inventor and patentee is a Mr. Zwicker, of Brussels, and anyone wanting the complete and thoroughly finished article had best apply to him. As Mr. Z. has obtained protection for his desk in England, it might be dangerous for any maker to reproduce it for purposes of sale. Amateurs, however, may safely make one for themselves on the lines herein laid down, as, never having seen Mr. Zwicker's arrangement, there is, so far as I know, nothing in common between the two, except the utilisation of the library-table for sleeping purposes, and the transformation of a part of the desk-top into a table. Furthermore, being "only an amateur," and not much of a one at that, I have no pretensions to teach my superiors in matters mechanical. I write only for the benefit of such amateurs as may be doubtful of their abilities for such a task, for they may be sure that where I lead anyone can follow; the result being, I trust, a piece of furniture which will be no disgrace to any room, whilst it will be found convenient, not only by the young men compelled to live in chambers or hired rooms, but even amid the more complete appointments of the settled home, if only for the accommodation of some member of the family when a "little stranger" or a bigger, if not more welcome, one arrives.

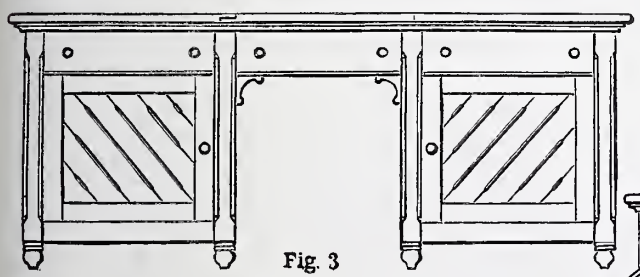
But before setting to work, two questions must be settled: Firstly, what shall be the length of the desk? We are not anxious to modernise the bed of Procrustes, whilst a bed 6½ ft. long for a man who stands five feet nothing in his socks is sheer waste of good material. Let each man take his own measure (a most difficult operation), and cut his wood accordingly. The desk here designed is meant for a fairly tall man, and gives nearly six feet of mattress. Any alteration in this particular will simply entail a corresponding alteration in the working plans. Secondly, what shall the desk be made of? Here another unknown quantity stands in the way of a correct solution—to wit, the length of the maker's purse. This too, then, he must settle for

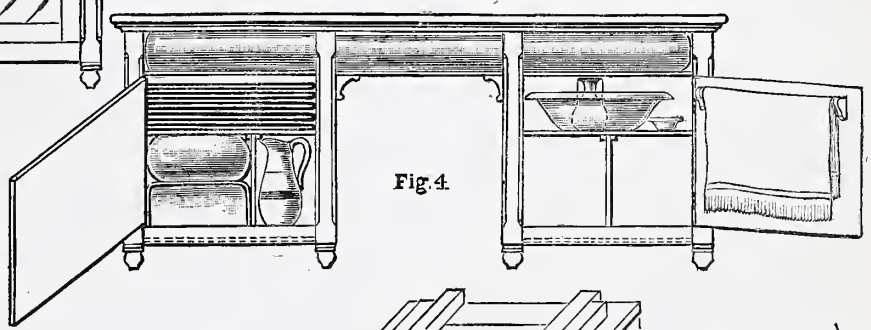


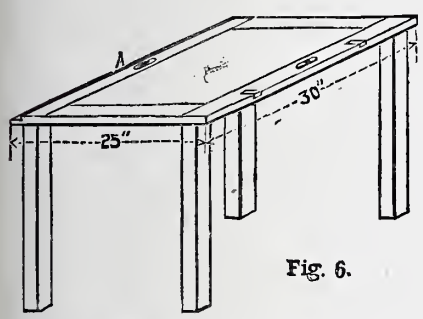



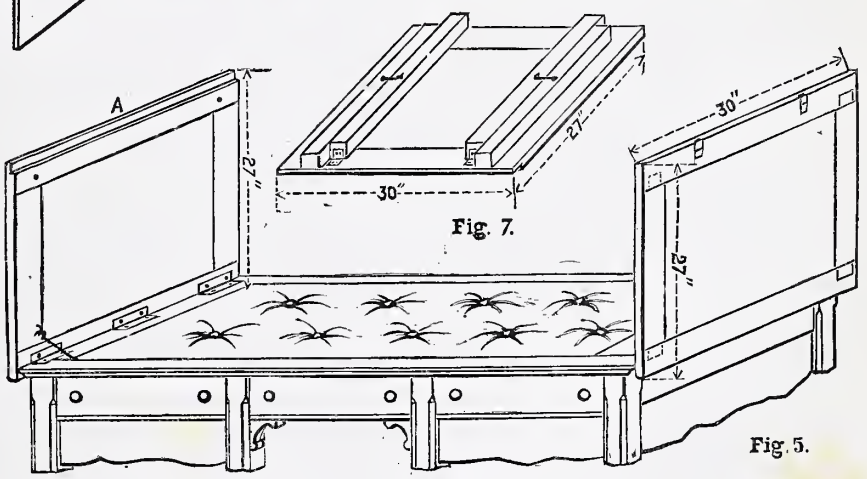




**Fig. 1.—Shaping of Legs at Top for Corners (A) and for Sides (B). Fig. 2.—Skeleton of Desk. Fig. 3.—Elevation, Front and Back. Fig. 4.—View of Interior, showing Arrangements. Fig. 5.—Desk opened, showing Mattress—A, Rebate to keep down Middle Section. Fig. 6.—Table—A, Rebate to fit under Left-hand Section. Fig. 7.—Table reversed, showing Legs folded. Fig. 8.—Section of Desk Top—A, Top Plank; B, Moulding; C, Front Plank imitating Drawer Front; D, Flooring for Mattress; E, Mattress Space; F, Leg of Desk. Fig. 9.—Top of Desk.**

***** All Figs. on Scale of ½ in. to 1 ft. except Fig. 1 not to Scale, and Fig. 8 on Scale of 2 in. to 1 ft.**

himself. Oak, walnut, mahogany, good pitch pine, have all their qualities and recommendations, but the supposition being that the amateur belongs to that large class which does not suffer from plethora of money-bags, the last named material has been in the writer's mind when drawing out the accompanying plans. So now to work!

We shall need eight legs 2½ in. square and 2 ft. 6. in. long, finished size. Four of them will have to be shaped at the top like, A, Fig. 1, for the corners, and four like B, Fig. 1, for the sides. The feet will have to be turned; they stand 4 in. high. Should the maker not have a lathe, and wish to do the whole work himself, the feet may be dispensed with, and a skirting-board, with a simple moulding at the top, run completely round. In that case the bottom cross-pieces should be tenoned into the legs nearly at the ground level, and the sides of the cupboard lengthened accordingly. Thirteen cross-pieces will be needed, all 3 in. wide. They should be as follows:—ten pieces 22 in. long, 1¾ in. thick; one piece 21 in. long, 1¾ in. thick; two pieces 22 in. long, 1 in. thick.

Let us begin to put together the skeleton of the desk. It will perhaps be best to first bind the front and back legs together. Pair them and arrange them in sets of four as they stand in the completed article. In marking for tenon and dovetail, a little care will be needed to prevent mistakes. Bear in mind that in each place the fixed cross-pieces must be flush with the *inside* of the cupboards; this will give us on the outside recessed panels ¾ in. deep. The bottom cross-pieces must be tenoned, the upper either tenoned or dovetailed, the latter preferably. The 1 in. thick cross-pieces are meant to be upper and outer ones. The cross-piece 21 in. long must be fixed across the leg space to hold the cupboard frames together. This is to take the strain partly off the sides and flooring of the mattress space, which otherwise would have to be wholly responsible for keeping the parts together should the desk need to be moved about.

Fig. 2 will, I think, make the arrangement of the cross-pieces perfectly clear. It will also show the grooves in the corner legs and the ledgers which are fastened to the middle ones, all being flush with the *outside* of the cross-pieces. These are to take the panels which form the sides of the cupboard. It will be observed that the 1 in. thick cross-pieces are reduced to that thickness in order to leave the grooves free for the end panels to be slipped in.

I have endeavoured to draw all the designs to scale, but not being a draughtsman, I have in each case added the dimensions for fear of error.

When all the legs and cross-pieces have been cut and fitted, they must be taken apart, the legs stop-chamfered, and the whole jointed up firm and tight. The end panels had next better be prepared. They may of course be plain, but as our desk is not overloaded with ornament, the planks which form the panels had better be stop-chamfered and fixed diagonally (see doors of cupboards, Fig. 3). The panel framework must be ¾ in. thick (the cross-pieces being tenoned into the uprights), and the panel proper of ⅜ in. wood and let into a groove in the framework. The dimensions, assuming the grooves in the desk-legs to be ½ in. deep, will be 17 in. by 23 in.

The panels having been slipped into their places, the planks at the head and foot of the mattress must next be fixed. They must be 2 ft. 1½ in. long, 6 in. wide, and 1 in. thick. The ends, instead of remaining square, must be bevelled off to an angle of 45 deg., so as to form a mitre with the planks to form the sides. They may be screwed to the legs from the inside. When fixed, the end planks will come right down on the framework of the panels, which, as will be seen, is not the case with the side planks.

The "flooring" for the mattress must now be prepared. The requisite dimensions will be found to be: Length, 5 ft. 11½ in.; breadth, 2 ft. 1½ in. It must be made of 1 in. wood, jointed in any safe way within the worker's powers, dowels and glue being perhaps as good as any. This must be dropped into the space left by the legs, and firmly screwed down. It will be amply supported in the centre by the cross-pieces underneath, and in my estimation likewise at the ends. In consequence, however, of the end planks being 6 in. wide, only ¾ in. of the cross-piece is available as a support. Should this be deemed insufficient, a ledger may be fastened to the end cross-pieces to increase their width. A cross-piece might also be fixed across the cupboard space similar to that across the leg space, if it be deemed safer to support the flooring along the whole length of its central line, but this appears to me to be superfluous.

The side planks must now be fitted. They must be 1 in. thick, 6 ft. 11½ in. long, and 5 in. broad. They will rest on the flooring, allowing the (inch-thick) edge of the flooring to be seen both front and back (see Figs. 3 and 5). The object of this is of course to represent the bottom planks of the drawers' space which would be there under ordinary circumstances. To carry out the illusion. drawer-knobs are fixed along the front. These can be readily purchased and glued into a hole bored with a centrebit. Four other knobs will be required for the cupboard doors.

It is immaterial whether the next process be the finishing of the cupboards or the fixing of the top. Let us take the former. The end panels being already fixed, the inner ones have to be placed. Nail ledgers to the top and bottom cross-pieces, flush with the *outside* (there are already some on the legs), and fill in with glue-jointed panels, which may be ½ in. thick. Dimensions, 22 in. by 14 in. For the floor, ledgers must be nailed to the four bottom cross-pieces of each cupboard—on the inner side, of course, and as near the bottom as possible—and the floor of, say, ¾ in. wood, glue-jointed, be dropped in. Dimensions, 22 in. by 22 in.

Fig. 4 will show the proposed internal arrangements. The left hand cupboard contains the bed-linen, the pillow, the bolster, and the water-jug. The other cupboard may contain the basin, water-bottle, and all the other bed-room and toilette requisites.

Of course, the maker will please himself in all these particulars, the shelves and partitions being held by glued blocks or ledger in any case. He will be guided in the matter by his special needs, and if he possess the "combination suite" already alluded to, or any other facilities for stowing away his bed-linen or other bed-room paraphernalia, the cupboards may be utilised for their more legitimate purposes. The object, however, is to make the desk-bedstead as complete in itself as possible, and the arrangement as sketched will be found convenient.

The doors call for no special mention, being made like the end panels, and as to size, 22 in. by 17 in. Of course, the appearance of the whole (see Fig. 3) will much depend upon the exactness of the work put into the panels. The doors must be hung upon butt hinges let into the legs and into the thickness of the door frames, the joint of the hinge being outward. It will be found more convenient to have doors front and back, though, of course, fixed panels may be substituted for one set of doors.

Now comes the top. Procure two lengths of 1-in. wood, 6 ft. 4½ in. long and 2½ in. broad, also two lengths 2 ft. 4½ in. long and 2½ in. broad. Along the outer edge of each of these run a simple moulding such as that shown at B, Fig 8, and mitre them at the corner, the moulding being underneath. Screw this moulding firmly to the frame of the desk. It should fit close to the leg top and the planks surrounding the mattress space, and project ¾ in. all round.

We now come to the desk-top proper. This, as will be seen on reference to Fig. 9, is made in three sections, the two outer ones being hinged to the moulding just fixed, the centre one being removable (see Fig. 5). The framework of each of these sections must be of 1-in. wood, and we will need for their construction the following:—Five pieces 30 in. long, 5 in. wide; one piece 30 in. long, 6 in. wide; four pieces 20 in. long, 5 in. wide; two pieces 17 in. long, 5 in. wide. The last mentioned six pieces, having to be tenoned into the others, have 2 in. extra allowed for a 1-in. tenon at each end. Now run a ½-in. rebate along those sides of the pieces which when fitted together will form the *inner upper* sides of the frames. This is for the purpose of afterwards fitting the leather or cloth-covered panels. Proceed to tenon the shorter into the longer pieces, putting the 6 in. wide piece to the left of the middle frame. Next form a 1-in. rebate on the under right hand side of the left hand frame, and another on the upper left hand side of the middle frame (see A in Figs. 5 and 6).

Now come the panels which are to fit into these frames; ½-in. wood, which must be glue-jointed, will, when planed down, do well if the rebate has been made exactly ½ in. deep, as the panels *when covered* should be flush with the frames. This at least is essential, and must be seen to. The exact dimensions should be, for the end panels, 18 in. by 21 in.; for the middle, 15 in. by 21 in. They must not, however, fit tightly, as allowance must be made for the thickness of the material with which they are to be covered. What shall this material be? Leather, if it can be afforded, and especially if the desk be made of one of the more valuable woods. In that case you must put a coat of paste evenly on the panels, lay the leather on, and press from the centre outwards. Afterwards the edges must be pasted down. For a desk made of the cheaper materials, however, I consider that green cloth or baize will look and answer quite as well as leather, and it has of course the advantage in the matter of cost. This must be "shrunk" by being wetted and dried, and then proceeding as just described. I would, however, advise glue rather than paste, and not too liquid, or it will show through the material. With their covering the panels should fit pretty tight, and a few small screws into the rebates from the under side will suffice to hold them in place.

The two larger sections must now be hinged on to the moulding as shown in Fig. 5. See to it that the hinges are of a size to come well over the moulding, for otherwise the piece of moulding might be torn away. They should certainly not be

less than 3 in. across when open, and may well be wider. Let them into the wood both of the table and of the cover, and see that the joint of the hinge is well to the edge of the moulding. They should be so fixed as to allow the "flap" to open until it stands at right angles to the desk, and no more (see Fig. 5). A hook may be fixed as shown to take off the strain and also to prevent the flaps from falling back on the occupant of the bed. When closed the left-hand flap should be fastened down with a couple of hooks and eyes, the hooks being attached to the inside of the sham drawer fronts.

On the longer sides of the centre section are drawn (Fig. 9) contrivances to serve as handles. They are made of brass, and consist of a small, shallow, oblong tray with a flange all round and a bridge across. The flange serves to screw them flush with the table top and the bridge to hold by when lifting off the top. These, if not readily procurable, may be replaced by some other contrivance, or for that matter dispensed with altogether. There are also two small brass bolts which are let into and lie flush with the wood. As the central section must be fastened to the right hand flap, these bolts, or something similar, are essential.

To cover over the bed and form the desk top, the left hand flap is lowered and fastened down, the rebate of the central section is slipped under the rebate in the closed flap; the right hand flap is then lowered and bolted to the central part.

Should the amateur prefer it, the rebates which interlock the left hand and middle sections may be done away with, and in that case the left hand piece of the middle framework will only be 5 in. wide instead of 6 in. The right hand flap must then also be provided with some means of fastening it down, and the two flaps will have to be closed before putting on the middle section. The latter must in that case be provided with bolts on the left hand frame as well as on the other.

If the amateur is fairly off for furniture, the desk may now be considered completed. If, however—as is more likely—his office or study is not encumbered with too many tables, Figs. 6 and 7 contain a suggestion which will be welcome. Get four pieces of wood 2 in. square (if a little less, it does not matter) and 22 in. long—less rather than more. Hinge these pieces on to the reverse side of the centre section of the desk-top, arranging them as in Fig. 7. The hinge end of the outer leg must be 3 in. from one side, and those of the inner legs 3 in. from the other. Note also that the outer legs must be $2\frac{1}{2}$ in. *full* from the edge, say $2\frac{3}{4}$ in.

A small bolt had better be fixed on, say, the inner legs, the socket being fixed on the outer. The bolt when shot will prevent the legs from swinging about when the table is lifted on and off.

When on the desk, the legs will lie along the side of the mattress, which must be stuffed very hard indeed if it does not "give" sufficiently to readily accommodate them. When the legs are unfolded, the table will appear as in Fig. 6, and be found handy if only for toilette purposes.

Our desk is now finished, and needs only to be stained and varnished or polished. In this, as in so many other details, the amateur must please himself. Personally I should prefer a dark walnut stain, French polished; but, once more, it is a question of taste. So, for that matter, is the whole style of the desk, which, but for facility of execution, might have been made otherwise.

But at least the amateur is now in possession of what the French call the "mother idea," and he can apply it as he thinks fit. I only trust that the results will be so satisfactory that no haunting sense of imperfections may disturb his dreams when he comes to lie on the desk-bedstead herein described.

## A FEW HINTS ON MAKING TAPS AND REAMERS.

BY DAMON.

Taps: how Made—Grooves—Shank—Finishing Hand Tap—Alteration in Hardening——Length—Number of Flutes--Their Shape—Cutting Flutes—Finishing Cut—Backing-off—Hardening—Tempering—Polishing—Making Reamers.

Although amateurs do not, as a rule, make their own taps and reamers, it sometimes happens that some special thread tap, or some particular size or taper of reamer, which one does not already possess, is required, when it is much quicker and cheaper to make it oneself instead of having one made by a specialist. A few hints on the usual method of manufacture may, therefore, be acceptable to novices. There is nothing new in what follows; but I am only writing for those who know nothing about the subject, and not for proficients.

Taps are generally made in sets of three. Fig. 1 shows the usual forms. Fig. 2 is a section to show the shape of the grooves or flutes. The dotted circle in Fig. 2 represents the bottom of the thread cut by the tap. The shank of the tap, marked *a* in Fig. 1, is turned down to rather less in diameter than the bottom of the thread, so that the tap may be passed right through a hole which has been tapped by it. This saves time which would be occupied in unscrewing the tap. The end of the shank is filed or shaped square to fit the tap-wrench which is used to turn it, if a hand-tap; or has a flat on it, or may be tapered to fit the chuck which holds it, if a machine tap. The thread is cut on a screw-cutting lathe in the usual way. Hand taps are usually finished off a trifle small (a very little), because hardening a tap makes it slightly thicker and shorter, so that it cuts a thread bigger in diameter than the tap was originally cut. Machine taps, however, are generally full, so that screws and bolts will be an easy fit. No definite rule can be given for allowances to be made for alteration in size during hardening, because different brands of steel vary so much.

Experiment with a piece of the steel being used is the only method of determining the amount. Then if the same brand of steel is always used, and the same process gone through in hardening, the same results may reasonably be expected, and the probable variation either in thickness or length allowed for. For all ordinary purposes, however, it does not matter, because the hole is tapped first, and then the screw is made to fit; and no amateur would attempt to make templet taps. Always use good steel for tap-making, and, in fact, for cutting tools generally. It does not pay to use poor stuff, for it will not take a good even temper, and, consequently, will not wear well.

There is no universal rule for the length of taps, but a proportion of about four times the diameter for the length of the threaded portion, and about four times for the length of the shank answers very well, and makes a nice-looking tap. It is better to adopt some system in making all kinds of small tools, so as to have the series uniform. Neglect of this principle is one of the great failings of amateurs and others who only occasionally make their own tools. The proportions given above are shown in Fig. 1, the diameter being taken as unity. The square on the end of the shank is usually made one diameter long.

The number of flutes is usually three, but in very large taps five may be cut, as it saves weakening the tap by cutting deep, and lessens the work on each cutting edge. An *odd* number, however, should always be used. If three flutes are cut, the width of the flute should be one-sixth the circumference of the tap, so that the width of the thread left is equal to the width of the flute. If five are put in, the width of the thread between them should still equal the width of the flutes. This is the proportion usually adopted, and is one easy to work to, and makes the taps look uniform; besides which, it provides plenty of room for the cuttings to lodge as the tap is screwed down: an important factor in the satisfactory working and length of life of a tap or reamer.

The shape of the flutes should be something after the style of those shown in Fig. 2, the corner, B, being well rounded. If a small corner is cut, as in Fig. 3, the tap is very likely to crack in hardening at the point B, and as soon as it comes to be used it will break. Some tap-makers cut the groove as shown at C, Fig. 3, but personally, I prefer Fig. 2, because the cutting face is radial, you get plenty of room for the cuttings without going deep with the flute, and one milling cutter will serve for fluting many different sizes of taps. Three cutters are all that are required for all sizes of taps—one to use from $\frac{1}{2}$ in. downwards, one from $\frac{5}{8}$ in. to 1 in., and a large one for $1\frac{1}{8}$ in. upwards. If the cutting angle of a tap is made too obtuse, and it is a large one, the force required to turn it round is very considerable; while, on the other hand, if it is too acute, although it cuts very freely, it soon gets the edge broken, and is spoiled. A radial face, and the thread only backed off a little, seems to be a good medium, especially for small taps. For large ones the angle may be made more acute, as the threads are stronger in proportion to the amount of metal they have to remove.

The flutes may be cut either in a shaping, milling, or slot-drilling machine, or, failing any of these, in the lathe by means of the slide-rest and overhead motion. This latter method is the one the amateur will most probably adopt. If it is intended to cut the flutes in the lathe, the tap must be fastened rigidly to the face-plate, so as to revolve with it. The ordinary driver will not do for this purpose, as it allows backlash. Fig. 4 shows the driver I generally use. An ordinary carrier is fastened on the shank of the tap. The end of the carrier passes between the two jaws marked *a*, *a*, one of which is tapped at A to receive a screw which holds the carrier fast against the other jaw. Of course an ordinary bell-chuck or jaw-chuck may be used; but I have found the above-mentioned driver so useful, that I consider it well worth the time spent in making it, as it can be used without taking off the face-plate, whereas a chuck cannot. There is one thing in making milling apparatus which should not be lost sight of—always make it strong enough. The action of a milling cutter tends to make the work spring and "chatter," which would effectually prevent a good finish being put on the work, besides, probably,

breaking some of the cutter teeth. To have a good appearance, the flutes should be cut the same length and depth. Nothing looks worse than irregularity in this respect. In fluting, it is best to work round the tap backwards—that is to say, having cut the flute marked *a*, Fig. 3, cut *b*, the one behind it, next; so that you can readily see when you have gone deep enough. If the flutes are cut in a lathe having no dividing-plate, three centre-dots may be made on the boss of the face-plate, so as to divide it into three equal parts, and one on the face of the head-stock as a pointer. The dots are then carefully brought opposite one another, the spindle locked, and the loose head-stock centre screwed up tight before cutting. Start the cutting at the point of the tap. The finishing cut should be a light one, to avoid springing the work as much as possible. The flutes having been cut, the next process is filing the "burrs" off. It will be noticed that a considerable "burr" is left on what will be the cutting face of the tap, spoiling the shape of the thread. This must be got rid of. By filing the face a little the "burr" may easily be broken off, using a chaser or anything of that kind for the purpose. On no account should the sides of the thread be touched with a file.

The threads will now require backing off to give them clearance. The taper tap will require the most clearance, the plug tap the least. The plug tap, in fact, has very little to do, being merely to ensure the holes being the same size and to cut a full thread at the bottom of a hole. There should be very little clearance from the circle, but a little is necessary. The next thing is to stamp on the diameter of the tap and number of threads per inch, with the maker's name, if thought requisite, as shown in Fig. 1. Squaring the end of the shank is also sometimes left till now. Reamers are generally stamped with the diameter, or the taper per foot if tapered.

The taps are now ready for hardening. This is by far the most difficult part of the job, owing to the uncertain behaviour of the steel. Before the steel is used at all it should be thoroughly softened by heating it to a dull red, and leaving in sawdust till cold. It is then much better to work, and is more likely to harden properly. One of the most annoying things in tap-making is to find a long tap or reamer, on which great trouble has been spent, bent or crooked after hardening, perhaps to such an extent as to render it useless. This is an occurrence which amateurs often experience. Annealing before using tends to lessen the danger, while much hammering increases it. If possible, therefore, a tap or reamer should be turned down to shape out of the solid, and not forged. If forging is necessary, the steel should be thoroughly annealed after it, then roughed out in the lathe and annealed again. Hammering sets up strains in the metal, which suddenly show themselves in hardening by causing the metal to bend. Roughing out even, if a heavy cut be taken, may cause strains, which may affect the satisfactory hardening. If the greatest accuracy of size and pitch is required in a tap, it is best to anneal after roughing out in all cases, whether the tap has been forged or not.

As to the proper heat for hardening, a deal depends on the particular brand of steel being used. Some steel will harden at a lower temperature than others, and the best heat is undoubtedly the lowest which will give the requisite degree of hardness. Experiment only will decide what this heat is. It is very little trouble to try a piece, and it may save a deal of time and money. Of course you have only the eye by which to judge the heat, and some practice is required to tell properly when two pieces of steel have been heated to about the same degree. Any way, steel must not be overheated, for *burnt* steel is undoubtedly *spoilt* steel. What smiths call "cherry red" is about right as a rule. In heating, the greatest care must be taken to heat evenly, and to prevent burning the thin cutting edges before the thicker part is properly hot. The fire should be clean and bright, but not too hot. It is a good thing when hardening taps or milling cutters to get them slightly red, and cover them with the ordinary mixture used for case-hardening, and then continue the heating. This has a tendency to prevent the cutting edges being burnt.

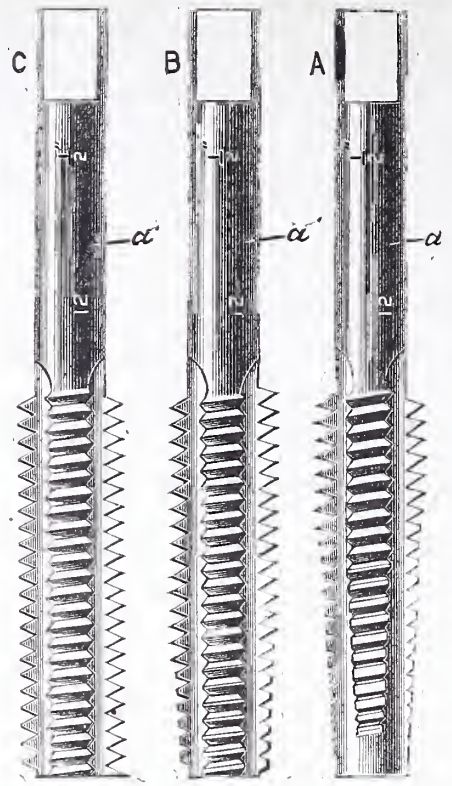



Fig. 1.—Taps of usual Form in Set of Three—A, Taper Tap; B, Tap; C, Plug Tap.

In spite of the quantity of different mixtures which are given as hardening medium, I prefer water. The ordinary cooling trough in the smithy will do as well as anything if the water is not greasy or too warm. Never try to harden a large tap in a small quantity of water. Always have the tank large enough, and plunge the tap steadily and quickly in, holding it meanwhile in a vertical position. If the tap is plunged in in an inclined position, it is nearly sure to be crooked.

When the hardening is accomplished the flutes must be brightened with emery-cloth. About half an inch of the shank nearest the thread should also be polished to show the colour while tempering.

Tempering should be done slowly. The slower the steel is heated the more uniform the temper is likely to be, and consequently the less likely are you to have the cutting edges too soft, while the rest of the metal is too hard: a frequent fault with novices, and one which is ruinous to the lasting qualities of the tool, as the edges wear away almost immediately it is used. If the temper is let down too low, the only thing is to re-harden and try again. A few failures must be expected at first, as some experience is required to tell when the temper is just right.

A good way of tempering taps, reamers, and tools of that class, when there are not many to do, is to get some pieces of tubing large enough to let the tap pass easily in. Get one of these pieces to a nice red heat, and then commence to heat the next, so that as you are using one and it cools, the next is getting ready. The tap should be oiled all over, and held with a pair of tongs in the hot tube, which may rest on a V block on the anvil. The tap must not be held still, but be moved about and turned round, keeping it meanwhile in the middle of the hot tube so as to temper it evenly. The colour must be carefully watched on the brightened parts until it reaches a "nut brown," or "dark straw" colour, when the tap must be rapidly cooled in water. These colours are rather difficult to describe, but by examining a new tap or milling cutter it is readily seen and should be carefully noted. If the tap is only intended to be used on brass, it may be left harder.

After tempering, the shank is polished

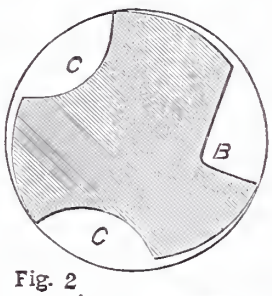



Fig. 2.

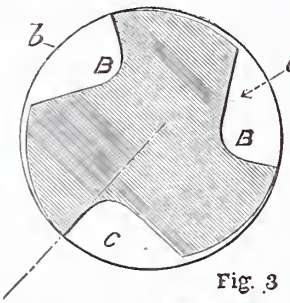



Fig. 3.

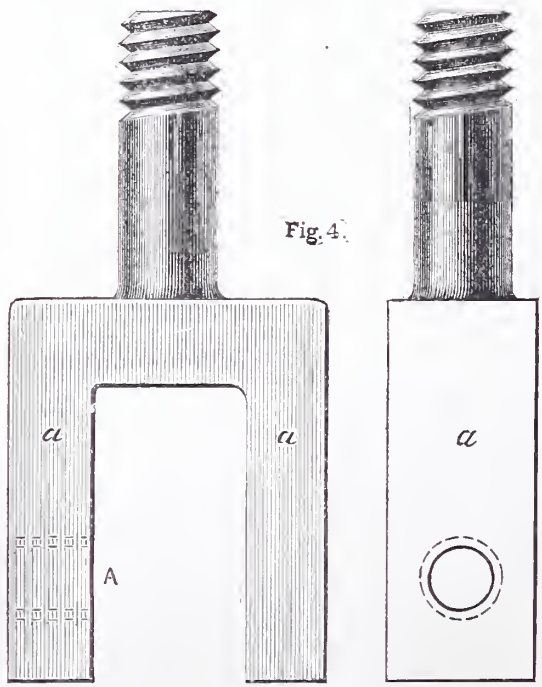



Fig. 4.

Fig. 2.—Section showing shape of Grooves or Flutes, with Cutting Faces Radial. Fig. 3.—Section with Corner Cut at B. Fig. 4.—Driver—A shows where Tapped for Screw.

in the lathe, leaving the colour on the flutes and about a quarter of an inch up the shank. The tap is then oiled all over, and is ready for use.

The method followed in making reamers is similar to that followed in making taps, In turning they are usually left full, and ground to templet size after hardening and tempering. If the reamer hardens a bit crooked it will often grind up to size. In fluting, cut a little deep, to allow for this grinding. More flutes are usually put in reamers than in taps ; an inch reamer may have nine, or even more, depending on the nature of the work to be done with it. A good pitch for the flutes is from $\frac{1}{4}$ in. to $\frac{5}{16}$ in. Always put in an *odd* number of flutes. If there are longitudinal grooves in the hole to be reamed, the flutes should be cut spirally. Reamers are somewhat given to "chattering." An irregular spacing of the flutes in a great measure obviates this, and should always, if possible, be adopted. The difference of spacing must only be slight, about ·0025 being quite sufficient. The cutting faces should be radial; the bearing surfaces should be narrow. In backing off, much clearance should not be given, but a little is necessary to allow the cuttings to get clear of the bearing surfaces, or they will make the hole rough. If too much clearance is given the chances of chattering are increased, which will cause the cutting edges to wear very fast, or perhaps break, and the reamer will be spoiled. For brass or gun-metal more clearance may be given than for iron, and the temper may be left quite hard.

In conclusion, I hope these few notes will make the paths of the novice in tap-making a little smoother. The hardening will be found to be the greatest difficulty ; the way in which a well-finished tap or reamer will bend or crack is most exasperating after some hours have been spent on it. Thoroughly annealing the steel before using, and leaving no sharp corners in the flutes, will do much to prevent these two evils.

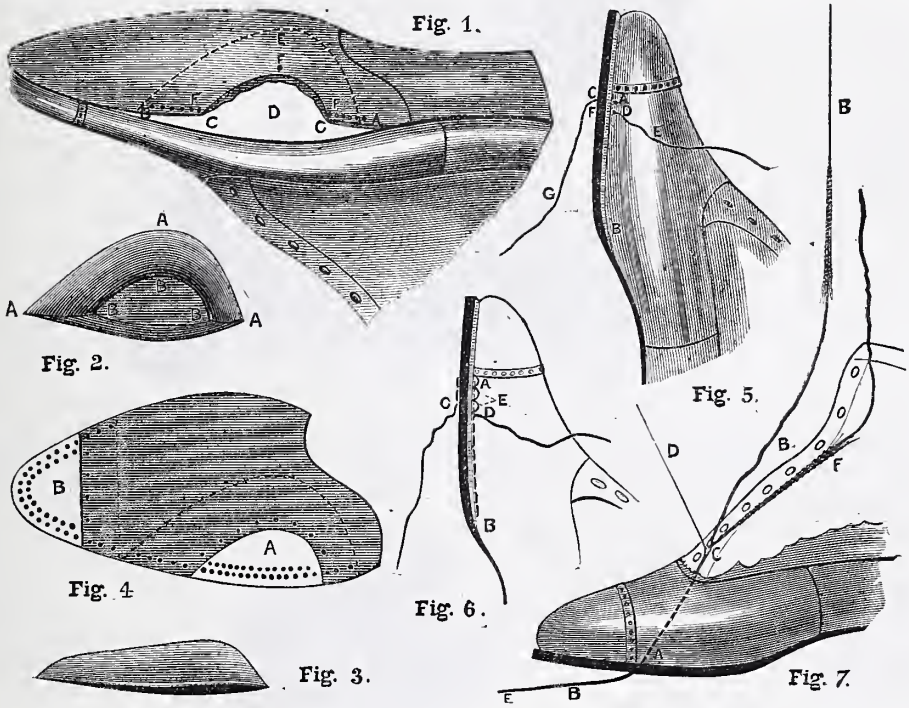



Fig. 1.—Section of Boot, with Sole Prised and Fitted to receive Underlay. Fig. 2.—Underlay, showing way to Fit and Skive it. Fig. 3.—A Skiver for Levelling. Fig. 4.—Half Sole, showing how to Underlay and Toepiece, and where Nails should be close to resist Wear. Fig. 5.—The Way to Loop-Stitch the Upper to the Sole. Fig. 6.—The way to make use of the Seat-Stitch in the forepart. Fig. 7.—The Way to Stitch-Draw, or a Substitute for Blind-Stabbing.

## BOOT AND SHOE REPAIRING.

BY W. GREENFIELD.

UNDERLAYING—TOE-PIECING — THE LOOP-STITCH—THE SEAT-STITCH—HOW TO STITCH-DRAW.

WE will now deal with the minor subjects in repairs that have connection with the sole, or bottom.

By underlaying is meant putting a piece under a sole where it is worn. Many people wear away the sole very quickly on the outside, while a few do just the same on the inside, and in either case an underlay in time will often save a sole.

When this kind of repairing is necessary most shoemakers (if they term themselves such) put the piece on outside—on top. This they do because it is less trouble, but I want you to spare no pains to do a small job well, because it is that alone that will make a large one come easy. Besides, anything that needs repairing is quite old enough. What it wants is to be made to look as much like new as possible.

To underlay, a last or iron foot must be put inside to keep the part that wants repairing quite solid. If the boot is machine or hand-sewn, rip it with a knife from A to B (Fig. 1), and lift it up as C C. If it is riveted it will have to be prised up with a chisel, and the rivets drawn out from A to C and B to C. Then cut out a piece of good sole leather, wetted, to the shape of Fig. 2; roughly skive it round the curved side, A A A, and then push it under the old leather at D (Fig. 1), but not quite as far as you know it will have to go ; then trim the old leather round from C to C with a knife, not taking off much, but all that is weak and thin, and being careful not to cut the new leather if you can help it. This done, knock the piece in to where it is wanted—that is, the dotted line E—and now draw a pencil mark round the curve you have cut, from C to C, on the new piece. Take the piece out again, and from the line B B and B scoop it out with the knife to A A and A, in the same way that you did the old in grafting a half sole, for in that case the old leather had to receive the new, and in this the new has to receive the old (C C, Fig. 1). Now put the piece in again, and put three short rivets in at F, F, F. Trim up the edge, leaving it quite full to allow for graving, rasping, etc.

If the boot is hand-sewn, then it must be sewn down from A to B, and it will look neater if a channel is cut in the new piece to receive the stitch, but as I shall have to give full particulars of this in another article, it will be out of place here, so it must be sewn through in the same way that the patch on the upper is sewn down. If it is riveted or machine sewn it can be riveted down from A to B, about the same distance from the edge, and in a like manner to that shown in half soling, in No. 112 of WORK, and in either case the edge can be knifed, pared, rasped, and finished as there described.

When a boot is worn very bad the underlay is not always enough to make the edge the proper substance ; then a little piece equal to what you want to fill that vacant place can be skived off a piece of hard sole leather, well wet, somewhat the shape of Fig. 3, put under the layer and riveted, or sewn down with it.

Toe-piecing. That is nearly a similar thing to underlaying, only it is at the toe ; but everything is fitted and done in the same way as shown by A and B (Fig. 4), which also shows how they should be nailed both on the old and new leather, and that it is often wise to put an underlay and toe-piece as well to a sole—more especially if the boot is old—as it saves a sole, and uses up the odd pieces of leather.

It sometimes happens that the upper leaves the sole for some distance along the side of the boot, say from A to B (Fig. 5). One way to sew this to the sole again is by loop-stitching it ; the loop, which is inside and draws the upper to the sole, can be set at every stitch, or each alternate one, but take care not to make the holes too large in the upper. To proceed, make a hole with the sewing awl through the sole from A to C, draw the thread through, and halve it ; then with a fine stab awl make a hole in the upper ; at A put the right hand end through, and draw it out through the inside of the boot ; make another hole at D and draw the end through to the outside, as shown by E. The hole is found inside, as shown in the last article on blind-stabbing ; though for such work as this it can be done another way, which I will show here, by the stitch-draw, later on.

When you are thus far, make another hole through the sole from D to F ; put the left end (C) in first, then the right (E), pull them tight on both sides, and the loop-stitch is set.

Another way is the seat-stitch. For this a row of rather long stitches are set in the upper, as from A to B (Fig. 6). This can be done with a stout stab awl and a sewing thread (about 9 cord of "Patent, No. 9"), with the stitches quite close to the sole. Then, at A, bore a hole through the sole, as A C (Fig. 5), being careful to make it exactly opposite the centre of the first stitch on the upper, A (Fig. 6) ; then lift up this stitch by putting the point of the sewing awl under. Then put one end through this stitch and the hole you have made in the sole, and halve thread as above. This leaves one end in the sole on the left and one through the

stitch on the right, as at C and D, only there are three stitches set to show how each stitch is caught up and drawn down; the two loops at E are only left loose to illustrate. Of course, each stitch must be pulled in quite tight, as it is that that draws the upper to the sole.

The stitch-draw is a ready means of finding the hole inside a boot, where it cannot be seen. We will take, for instance (Fig. 7), the fore part of a boot, and that you want to get a bristle through at A from the inside; well, B B B must be a spare end; it can be put through the hole A from the outside, and drawn nearly through; then, some little distance away from the bristle, say at C, a hole can be made with a fine awl; then take one end of the thread you are going to sew with and put the bristle D through the hole C, till you get to the junction of the bristle where the thread goes between, as shown at C; then pull the thread, B B B at E, back again until the bristle D F is through to the outside; take it out of B B B, hold it at D with the left hand, while B B B is pulled through with the right from the inside.

This, it will be seen, is blind-stabbing, with less learning. But when blind-stabbing is learnt it will prove, although this is very handy, it is blind-stabbing with less speed.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 53.—Massey's Small Launch Engines.

I TAKE the opportunity afforded me in the present number of WORK to call the attention of my readers to the specialities of Mr. Henry B. Massey, Engineer and Machine Tool Maker, Spalding, Lincolnshire, a manufacturer of amateurs' lathes, planing and milling machines, etc., who is well known in the Eastern Counties. It is not for these only, however, that he is noted, as he is a maker, also, of steam launch engines, one of which, an entirely new design, is illustrated in Fig. 1. These engines are of improved construction, having double steam jacketed cylinders and valve boxes in one casting, supported, as may be seen, on six forged steel pillars, which tend to render the engine as light as possible, and also imparts great strength to it just where it is most needed. The outside of the steam jacket is lugged with mahogany, and fitted with polished brass bands, giving the engine a neat appearance. Each piston is fitted with three steel rings. The crank shaft is of a special combination of cast steel and iron, which renders it very tough and strong. The reversing handle can be either vertical or horizontal as may suit the convenience of customers. The main bearings, eccentric straps, guide plates, glands, etc., are of hard gun metal, and set up with double nuts. The smallest size has a bore of 2½ in. and 3 in. stroke, and is suitable for driving a boat about twenty-five feet long. The price of the engine is £30. The illustration in Fig. 1 is from a drawing of an engine with 5 in. cylinders and 5 in. stroke, the price of which is £55. Intermediate and larger sizes are supplied at proportionate prices.

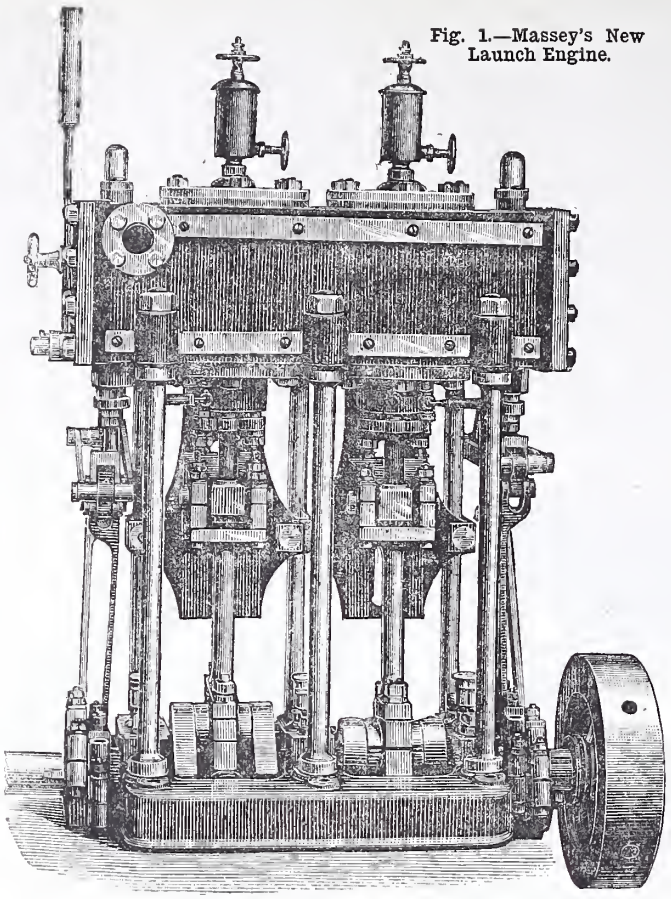


Fig. 1.—Massey's New Launch Engine.

### 54.—Massey's Improved Planing Machines.

These planing machines are manufactured in five sizes, the three smaller sizes being specially suitable for the requirements of amateur engineers and others who require, and are desirous of doing, small but good work. They are of sufficient strength to take good cuts off any sized piece of work that they are capable of taking in, and are provided with a self-acting feed motion in the horizontal cut. The fiddle slide is made specially strong for vertical cutting, and is graduated for angular work. The T-slots in the tables of all the machines are cut from the solid metal, and all heading screws are of steel. The two larger sizes are similar in design to the smaller ones, and suitable for the purposes of mechanics, electricians, and amateurs requiring to do a larger class of work. Nos. 1 and 1A machines are fitted on short standards for bench, and plane in length 14 in. and 18 in. respectively. They are sold—No. 1 at £12, and No. 1A at £15. No. 2 size, which is represented in Fig. 2, planes 24 in. long by 12 in. wide and 10 in. deep. This is a hand-power machine, and is sold at £20. Nos. 3 and 4 machines plane, the one 3 feet, and the other 4 feet in length, and are made to drive either by hand-power or by steam-power, or by both. The prices of these machines are £30 and £36 respectively. Various forms of vices and special chuckings for angle work are made to suit all sizes of machines. The construction of these machines are sufficiently apparent from the illustration that has been given of No. 2 size, and there will, in consequence, be no necessity for saying anything further with reference to its parts and action.

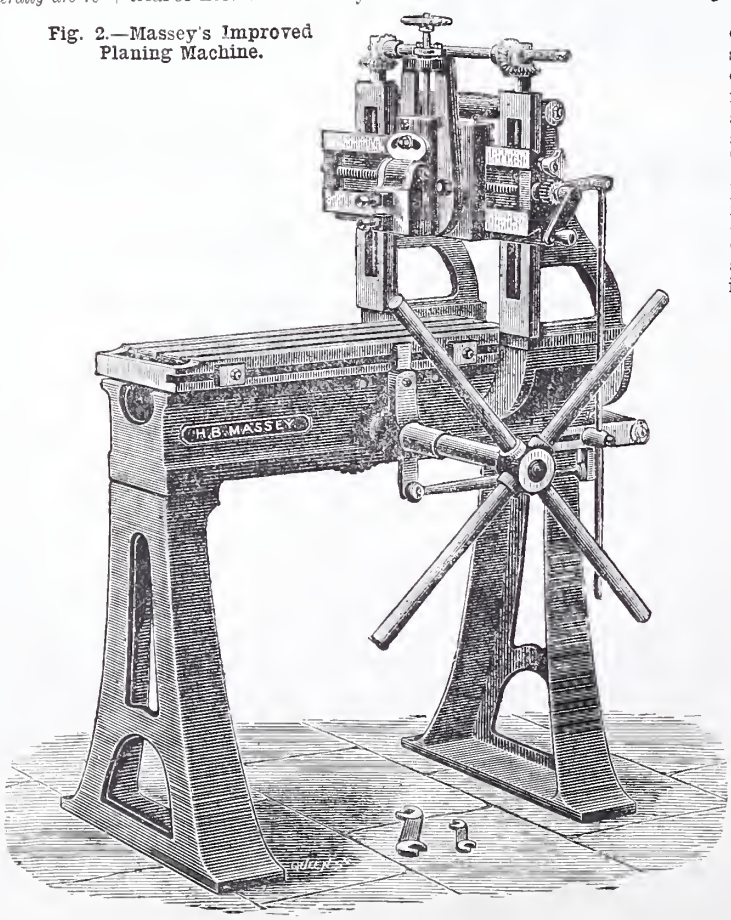



Fig. 2.—Massey's Improved Planing Machine.

### 55.—Watch and Clock Making.

Readers of WORK should not lose sight of the excellent series of scientific handbooks, entitled "Manuals of Technology," published by Messrs. Cassell & Company, Limited, and edited by Professor Ayrton, F.R.S., and R. Wormell, D.Sc., M.A. Neither professional clock and watch makers nor amateurs who like to try their hand at cleaning their own clocks should be without the manual. "Watch and Clock Making," written by Mr. David Glasgow, Vice-President of the British Horological Institute. It affords, first of all, a clear and succinct account of the progress of the watch and clock trade from the earliest time to the present day, and then proceeds to deal with the theory and practice of every branch of the art in an intelligible and exhaustive manner. For practical workmen it forms a most desirable book of reference.

THE EDITOR.

## JGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

A PERPETUAL CLOCK.—Mr. Justice Day has itten a letter praising a new device in clocks, invention, it is said, of a Leeds gentleman. claims that his clocks are driven solely by tural electricity from the earth itself. If this opens up an entirely new field for in-ntion, and, in effect, gives the world a new tor power. We cannot help thinking, how-er, that the vague description given of this w departure in horology scarcely conveys a ry clear description of what is actually accom-shed. An anode and cathode must, at all ents, be used, and one of these must sensibly teriorate within a limited period. But the ea is attractive and those having a taste that ay might profitably experiment. A sufficiently werful current once obtained, the mechanical rangement offers no difficulty whatever.

TYPE WRITERS.—Patent agents are often asked nat particular invention would be most likely prove profitable to the designer, and a ry common answer is a really cheap key-type riter. There are many machines in the market, ch as the "Merritt," "Columbia," &c., which int beautifully, but do not allow the user to tain the speed necessary for such work. The key riters hitherto produced are excellent machines, most every one of them possessing some dis-nctive feature, but the cheapest costs ten guineas. machine that would sell for two or, at most, ree, while retaining a key action, would pro-bly be the most profitable invention of its year.

ELECTRICAL PLANT GROWING.—Although the ggestion that the electric current would mate-ally hasten the growth of plants has been here id there followed up, nothing like concerted tion, under circumstances which would effec-vely preclude even unintentional deception, as yet been attempted. We might suggest to ur readers that they might render good ser-ce, both to science and horticulture, if they ranged to try the experiment in concert at me large market garden establishment, where mparison of the electric and non-electric ethods of cultivation could be publicly and curately tested. If the assertions occasionally ade are true, the former will, ere long, come to fashion, and will conduce to the material nefit of its users. An American journal gives the result of recent experiments by a cor-spondent a saving of one week out of five in using lettuce and similar plants. This would worth securing if the expense were not too reat, but upon this point no specific informa-on is to hand. Meanwhile, experiments nearer ome would be of interest.

AN EASILY MADE ÆOLIAN HARP.—One of the mplest and easiest ways of making an Æolian arp is to take a plain piece of common deal, bout an inch shorter than the window in which ie harp is to be fixed, and as wide as it may be esired to make it, dovetailing or mortising the ids into two channelled, round pieces of wood f the same width, so that the whole will loosely t the window frame. Elastic bands, or pieces f india-rubber cord, of varying thicknesses should ien be passed into the channels at the two ends, hich will thus keep three, five, or as many lastic cords as may be desired, stretched close to, ut not touching, the deal centre-board. This placed in the window frame, and the window rawn down when the arrangement is complete.

The channels in the cords may be of any de-ired depth, provided they keep the strings clear f the centre-board and of the bottom of the ish. Square or half-round pieces may be used or the ends, but to those possessing a lathe it ill be easier to make them circular, cutting the hannels at the same time; or a piece so turned ay be cut in half longitudinally and nailed or crewed to the centre-board ends. No very neat tting is required, and the harp when completed urnishes much amusement to children. Of ourse, the sound is somewhat different to that iven by a harp with metal strings, but it is not musical, and the elastic bands or cords are very ensitive to a current of air.

## SHOP:

### A CORNER FOR THOSE WHO WANT TO TALK IT.

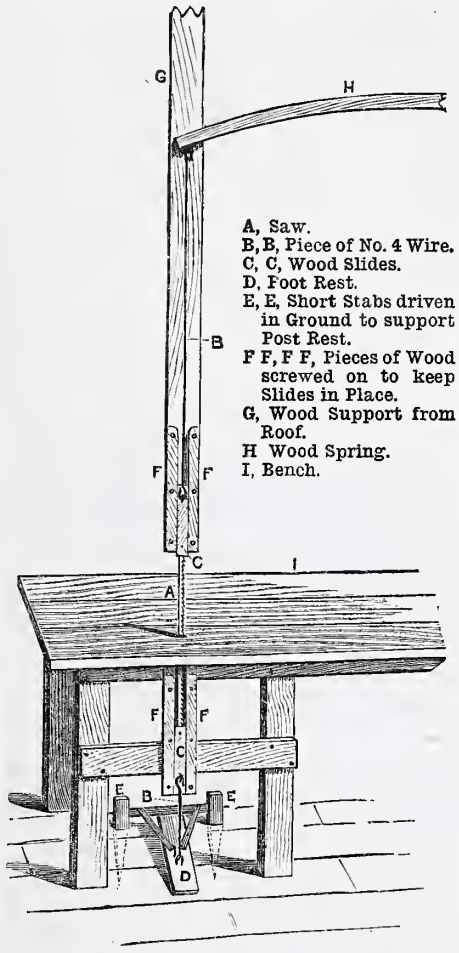
*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTERS FROM CORRESPONDENTS.

**Cotton Belting. — Erratum.** — J. N. (*York*) writes:—"In the answer to S. A. & Co. (*Stockport*), page 254, Vol. III., '56 feet' should read 5,656 feet per minute as the running rate of the cotton rope referred to."

**Saw.**—W. W. (*Caverton*) writes:—"I send herewith a sketch of a saw I have just put up, which I find works delightfully. It cuts 1½ in. stuff just like




Saw.

cheese, and I think it is the simplest saw that could be made. If there is anything that is not quite clear, I shall be glad to answer any questions about it in 'Shop.' C, C are slides kept in their places as a dovetail, and there is a weight of about two stones on the foot-board."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Gas Engine Slide Valves.** — JACK. — I don't think you can re-face the valve of your gas-engine unless you are an engine-fitter, and accustomed to the use of file and scraper. There must be four surfaces to get up, also the valve must be perfectly parallel. You would require a couple of files and a scraper, and a good surface-plate. It is not likely the valve would be cut deeply enough to require planing.—F. A. M.

**Developer.** — PHOTOGRAPHER. — The developer you refer to is Secretan's New White Developer for dry plates, lantern plates, Argentic bromide paper and opals, which can be used for either plates or paper without fear of fog or stain. For short exposures it is invaluable, and if diluted with an equal quantity of water, and more time given, will develop every detail without any tendency to hardness. For paper pictures the ordinary developer diluted with twice its bulk of water is most valuable. There is no fear of any stain, in fact, prints can be taken out of the developer and placed in hypo without washing, and no stain will occur; it is, however, advisable to wash in water before fixing. No acid water is needed. The ordinary developer gives great sparkle and delicacy in lantern slides and clear glass in shadows. In any case the developer can be used continuously for a number of exposures, thus avoiding the necessity of mixing fresh solution for each development.—D.

**Writing on Glass.**—J. S. (*Cardiff*).—For handbooks on this subject write for particulars and prices to The Decorative Art Journals Co., 15, St. Ann Street, Manchester, and to Messrs. Brodie and Middleton, Long Acre, London, W.C.—H. L. B.

**Price for Lettering Signs.** — SKIBO. — Find out what are the approximate charges that are ruling in your neighbourhood. Prices also depend upon the class of work required and the skill of the workman.—H. L. B.

**WORK Numbers, etc.**—E. G. (*Nottingham*).—There are fifty-two numbers in each yearly volume of WORK. Volume II. began with No. 53, and ended with No. 104. The price of back numbers is one penny. All the back numbers can be had of the publishers, Cassell & Co., Limited, Ludgate Hill, London, E.C.

**WORK Volumes and Contents.** — W. C. (*London, E.*).—The price of the volume of WORK is 7s. 6d. through any bookseller. The Indexes to Volumes I. and I. and II. are published at one penny each.

**Chamfer Plane.**—Y. R. (*Middlesboro'*).—I have not seen a plane like yours, and think it would not work well. The cutter, fixed as you show, would penetrate too deeply at first, and its fixing would give way. Better get a plane maker to get out a plane suitable for the purpose. The fault in yours is that there is no wood or other material fitting the curved surface, and limiting the penetration of the cutting edge.—B. A. B.

**To Strop a Razor.**—RAZOR.—The two articles mentioned by you were written by different people, so that the terms used by one would not necessarily be employed by the other. In the article "How to Strop a Razor," I make no mention of the term "lines of friction," but you are wrong when you say these cross one another in that article. Note the lines on razor in Fig. 5 in article "Setting a Razor":—"They are slightly inclined from the handle and back towards the point and cutting edge." These lines should have been rather more inclined to agree with the position of razor on the stone (Figs. 1 and 2); but as they are only to illustrate what the meaning of open and crossed lines are, they answer the purpose very well. If you will now turn to the article "How to Strop a Razor" (see No. 105, page 7), and note the position of razor, A, Fig. 1, and imagine the path it takes while descending to D, Fig. 2, the lines of friction *on the razor* will take the same direction as those recommended in article "Setting a Razor" (see No. 100, page 782): that is, inclined from the handle and back towards the point and cutting edge. On reversal, B, Fig. 1, is drawn upwards till it assumes position C, Fig. 2; again, the lines of friction are from the handle and back towards the point and cutting edge. The only crossings of the line of friction I can see is that, on the upward stroke of the razor, it crosses at an angle on the strop the path which the razor formed on the downward stroke. This is the only case in which the lines do cross. If in "Setting a Razor" (Figs. 1 and 2) the tool were held at right angles to the stone and pushed forward, and at the same at an angle across it, and always worked in the same angle, the same effect would be obtained as by holding it at an angle and pushing it straight forward, as advised. I, in stropping a razor, proceed by the former of these methods: that is, hold the razor almost square across the strop while drawing it upwards and sideways, or reversed. I hope you will be able to follow these few notes.—P. B. H.

**Improved Bottle.**—LONG VALLEY.—So far as we can gather from the particulars sent us, we fail to see any novelty in the plan proposed, inasmuch as we used just such an arrangement over thirty-five years ago, and found it very convenient, as it possessed all the benefits and advantages proposed in the description. The words suggested as a title for a trade mark would not be registered, as they would be held to be "descriptive" not "distinctive," which the law and ruling of the courts hold no valid trade mark may be. If a trade mark is obtained as a separate property from the patent, the right conferred thereby becomes the property of the public directly the patent right expires. An inventor may, of course, prepare his own title, specification and claims, and put them in himself, and in many cases will do better by this than in seeking the aid of an "agent," who, in too many cases, is incapable of affording an inventor any useful aid in obtaining a sound and valid patent, as far too many are merely copying clerks, law writers, amateur dabblers, and otherwise unqualified and unable to afford what is essential for obtaining of a sound patent, or, otherwise, a legal property; in either case he would not secure what he seeks, and is supposed to desire, when he decides on applying for the grant of a patent. An inventor under such circumstances is in the position of the captain of a

ship, with no chart on board, seeking to enter a strange port on a dark night without the aid of a properly skilled pilot to take him in, and about as likely to sueceed. There is no difficulty in any one getting a patent granted in response to his application, but then, if it is not a valid one, capable of securing the support of the law to sustain it, what good is it? There is not a day that passes that at least half a dozen useless, imperfeet, and invalid patents are not applied for, and if put in, in accordance with the rules as to the size of the paper, etc., are granted to the applicants, but until they have passed the ordeal of the law courts are not a decided property.—C.E.

**Water-proof Cloth.**—A.M.—(*Conndon*).—We have never heard of the material named being applied to the purpose mentioned. What we have always seen used in the interior has been pitch, which, so far as we know, fully answers the purpose required. We have inquired of various persons who are engaged in the business here in London, but they, none of them, ever heard of it being so used. There is a eheap material employed for covering the exterior which may be had of Messrs. Dottridge Brothers, Dorset Works, East Road, London, N., who supply all that is necessary and required in the business, and if A. M. will send his trade card and inquiries, we have no doubt they will furnish him with all particulars, prices. etc.—C. E.

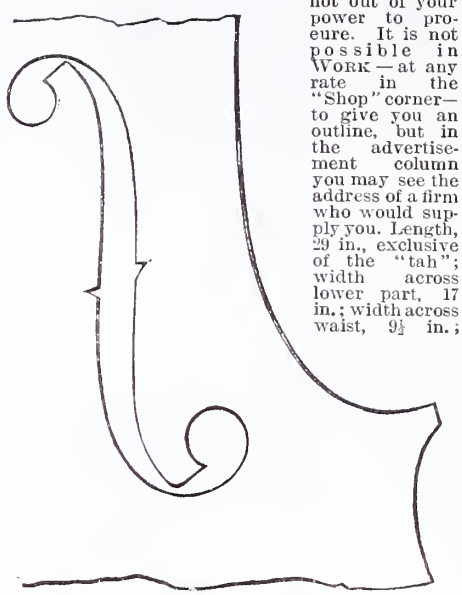
**Trade Marks.**—LONG VALLEY will, doubtless, have seen that his former letter has been answered in due course, hefore this can appear.—C. C. C.

**Engine Cover.**—W. (*Hough, near Grantham*).—Sailcloth makers produce a special matcrial for this purpose called "tarpaulin canvas," which is well suited for the object in view, and moderate in priee, being very strong. To make it, measure the length of the engine with the funnel lowered, over all down to the lowest point it is desired to cover, and do the same over the breadth of the engine. This will give the area of the cover, *i.e.*, length by breadth. This canvas is, we believe, woven in breadths of twenty inches wide; therefore, to ascertain how much will be required, turn the number of feet into inches and divide them by twenty, the resnlt will be the numher of hreadths needed to give the width, and the length in feet multiplied by the number of breadths, and, divided by three, will give the number of yards required. The canvas must then be sewed together with a "sailmaker's seam," using untarred sail twine, and the edges may he doubled in and stitched so as to form a broadish hem, or be roped round after scwing on a rope or line of the size selected. Now spread the cover out on a boarded floor, and taek it down at the four corners to keep it steady and even. If it be desired to make it a "tarpaulin" cover, get some Stockholm or vegetable tar—taking care *not* to use coal or gas tar—make it boiling hot, taking great care that it *does not boil over*, or there may be a job for the nearest fire brigade, and when it has got thoroughly heated it is then fit for use. Whilst this is being done, under the charge of someone to keep it stirred and lift it off when it seems likely to boil over, you should, with a whitewash hrush and a bucket of water, brush the canvas all over—taking care to do it evenly—letting it absorb a good dose of water, and then with a long-handled tar brush apply the hot tar evenly and liberally all over it, and it will be found that as the water evaporates, the tar will dry into the canvas and be absorbed into its very substanee. In a couple of days' time, if the weather is dry and hot, you may give it a second dressing of hot tar—this time omitting the water—and, when dry, it is fit for use, unless it be preferred to give it a third coat hefore using, which will be beneficial. In case the tar may be objected to the cover may be waterproofed in the following manner. Take 1lh. soft soap, 1 gallon hoiling water, 3lbs. mixed paint of any desired colour, mix them well together and coat the canvas evenly all over with it. When dry it may be finished off with one or two coats of oil paint of the colour it is desired to remain. We have used both these plans and found them satisfactory. Of course, a greater quantity of this waterproofing may be made at a time by increasing the quantity of the materials named, hut keeping to the proportions specified.—C. E.

**Photography.**—A. W. (*Paisley*).—You slightly misconceive the purpose and intention of these columns, which are for the express purpose of giving short and concise replies to correspondents. A. W.'s case is not at all uncommon. We should advise that *working* models be made of each instrument, and then, *if* they bear out the expectations of the maker, he should then obtain the provisional protection of the Patent Office, and afterwards submit them for approval to any good manufacturing firm and make his own terms with them. We may remark that rough sketches, such as those sent, give very little idea of the *real working* capabilities of the completed instrument, and we must decline to offer an opinion as to the practical value of the inventions. Plans and diagrams are all very well as suggestions in working out a design, but utterly differ from those carefully made from the completed work. Very few will be found not to require considerable modification hefore they realise the intentions of the designer.—D.

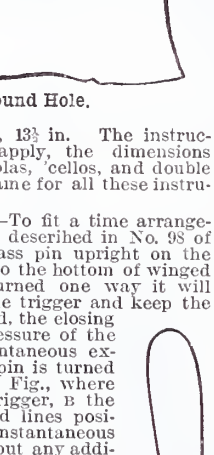
**Effective Pressure Rivet.**—BILSTON.—The mean effective pressure of the steam is hest obtained by taking indicator cards from both ends of the engine cylinder, drawing a series of equidistant *breadths* of the diagram perpendicular to the atmospheric or line of pressure, adding them together, and dividing the total by the number of the divisions. This will give the effective mean pressure per square inch through the stroke, or rather, one revolution. The effeetive energy exerted by the steam on the piston during each double stroke or revolution, is the product of the mean effective pressure, the area of the piston, and the length of the stroke, or (p.m-p.m.) A.S., and if N be the number of double strokes in a minute, the I.H.P. in foot pounds per minute is (p.m.-p. m.) A.N.S., from which the indieated horse power is found by dividing hy 33,000. The net or effective horse power is ohtained by the use of the formula :—$\left\{\frac{P}{r}\left(1+\log\frac{r}{2}\right)\text{-p b}\right\}=\text{A.L.N.}\frac{}{33,000}$.—C.E.

**Violoncello.**—J. D. (*Glasgow*).—Herewith you have a good pattern for sound-hole. I have previously replied to your query (*re* Bass Bar). The following dimensions may perhaps assist you, hut you ought to have a good outline. This is surely not out of your power to proeure. It is not possible in WORK—at any rate in the "Shop" corner—to give you an outline, but in the advertisement column you may see the address of a firm who would supply you. Length, 29 in., exclusive of the "tah"; width across lower part, 17 in.; width across waist, 9½ in.; width across upper part, 13⅜ in. The instructions in violin making apply, the dimensions of course excepted, to violas, 'cellos, and double basses: the rules are the same for all these instruments.—B.



Violoncello Sound Hole.

**Blind Shutter.**—NERO.—To fit a time arrangement to the blind shutter deserihed in No. 98 of WORK, solder a small brass pin upright on the trigger; rivet another pin to the hottom of winged nut, so that when it is turned one way it will engage with the pin on the trigger and keep the lens open as long as wished, the closing being done by a second pressure of the trigger. When only instantaneous exposures are required the pin is turned out of the way. Sce the Fig., where A represents the pin on trigger, B the pin on nut, and the dotted lines position when turned for instantaneous work. Another plan, without any additions to the shutter, would be to carefully wind the shutter until the lens is fully open, then close in the usual way. Hope I have made it plain; hut if any further difficulty, write again.—W. E. D., JR.




Shutter Time Arrangement.

**Brooms.**—BRUSHER.—Numerous plans have been brought forward for the purpose named, and some have been patented, but whether they have been adopted or turned out useful we do not know. We should not advise any attempt at patenting before the novelty of the invention has been ascertained, as it would most probably turn out that the idea had been puhlished or used before. If there is a free public library in the town, most probably eopies of the specifications will be found there. If not, the Patent Office will present a set if application is made for the same in a proper manner. Failing this the hest thing would be to spend a few hours in the Patent Office Library, Southampton Buildings, Chancery Lane, London, and consult the specifications bearing on the matter, when BRUSHER may quickly ascertain if there is any novelty in his plan.—C. E.

**Xylonite.**—G. A. B. (*Normanton*).—The address is:—The British Xylonite Company, Limited, 124, High Street, Homerton, E.

**Spots on Sword-Scabbard, etc.**—TROOPER.—The sword scabhard being of iron or soft steel tarnishes more readily than the sword blade, and requires protecting from rust. To remove rust stain and preserve from reeurrence of such to any of the iron or steel appointments, adopt the following plans. Sword scabhards are apt to get rusty inside as well as out, and communieate stains to a sword blade. Unscrew the small nut-screw that holds the lip edge in the top of the scabbard, take it out, also the thin pieces of wood or leather which line the scabbard; elean out any rust with long thin blades of iron on which is tied emery eloth; then rub paraffin oil, replace the wood or leather casings the same way they were drawn out, and screw the lip in its place again. For outside spots or stains, rub them with fine emery powder and lard, using the end of a cork or soft pieee of willow. When all the stain is got out, apply rotten-stone or tripoli and sweet oil on these parts—this is to smooth the dulness caused by the emery powder—then go over the seabbard with this rotten-stone with a soft woollen rag; this will equalise the lustre all over. Finish off with a soft wash leather or a soft piece of old silk rag with whiting, or charcoal powder, free from oil; the blade to he brightened in the same way. If much rusted all over, adopt the following plan. First cleanse from grease—should any be there—with a hot solution of soda, and wipe dry. Then make up with 1 pint of hydrochlorie (muriatic) acid to 1 quart of water. Let the articles to be cleaned soak twenty-four hours, scrub the rusty metal well with a hrush till the parts are bright, or nearly so, eomplete the brightening of the patchy places with fine emery and lard—after you have thoroughly washed off all the acid, which must not be allowed to remain on. The scahhard, sword or stirrups will have a dull, lustreless surface through the action of the acid, or "pickle," as it is termed by workmen. Now use emery and lard. After the emery brightening use the rotten-stone and oil, finishing as before deseribed. Many things are used for surface protection, and are sold by cycle dealers. To make your own, any of the following serve. Have a box of dry slaek lime, and keep bits, spurs, stirrups and chains in it; they will not rust there. A sword best kept in a green baize bag, and ruhbed up now and then. If kept in an armoury or hung up hand for use or display, cover with mercurial ointment or equal parts of carholic acid and sweet oil rubbed on with a rag, or one part of paraffin and two parts of mutton suet smeared over. Plumbago and lard are a good cover; a better is dry white lead and lard—this must be warmed to be removed. As a rule, troopers after their drill see to their appointments, and do not let water stains remain on the but clean off at the first chance. Five minutes then save an hour's work or more that neglect will cause. The hurnisher and burnishing chalk are essential to get up lustre to steel or iron. If want of a hurnisher, use a large new bradawl or any round hright steel tool. If mustered in the rain, a light rub of sweet oil hardly dims the lustre of steel, and preserves from rust.—J. C. K.

**Bicycle "Hub Dish."**—SELF-HELPER.—The "hub dish" your correspondent means the steel cup in the hub end where the balls run. A new cup would have to be sweated in by using a medium sized blowpipe, which would not injure the plating. The new cup must be heated up sufficiently to temper hard by sudden cooling in water. Small quantities of steel castings can be had of George's Cycle Company, Upper Street, Islington, or Brown Bros., 7, Great Eastern Street, London. They will give castings for their own patterns or machines, or make castings from patterns sent.—A. S. P.

**Conservatory.**—BOTANY.—The construction of a small conservatory of the dimensions you give, viz., 17 ft. by 5 ft. wide—is a very simple matter, and the work may he readily undertaken by an amateur of ordinary ability. You would do well to set out the dimensions on paper to a scale, say half an inch to the foot; then with a pair of compasses and a rule you can ensure the centreing of every pieee of timber the required size before putting together. Having regard to the possibility of the glass-house being required to he removed, it would be hetter to leave out the hrick-work, and construct the house of wood and glass only. It should make a ground frame of wood, 5 in. wide by 1½ in. deep, the ends of which may he plain overlapping joints; to the corners of this frame should he neatly fitted the four uprights, of 4 in. square each, which should be kept in a vertieal position by means of struts, eight in number; then four lengths of the 4 in. square stuff should he fitted crosswise to the uprights to form the top frame. Prepare a ridge-board, 1 in. thick hy 6 in. wide, to which the rafters must be fitted and connected to the top frame. These rafters, or sash-hars, may be purchased ready-cut to the required shape in every town almost. Of course, some of the same matcrial must be used for the side lights, and the spaee helow must be conveniently covered inside and out with matched boarding; the space being filled up with sawdust, which is a bad conductor of heat. The most suitable kind of wood for the framework is dry spruce deal, as free from knots as possible; and, unless you are a good amateur wood-worker, it will be best to buy the door or doors ready-made; certainly it will be cheaper. For artificial heat hot water is the best, and the system most reliable in a small way is to have jacket-boiler and stove combined, costing from about £2 10s. upwards. This will hold a good supply of coke, and will require very little attention. If further details are required write again.—C. M. W.

[M]**agnetic or Galvanic Belts.** — J. McA. ([Gl]*asgow*).—The belts and appliances for the cure [of r]heumatism and paralysis, made and sold by Mr. [Col]e, 248, Caledonian Road, London, N., are made [o]f permanent magnets. Similar appliances may [be m]ade of 3 in. lengths of hard crinoline steel per[ma]nently magnetised, coated with silk, and sewn between two pieces of fine flannel. If made up [in t]he form of a belt, quilt the pieces of magnetised [stee]l at distances of two inches apart, vertically, in [two] rows throughout the length of the belt. The [tw]o ends of the belt may be fastened with leather [stra]ps and buckles, or with straps made of webbing. [The]re need be no difficulty about making the belts. [Mr]. Cole's success is due to his knowledge of how [to a]pply the magnets, for, if wrongly applied, they [wil]l, he claims, do more harm than good. Lumbago [is a] rheumatic affection of the lumbar muscles. A [ma]gnetic belt worn around the loins should give [rel]ief, and aid other measures (hygienic and [die]tetic) in effecting a cure.—G. E. B.

[M]**anganese.**—Oblong.—Manganese is a metal of [a r]eddish-white colour, obtained from ores found [in] Cornwall, Devonshire, North Wales, Somerset, [Wa]rwickshire, Aberdeenshire, Wicklow, Germany, [Spa]in, Austria, Italy, France, Sweden, Canada, and [th]e United States of America. The ores vary in [com]position, but that found in most abundance is a [per]oxide of manganese, composed of one part [ma]nganese and two parts oxygen, represented by [th]e chemical formula $MnO_2$. This is the ore em[plo]yed, when broken to the size of peas, to charge [th]e porous cells of a Leclanché battery. When [us]ed in this way it will last just as long as it has [an]y free oxygen to part with, the time being [go]verned by the quantity of the ore placed in the [cel]l and the quantity of electricity drawn from it in [tha]t time. If a Leclanché battery is frequently [us]ed for long runs of more than ten minutes at a [ti]me, or if the battery is connected to work having [a] low resistance, or short-circuited by connecting [th]e two terminals with a short thick wire, all the [ox]ygen available from the manganese will soon be [us]ed, and the cell will be soon exhausted.—G. E. B.

[E]**lectric Light for Necktie.**—Long Reader. [U]nless you are a working jeweller, knowing [so]mething about electric appliances, I should not [ad]vise you to attempt making an electric light [sc]arf-pin for the necktie. The tiny pea-lamp used [in] making these pins cannot be made outside a [su]itable workshop, fitted with costly machinery. [Th]is class of jewellery can be obtained from [M]essrs. J. E. Hartley & Co., 13, St. Paul's Square, [Bi]rmingham, or from Messrs. Cathcart & Peto, [5]8, Hatton Garden, London, W.C., who also supply [th]e small ebonite batteries for furnishing current [to] the lamps. One of these batteries, containing [tw]o cells, will go easily into the inside breast pocket [of] a coat and light up a 4-volt lamp.—G. E. B.

[S]**hip Stoker Engineer.** — Sahab. — If your [co]rrespondent will refer to the Merchant Shipping [A]ct Amendment Act, 1862, he will find it is [sp]*ecially* provided that "service in the capacity of [s]eaman, stoker, donkeyman, greaser, winchman, [la]bourer, engineer's steward, or any other capacity [th]an that of engineer taking watch on engines and [bo]ilers for propelling, will not be accepted." The [ob]ject of this Act is to provide that only properly [qu]alified men should have charge of the machinery [on] board ship, which is now of such a powerful and [co]mplicated character, and requires men of com[pe]tence and ability to have charge of it. The ser[vi]ces of mere "drivers" and "cock turners" are of [no] utility in the present day, as the circumstances [an]d conditions of steam-ship machinery have so [en]tirely changed. It is a most wholesome and ne[ce]ssary provision, in the interests of the public who [ha]ve to travel in them, that the machinery of such [sh]ips should be in charge of only properly qualified [an]d competent men, as life and property are so [em]inently dependent on their skill, ability, and [at]tention. Unless our correspondent has served [hi]s time at making and repairing engines, "he [m]ust prove that for not less than three years he [ha]s been employed as a journeyman mechanic in [an] engine factory or workshop on the making or repair[in]g of engines. In either case he must also have [se]rved one year at sea in the engine-room as an [en]gineer on regular watch in the foreign, home, or [co]asting trade, or he must have served at least four [ye]ars at sea in the engine-room as an engineer on [re]gular watch in the foreign, home, or coasting [tr]ade." Having done all this, he may offer himself [fo]r examination, and on the results of this examina[ti]on will depend whether he can obtain a certificate [en]titling him to be employed as a capable man in [th]e engine-room of a steam-ship. For each grade [of] engineer, the candidate must prove by examina[ti]on that he is a fit and proper person to be en[tr]usted with the care of engines and boilers on [re]gular watch at sea; and if he cannot do this, he [w]ill not be certified as fit and proper to fulfil the [d]uties required, and, consequently, must be content [w]ith what he can obtain as fireman, donkeyman, [g]reaser, etc., as provided by the Act.—C. E.

**Bicycle Papers.** — One Anxious. — The ap[p]earance of my article rests entirely with the [E]ditor of Work, who has the full series of papers [o]n Safety Bicycle Construction in his hands.—[A]. S. P.

**Cleaning Oil Paintings.** — No better man can [b]e recommended than Edwin W. Izod, 220, Great [P]ortland Street, W.—F. B.

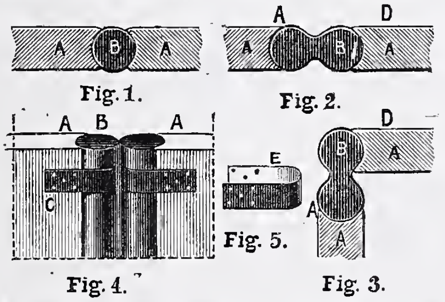
**Framing Oil Paintings, etc.** — A very good [a]nd reasonable man is Wm. Hayward, 18, Giltspur [S]treet, E.C.—F. B.

**Scroll for Iron Kitchen Stand.**—T. H. (*Newcastle, Staffs.*).—Had you sent a sketch, however rough, of your stand, it would have given me a better idea of its style; as it is, I have done my best, bearing in mind the materials to be used, and trust it may suit you. I have added the "T. H." to fill up the centre space. You will remove all the

Scroll for Kitchen Fender.

white shown in the design, and if you prefer plain Roman letters, you may substitute them for those given. One word of caution: the centres of the two O's will require small stays being left, or they will drop out.—Worker Bee.

**Screen to Fold without Exhibiting Crevice.** — H. C. (*Lee, S.E.*). — The method you illustrate (which you observed in a farm-house) of constructing a screen in such a manner that it shall show no crevice between the frames is a very good one; but it was some time before I clearly understood all your sketches, and was in doubt as to what use the clamps were. However, it is overcome, and I reproduce your drawings, shaded, and with necessary additions. First, however, I must tell readers that, constructed as in Fig. 1, it will not fold flat, which you explain; but that, as in Fig. 2, all will be well as regards the folding. I cannot really see the advantages gained, as the amount of extra labour necessary, besides the appearance of the clamps, will hardly be compensated for. An ordinary screen, with towel-horse joint, and covered completely with fabric, pleated where it contacts with the union of the frames, should not be objectionable. If a screen of the sort with joints (Fig. 2) were covered completely with fabric, the latter would, as in ordinary cases, have to be pleated, for the distance from A to D (when partly




**Screen to fold without exhibiting Crevices. Fig. 1.—Plan of Screen (which will not fold flat). Fig. 2.—Plan of Screen to fold quite flat. Fig. 3.— Ditto with Frames at Right Angles to each other. Fig. 4. Perspective View of Fig. 3. Fig. 5.—Clamps to retain Frames to Rod.**

folded) would be in excess of that from A to D (open). At any rate, I will explain your letter. B (Fig. 1) is a rod extending the whole height of the screen, to which fits the grooved edges of the frames, A, A. Two or more clamps (C) are screwed to each frame in such a way that they show on both sides of the screen, while the bend (E) passes around the rod B, which should be slightly shallowed to receive them at those parts, thus retaining the frames. With screen, Fig. 1, they must be fixed one above the other, while with Fig. 2 both on a level; in the latter case the bends passing through slots. The upright rod of Fig. 2 must consist of a shaped solid piece, or of two rods screwed together. Had you shown a *perspective* sketch, however roughly, of clamps, I should be more readily have understood.—J. S.

**Wood Sample.**—T. A. (*St. Helens*).—The sample of wood sent is American white wood, and can be purchased at any yard in Liverpool. The price would be about 3d. per foot super.—A. J. H.

**Drill Chuck Slipping.**—Bertie.—I think it will comfort you to know that the slipping of your drill chuck has probably saved the life of some of your drills, which would otherwise have been broken off; so it is not an entirely bad feature. You don't say what sort of chuck you have, so I will suppose it is one of those you clasp on the drill by turning it with the hand. I have an old one of this sort which takes drills up to ½ in., and have frequently found it slip when holding the larger sizes, and have had to stop and close it harder, when it would generally hold unless the drill caught, as it does sometimes when just getting through a hole; that is, when drills are most often broken, unless the chuck slips. But suppose the chuck slips when you are simply boring, then you should consider how you can reduce the strain on it. Does the drill want sharpening? of course it will take double the power to drive if it is blunt. Are you, perhaps, trying to bore too large a hole out of the solid? Say you want to bore a ½ in. hole, you should use about three drills in succession, say $\frac{3}{16}$ in., ⅜ in., ½ in., if you are boring in iron. If it is brass you are boring, another difficulty arises from the twist drill being too greedy for that metal, so that if the centre of the hole is cleared out it is apt to dig in. I should use a ¼ in. drill first, and then, in following with the ½ in. one, be very careful to hold the work *back* against the back centre, so that it cannot feed in too fast, as it is apt to do. The straight-flute drills are better for brass than twist drills.—F. A. M.

**Stain for Red Ivory Balls.**—W. C. R. (*Glasgow*).—Make your red dye as follows:—½ lb. of new scarlet cloth cuttings; rub in well ½ lb. of soft soap. Put in an earthen vessel, pour in two quarts of water. Boil for a considerable time, stirring occasionally, till the colour is extracted from the cloth. Take out the cloth, wringing it to get the whole of the dye out. Now dip your ivory balls into aquafortis, and then into cold water. Have the dye liquor just at the boil, then put in your balls without keeping up the boiling. The stain will strike in in a short time. Avoid any metal, as iron or copper, touching the balls, or it may make a dark stain on them. When taken out of the liquor, cover with a cloth so as not to dry too quickly. Another plan for red stain is to make up nitrate of tin thus:—Dissolve in rather strong nitric acid thin strips of metallic tin. Great care is necessary to add only very small portions of the tin to the acid gradually. This must be done in an earthenware bowl. Boil the balls in this liquor for a brief time, and then in cochineal dye, into which put some of the nitrate of tin. Let the balls boil till they assume the proper colour. You may buy the nitrate "bowl liquor," as it is termed, of a dyer who makes it. It may be as well to try the operation first on any old bit of ivory before trying on your balls. Let the balls be covered up with a cloth in drying, or they may crack on the surface.—J. C. K.

**Greenhouse.**—A New Reader.—You will find a thorough description of what you want in Nos. 12, 14 and 15, Vol. I., under the heading of "The Tenant's Greenhouse," where the subject is gone into far more fully than would be possible in the already over-crowded columns of "Shop."—E.D.

**Address Wanted.**—J. M. K. (*Glasgow*).—You have omitted to send your full name and address for A. S. P.

**Die Sinking.**—I. W. A. W. (*Wroxesbury*).—I may say that I am unacquainted with the process of Die Sinking and using, except that I know that making stampings for cycles is done with ponderous machinery, the steam hammer holding a prominent place. The dies are costly things to make, and, when made, unless many thousands of the parts are stamped from the dies, they will not pay the original cost. If I. W. A. W. wishes to become acquainted with this kind of work, he should get into a factory where such work is done, for there only can any useful experience be obtained.—A. S. P.

**Bicycle Castings.**—J. B. (*Glasgow*).—This correspondent can have my address of our Editor. I have the wood patterns of the parts referred to by him, which I can either lend or sell him; or I could get castings from them, but not in less time than one month. I get my malleable castings from Forsyth & Millar, Broad Street, Bridgeton, Glasgow.—A. S. P.

**Bicycle Tyres.**—Artist Novice.—Make a clean cut slanting, say, two inches long on both ends of the tyre with a sharp knife dipped in water; smear the cuts with Snell and Brown's "Tyre Splicing Solution"—of any cycle depot, 1s. bottles; let stand before joining an hour or so; then join the ends evenly and press together, the tyre may then be put on the wheel at once.—A. S. P.

**Cyclometer.** — Oblong. — Unless your correspondent is an optician, or perhaps a practical clock or watch maker, he could not construct a reliable cyclometer. Even then he would have to get a good one and dissect it, in order to see the construction; then he might make a copy. For any one unacquainted with that kind of work to attempt one would be simply out of the question. They can be bought very cheap, from 15s. to 30s.—A. S. P.

**Magic Lantern.**—H. E. (*West Bromwich*).—Before much assistance can be rendered to you, you must quote the article, number and page of Work to which your letter refers, and state specifically what you wish to know about.

**Cast Steel Wheels.**—Vulcan.—Do you mean the common wheels for pitch chains? If so, I should say the teeth should not be less than ⅜ in. broad by $\frac{3}{16}$ in. thick.—I.

**Sand Blast Machines.**—Toxtethian.—Except that the sand is driven against the files by a steam pressure of from sixty to a hundred pounds per square inch, I know nothing of the process. Still, if you hunt up the number of the patent specification, which you can do in the Liverpool Library; you can get a copy of it for a few pence of H. Reader Lack, Patent Office, Southampton Buildings, London, W.C.—I.

**Protractor.**—W. E. H.—I presume you allude to the instrument called the "protractor," which you can get of any mathematical instrument maker. What kind of "metal goods" do you want? Unless you say what class of goods you want, of course I cannot tell you where to go.—I.

**Model Engine.**—LEMUR.—Without seeing your model I cannot tell you what is at fault, but should think, from your description, that some portions of the mechanism are not sufficiently sensitive. Try the effect of easing some of the joints of the fittings.—I.

**White Enamel.**—F. L. (*West Cowes*).—The best job for a counter top would he to give it a solid coating of hest white lead paint, say four coats. Use the colour finely strained, avoid streakiness of brushwork, and use fine glass paper hetween each coat. Finish with two or three coats of white hard hath varnish, or one coat of any good maker's enamel. There are many other methods, but the above is usually the most practicahle. Don't attempt to make either varnish or enamel.—F. P.

**Repainting Wooden Boxes.**—J. T. B. (*Warrington*).—First get a little weak soda water, and cleanse and ruh down the surfaces with pumice stone, well rinsing with water at the finish. The inside and outside can now have a coat of thin cream paint, made with more turps than oil. Then stop all holes, etc., with putty. Now paint insides only a good oily coat of light huff, and then, next day, a coat of flatting paint a few tints lighter than hefore. Next, "ground" the outsides with huff paint, then comh them with graining colour, and varnish with "church oak." For graining, see No. 58, page 86; and No. 62, page 152, or the whole "Art of Graining," contained in Vol. II.—F. P.

**Damp-proof Paper.**—C. G. M. SOUTHARD.—I know of no arbitrary reason why either tar-paper —or the more modern and superior waterproof paper, made hy Stather & Sons, of Hull—should he fixed to the wall by either the coated or clean side. I see many pieces fixed in a twelvemonth, and the hulk of it has the coated side outwards. So far as experience and practice go, either side will affix itself hy stout paste to a wall in fair condition. In numherless cases I have had ocular demonstration of this fact, and, furthermore, I know of no *theory* for or against on either side. Sometimes, when covering it with a light and delicately tinted wall-paper, it is *advisable* to put the darkest side next the wall to prevent the hlackness interfering with the solidity of the flank of wall. If you use much of this article, send to Stather's for their patent paper, it is greatly superior to the old thing.—F. P.

**Articles on Plain Painting.**—G. M., JUNR. (*Portland*).—These articles, which appeared in Vol. I., consist of "Introduction," No. 27, page 418; "White, Yellow and Red Pigments," No. 29, page 450; "Blue and Black Pigments," No. 35, page 550; "The Three Simple Divisions of Colour—Secondary and Tertiary Pigments," No. 36, page 566; "Oils, Varnishes, and other Vehicles; Solid and Liquid Driers," No. 42, page 659, and continued in No. 43, "Mixing Oil Paints, and Compounding Tints and Shades of Colours for Practical Use," No. 44, page 698. In No. 46, page 723, the same subject is continued, and the second and third coating is explained. The final coating and flatting processes are explained on page 739, No. 47. These three papers last mentioncd contain a practical lesson on the actual manipulation, as well as much invaluahle matter respecting technique and theories. No. 50 contains an exhaustive paper on *tempera* work—"distempers." The concluding chapter is an illustrated one, on "House-painters' Brushes, Knives, etc." The best advice I can give you is to get the complete volume and have it bound up.—LONDON DECORATOR.

**Lime-Washing Walls.**—E. W. (*Chingford*).—The painter's apprentice usually does the liming work, and he also gets in a "fearful mess." The rougher the wall, of course the more it splashes. A very common brush also makes matters worse, as the cheap fibre will not hold the lime-wash like hristles, but the latter are expensive. I can only say get a dccent brush, and practice for a week or two to gain expertness! Use it fresh slacked, or it will not bind.—F. P.

**Material for Gilding On.**—REDCLIFFE.—Your query is scarcely explicit enough, but assuming you want a recipe for preparing the picture-frame makers' *composition*, with which the ornament is moulded, see reply to AMATEUR, page 683, No. 94, Vol. II.—F. P.

**Concertina Reeds.**—G. D. O. (*No Address*).—All these are made of hrass, steel, and German silver. The strips of metal of the proper gauge and temper to produce approximately the sound required, may he obtained from Messrs. Dawkins, Charterhouse Street, London, E.C.; hut they must be tuned hy filing in order to make them quite true as to pitch.—G.

**Photo Lithography.**—HALF-TONE.—Please accept my apologies in the delay in replying to your query, regarding the transfer of photos in half tone to stone, but I have heen ill with the influenza and unahle to write. There are several methods of doing this, one of which is to wash the transfer paper with the medium first, then photo on to this, and transfer to stone in the ordinary way; hut, with the Editor's kind permission, I will write more fully upon the subject as soon as ever I am well enough. Will W. G. BLACKBURN and LITHO (*Birmingham*) kindly accept the same apologies for delaying their replies.—A. J. A.

**Phonograph.**—T. H. (*Bradford*).—I am sorry I cannct give instructions for making these wax cylinders, for reasons that have been already given in this column.—W. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Gum.**—STICKY writes:—"Will any reader tell me through 'Shop how to make and put on gum sueh as is on the hacks of stamps and adhesive lahels?"

**Soap.**—G. A. (*Fulham*) writes:—"Can any reader inform me how to mako soap similar to the '*Sunlight*,' and whether it can he suhjected to any special treatment so as to strip and cut about an hour after it is put in the frames, even while it is still warm?'

**Colouring New Ivory.**—R. P. C. (*Sunderland*) writes:—"I would like to know the hest way to colour new ivory for piano-keys to match the old ones, which are of a yellow cast."

**Split Cane.**—J. T. (*Shadwell, E.*) writes:—"Will any reader kindly inform me as to the price, etc., and where I can ohtain cane ready split similar to that used in caning chairs?"

**Wood Pulp.**—C. H. C. (*Hornsey*) would he glad if anyone could tell him where pulp (wood preferred) is to be obtained.

**Pair-Oared Boat.**—H. C. (*Lancaster*) writes:—"Will some reader of WORK kindly give me a few instructions as to how to make a pair-oared boat, to hold about three or four persons? What kind of wood, etc., will he required?"

IV.—QUESTION ANSWERED BY A CORRESPONDENT.

**Fret Clock Design.**—M. (*Bishop Auckland*) writes in reply to H. O. H. (*Bristol*) (see page 222, Vol. III.):—"Try Booth Brothers, Upper Stephen Street, Duhlin; Harger Brothers, Settle, Yorks; J. H. Skinner and Co., East Dereham, Norfolk, or H. Zilles & Co., Wilson Street, Finshury, London."

**Crystoleum Painting.**—M. (*Bishop Auckland*) writes in reply to PAINT BRUSH (see page 238, Vol. III.):—"I have found starch a very suitahle medium for this purpose. You must use the best quality of starch."

**Artists' Easel.**—M. (*Bishop Auckland*) writes, in reply to S. A. W. (*Wallasey*) (see page 158, Vol. III.):—"I send sketch of one I made, which I think will suit you. Fig. 1 is the front view of the top joint, and Fig. 2 a side view. It is made in two pieces, the back one heing 2 in. longer than the front. The front is hollowed to receive the ends of legs, which are fixed with countersunk-headed screws. A notch is cut in the hack for the hack leg, which is fixed with a strong wire. The legs are jointed in the middle, as shown in Figs. 3 and 4, and turn upwards when folded. They are jointed with screws, and fixed open by a pin, as shown at A. The legs are 1½ in. wide and ¾ in. thick. A piece of brass, about the size of a foot-rule, is fixed

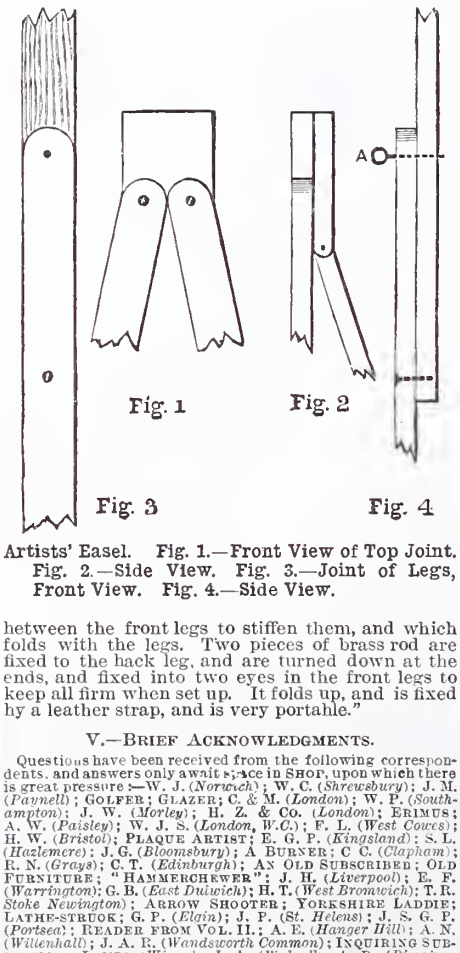



Fig. 1 Fig. 2

Fig. 3 Fig. 4

Artists' Easel. Fig. 1.—Front View of Top Joint. Fig. 2.—Side View. Fig. 3.—Joint of Legs, Front View. Fig. 4.—Side View.

hetween the front legs to stiffen them, and which folds with the legs. Two pieces of brass rod are fixed to the hack leg, and are turned down at the ends, and fixed into two eyes in the front legs to keep all firm when set up. It folds up, and is fixed hy a leather strap, and is very portahle."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only awnit space in SHOP, upon which there is great pressure:—W. J. (*Norwich*); W. C. (*Shrewsbury*); J. M. (*Paynell*); GOLFER; GLAZER; C. & M. (*London*); W. P. (*Southampton*); J. W. (*Morley*); H. Z. & Co. (*London*); ERIMUS; A. W. (*Paisley*); W. J. S. (*London, W.C.*); F. L. (*West Cowes*); H. W. (*Bristol*); PLAQUE ARTIST; E. G. P. (*Kingsland*); S. L. (*Hazlemere*); J. G. (*Bloomsbury*); A BURNER; C C. (*Clapham*); R. N. (*Grays*); C. T. (*Edinburgh*); AN OLD SUBSCRIBER; OLD FURNITURE; "HAMMERCHEWER"; J. H. (*Liverpool*); E. F. (*Warrington*); G. B. (*East Dulwich*); H. T. (*West Bromwich*); T. R. *Stoke Newington*); ARROW SHOOTER; YORKSHIRE LADDIE; LATHE-STRUCK; G. P. (*Elgin*); J. P. (*St. Helens*); J. S. G. P. (*Portsea*); READER FROM VOL. II.; A. E. (*Hanger Hill*); A. N. (*Willenhall*); J. A. R. (*Wandsworth Common*); INQUIRING SUBSCRIBER; LAMPS (*Wigan*); J. A. (*Walsall*); A. F. (*Birmingham*); MAKE BY THE GROSS; A READER OF "WORK."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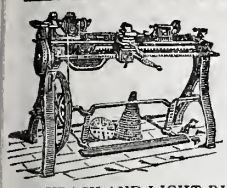

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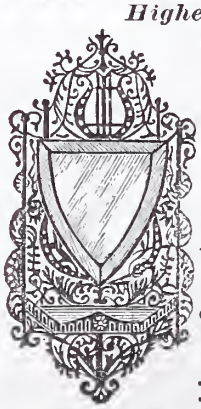

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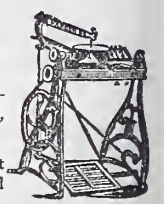

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VOL. III.—No. 127.] SATURDAY, AUGUST 22, 1891. [PRICE ONE PENNY.

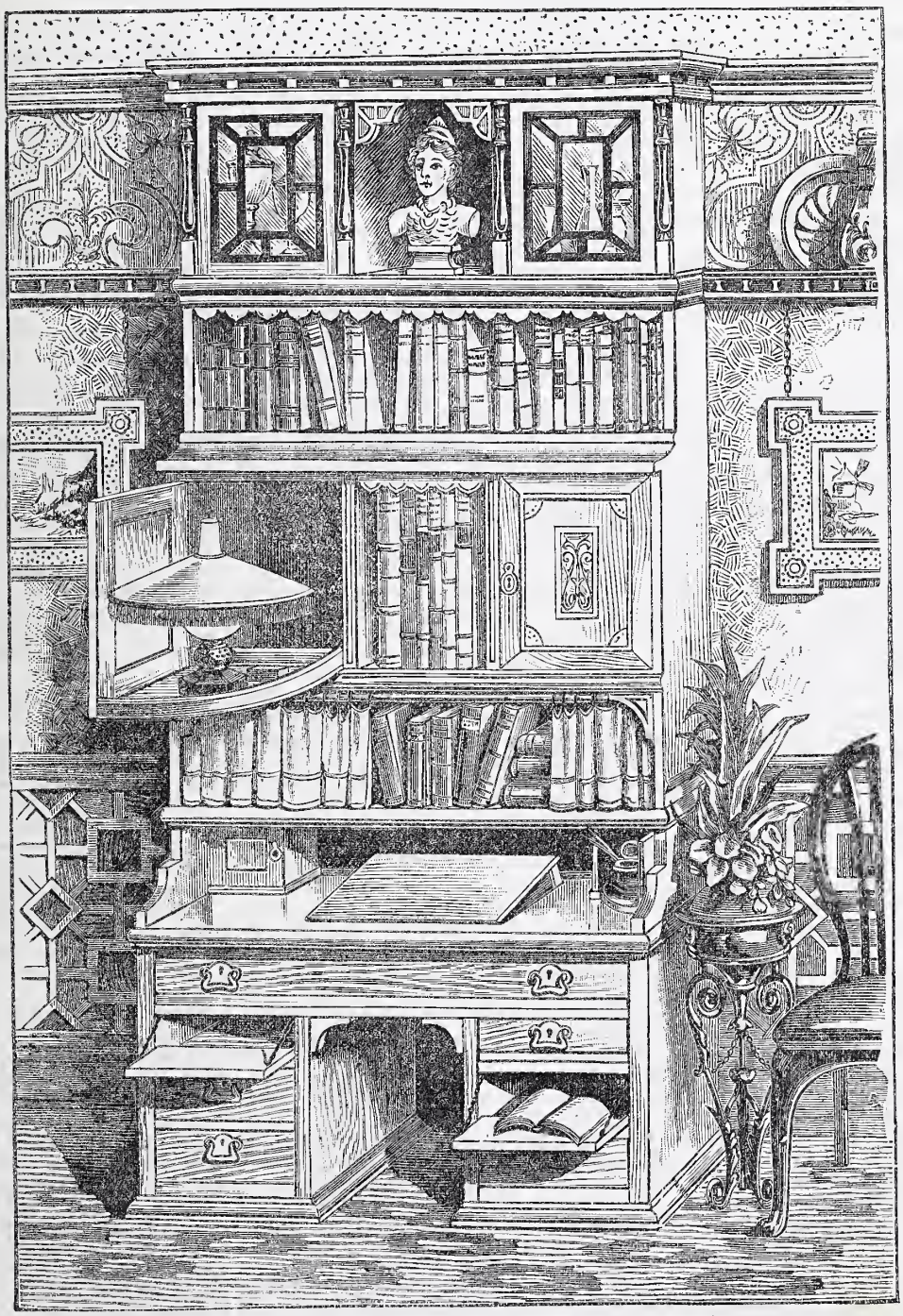
### DESIGN FOR WRITING-TABLE AND BOOKCASE.

BY MISS FLORENCE M. GARDINER.

It having been my lot, while staying in expensively and otherwise well-furnished houses, to suffer such physical and mental torture, owing to the inadequate and often total absence of some simple and compact arrangement for holding books and writing materials, that in self-defence I have been compelled to evolve a piece of furniture for this purpose, of which the accompanying design will give a fair idea. I feel sure it would be a welcome addition to most households, as it is well adapted to the requirements of every-day life; could be obtained at a moderate price, and would, doubtless; be within the capabilities of numerous amateur readers of WORK, with clever fingers and a taste for cabinet-making.

Though it is the lot of only a few to add to their income by the pen, yet everyone has more or less writing to do, and it is a priceless boon to have one's books (those companions of prosperous and evil days, and soothers of our idle hours) close at hand, instead of—as they often are—difficult of access when we most require them. Happily, there are few of us in this enlightened nineteenth century, with "souls so dead" that we have no favourite authors to whom, from time to time, we may turn for amusement, guidance, and comfort.

Here, then, is a design of a useful and handsome piece of furniture, appropriate to almost any room. Where the cost need not be considered, mahogany, walnut, or satinwood may be employed in its construction; but if it is necessary to practise economy, I would suggest deal, simply stained or enamelled in some suitable shade. In the latter alternative, I can personally recommend the excellent Foo-chow enamel paints of Messrs. Macpherson & Co., Knott Mill, Manchester, owing to their quick drying qualities, and the large range of colours to select from. In either case, brass fittings for the drawers should be used. The dimensions must, of course, depend upon individual convenience; but if one of the recesses found on either side of the fireplace in many rooms is utilised for this piece of furniture, the width would then regulate the size.



A Writing Table, Bookshelves, and Cupboards in Combination.

The table contains six small drawers and one large one. The fronts of the former fold down, and are firmly secured, thus serving the double purpose of library steps or shelves. The long one is divided into different compartments to suit the various kinds of paper, postal wrappers, telegraphic forms, etc., which are constantly needed, and so should always be close at hand. Under the sloping flap, space is left for placing letters and papers uncompleted. If desired, greater privacy could be secured by the addition of a revolving flap, which would entirely cover

the top of the table, when not in use; but as the object has been to minimise the cost as far as possible, this is not shown in the illustration.

The two small cupboards are respectively for the inkstand and pens, stamps, etc. The larger ones hold a lamp and different supplies, such as paste, gum, and the ink bottle.

The lower shelf is concealed by a curtain of plush, or other appropriate material, attached by rings to a brass rod. This forms a convenient receptacle for the various small articles which accumulate around one—for instance, pen and paper-knives, scissors, twine, rulers, etc. The central compartment and the shelf above are for books of reference; and the upper portion is divided into china cabinets with glazed doors. There is a niche between for bust, bronze, or any suitable ornament.

## ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

*Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.*

### Rules for Engine Drivers and Boiler Attendants.

Steam Boiler Feeding—Incrustation in Steam Boilers—Fire Bars Warping, etc.—Condensed Steam in Pipes—Priming of Steam Boilers—Plugging Leaky Tubes—Drawing Tubes—Grinding in Cocks—Firing Steam Boilers.

I shall now continue my remarks on this subject and complete them in another paper. It may be as well to say that Rules 1-18 were dealt with in page 229 (*et seq.*) and Rules 19-30 in page 290.

31. *Steam Boiler Feeding.*—In working steam boilers, a certain and constant supply of water is of very great importance. It should be as hot as can be forced into the boiler. In small powers the pump may be attached to and worked by the engine, but with large powers we prefer to have a separate pump of simple construction, such as the donkey pump, as, should the engine break down, a supply of water may still be kept up in the boilers. If a plunger pump is used, care must be taken that the plunger is a tight fit; if it is worn, the pump may be working without forcing any water into the boiler, and should this not be detected, dangerously low water may be the result. Pumps for boiler feeding are best run at a moderate rate of speed—say, a plunger speed of about 300 feet per minute. Several successful automatic self-feeding water supply apparatus are also now in use. If feed-water is drawn directly from a river, a strainer should in all cases be employed, as dirt or sand may be drawn into the pump and disable it. In large establishments, and to avoid the chance of being laid idle, in addition to the pump it is advisable to have a second feeder; for this purpose an injector may be used. The chief advantages of using an injector are that it may be worked without running the steam-engine, and the steam admitted to the injector is condensed and re-enters the boiler, and from the absence of working parts the wear and tear is less than with a donkey pump. Injectors, however, should be carefully managed, or they may give some trouble.

In working injectors, which may be fixed horizontally or vertically, a continuous supply of dry steam is necessary. This should be regulated by a valve on the boiler or steam-pipe. The water supply must be continuous, and should not be hotter than 135 deg. Fahr. with low pressure, or 105 deg. Fahr. with the highest pressures. Injectors may be fixed either above or below the water supply, and they will draw from two feet to twelve feet, according to size. An injector has one advantage over a pump—that is, it will usually stop forcing water before the pressure in a boiler becomes dangerous, owing to a jambed safety-valve or what not, whilst a pump will go on forcing water and raising the pressure till the boiler has to give way unless the valve is released. An injector will not work if allowed to get hot or any dirt to get in it; the suction-pipe should in all cases be fitted with a nozzle. Suction and delivery pipes should be kept as free from bends as possible, as the friction of the water through the pipes is considerably increased by them.

Injectors, like pumps, must be kept very clean, and all pipes and joints perfectly tight, or they will not work. It is advisable to fit injector and pump pipes with cocks for draining off waste water; these will be found particularly useful in case of frost. For automatically regulating the water supply to about one level in the boiler—an important factor in economical working—several plans have been introduced; one of the simplest with which we are acquainted consists in the arrangement of a small single-acting steam cylinder mounted on the feed-chest, and having the piston-rod connected to the feed-valve, which is kept closed by the downward pressure of a spring on the steam piston. A pipe connected to the cylinder leads to the steam space of the boiler; the lower end of this pipe is closed by a valve, the spindle of which is connected to a counterbalanced lever having a float suspended from one end. When the float sinks below a certain point, the steam-valve opens and admits steam under the piston, which, being forced up, admits water into the boiler till the normal level is attained.

Sandy water should not be used as a feed-water, as it will rapidly cut the pump plunger to pieces and jamb the valves.

32. *Incrustation in Steam Boilers.*—Dr. Joseph Rogers, of Indiana, who has studied closely the question of incrustation in steam boilers, gives tannate of soda the preference over any other preparation with which he is acquainted for the chemical purification of the feed-water, and it is without doubt the principal ingredient of many of the boiler-cleansing fluids sold, about which the vendors profess to make a great secret. The action of tannate of soda may be described as follows: The tannates of lime and magnesia are insoluble in water; hence when tannate of soda is present the carbonates of lime and magnesia in the feed-water (and held in solution therein by the carbonic acid in the water) are precipitated as they enter the boiler in the form of tannates of lime and magnesia. These compounds are not crystalline, pulverulent, and heavy like the carbonates, but light, flocculent, and amorphous, so that they do not subside in the boiler, but are held in suspension in the circulating water, gradually finding their way to the mud collected, from which they can be blown out as may be convenient. The soda of the decomposed tannate of soda appropriates the carbonic acid of the lime and magnesia, forming a bicarbonate of soda, which in turn decomposes the troublesome sulphate of lime, forming sulphate of soda, which remains in solution, while the carbonate of lime formed is decomposed, as above stated, into tannate by fresh portions of the tannate of soda present. The solvent action of the tannate upon hardened scale is slow, but when the boiler is once clear there is little doubt that it is a most excellent preventive, and, unlike other remedies used, it has no injurious effect upon the iron of the boiler.

Numerous other remedies have been used to prevent incrustation, with varying success. Some of these we give herewith, but it must be understood we do not in any way guarantee their success. (1) Potatoes, $\frac{1}{50}$ of weight of water, is said to prevent adherence of scale. (2) 12 parts salt, $2\frac{1}{2}$ caustic soda, $\frac{1}{4}$ extract of oak bark, $\frac{1}{2}$ potash. (3) Pieces of oak-wood suspended in boiler and renewed monthly. (4) 2 oz. muriate of ammonia in boiler twice a week. (5) A coating 3 parts of blacklead, 18 tallow, applied hot to the inside of the boiler every few weeks. (6) 12 lb. of molasses fed into an 8 horse-power boiler at intervals is said to have prevented incrustation for six months. (7) Mahogany or oak sawdust in small quantities. Use this with caution, as the tannic acid attracts iron. (8) Carbonate of soda. (9) Slippery elm bark. (10) Chloride of tin. (11) Spent tanner's bark. (12) Frequent blowing off.

Hard feed-water containing lime, etc., may be softened to a very considerable degree by treating it with a mixture of lime and soda, allowing the precipitate to settle before the water is used. This will largely prevent incrustation.

33. *Fire-bars Warping, etc.*—One of the reasons for grate-bars warping is insufficiency of air space between the bars; this should be arranged to suit the fuel burnt, as some coal requires much more air space than others. Another reason is that in many boilers the fire-bar bearers are fitted close up to the bridge and head-plate, consequently hot ashes and clinkers accumulate, having no place to escape. This may be obviated by putting the bearers a short distance from the end of the bars, so that the ashes, etc., have room to escape into the pit. Long fire-bars warp more than short ones, and thick bars more than thin ones. The air spaces between the bars should be wider at the bottom of the bar than at the top, as this facilitates the admission of air and the escape of ashes. Air and water bars have their advocates, and doubtless possess some advantages; but the water-bar, although long known, has made little progress, probably owing to the cost of maintenance and the danger arising should they burn out or rupture suddenly. In burning anthracite coal, water hearths are used to some extent. A very great variety of fire-bars have been introduced, but I cannot discuss their merits or demerits here; it will be sufficient to say that good fire-bars should give ample air space, so that the amount of oxygen necessary for complete combustion is readily distributed through the fire, and at the same time should not be given to warp, and should be easily cleaned or renewed.

34. *Condensed Steam in Pipes, etc.*—There are two ways of effectively getting rid of this—viz., by using a steam trap for getting rid of the water after it is made, or by the use of a steam separator, which acts directly on the steam itself and relieves it of the water. To prevent radiation and reduce the amount of condensation to a minimum, all steam-pipes should in the first place be carefully covered with some good non-conducting composition, such as silicate cotton, slag wool, or asbestos. If the engine is situated more than 25 ft. from the boiler, it will be advis-

ble to fix a steam trap or separator in the pipe. Choose a simple form of trap; a good one is arranged with a cam motion for quick opening, combined with a loose valve, which reduces the friction considerably and renders it less liable to stick. We have recently seen a new form of separator in use which appears to give capital results. It consists, briefly, of a circular cast-iron chamber with a branch connecting it to, and forming part of, the main steam-pipe. The steam on entering the chamber is conducted to one side by a partition narrowed down at its orifice, so that in rushing in it acquires a whirlwind motion at a high velocity. The particles of water being of greater specific gravity than the vapour, are thrown outwards and run down the sides of the chamber, whilst the steam at the centre of the vortex, free from water, passes to the engine cylinder through a centre pipe provided for the purpose. This pipe is of trumpet form. The condensed water collects at the bottom of the chamber, and is released by a drain-cock. Expansion steam-traps should be used with caution.

Stop and starting valves should in all cases be turned off or on gradually, in the first case not to stop the flow of steam suddenly and cause a recoil, and in the second to allow the pipes to warm and gradually expand. We have known many cases of fracture from steam being suddenly turned into cold pipes. All steam-pipes should have as few joints and elbows as possible; the pipe carrying the exhaust steam away should be of ample size; small exhaust-pipes cause back pressure on the piston, and consequent loss of power. The beats or pulsations made by the escape of the exhaust steam should be at regular intervals; if they are intermittent or irregular, steam is probably passing the piston or slide-valve, which should be examined and adjusted. In conecting feed and steam pipes, allowance should in all cases be made for expansion.

35. *Priming of Steam Boilers.*—Priming or "foaming," or, in other words, the production of "wet" steam, may generally be said to arise from one of the following causes:—(1) Want of steam space; (2) too much water in the boiler; (3) dirty feed-water; (4) bad circulation of water or badly-proportioned boiler; (5) grease in the boiler, and some kinds of boiler fluids, especially if put in in quantities, will cause priming; (6) too much steam drawn from the boiler, causing a whirling motion on the water; (7) by forcing the fire. The amount of priming varies considerably with different boilers, and is to some extent under the control of the attendant. Perforated pipes or baffle-plates will usually check priming to a certain extent, and a wooden grating, fastened by chains, and allowed to float on the water immediately under where the steam is drawn from the boiler, will usually stop priming almost entirely.

36. *Plugging Leaky Tubes.*—Split or leaky tubes may be plugged for temporary use with iron or wooden plugs. Care should be taken that the plugs are not too tight a fit, or the evil may be increased in driving. In using wooden plugs, unless the split is a short one and at the extreme end of the tube, it is a good plan to use two plugs, driving one in past the split and another to follow it. Iron plugs, with a collar on the one end to close the end of the tube, are also used. Small leaks at the tube ends may often be stopped by expanding the tube with an expander, but care must be taken that this operation is not carried too far, or the tube may be split. Many boiler-makers prefer to plug tubes with well-fitted ferrules. The author has used the following plan with success, and can recommend it. Make taper plugs of pine about 4 in. long, bore a hole through them, and drive them in flush with the end of the tube. Take a round rod or bar of wrought-iron, and screw a thread on each end; pass the bar through the plugs, and put on saucer-shaped washers filled with red lead, to cover each end of the tube; put on nuts and tighten up. If tubes are plugged under steam, damp down the fire with small coal, and close the dampers.

Leaky feed-pipes, etc., may usually be temporarily repaired by wrapping them tightly round with narrow bands of canvas coated with white lead. The bands should be, say, 3 in. wide, and overlap each other half way; they should be very tightly tied on with waxed or tarred rope. Soft pine wood is the best to use for plugs, as the water penetrates the pores of the wood, causing it to swell, and the plug is thus held firmly in position. Oatmeal or any similar substance should not be introduced in a boiler to stop leaks, as they clog the water-gauge passages and valve-seats, which may result in serious accident; at the same time, they are liable to cause priming.

37. *Drawing Tubes.*—If the proper appliances are not to hand, drawing tubes is often a troublesome job, from accumulation scale of and other causes; but as a competent engine driver should be able to draw a tube, I give a note thereon. If the scale on the tubes is very hard, it may be cracked off by putting a red-hot bar into each tube before drawing. In the first place, cut off or bend in the ends of the tube, then pass a rod—arranged with an eye at one end, and a nut and strong steel washer at the other—through the tube; if you cannot draw by hand, fasten a pair of blocks on to the eye, and pull the tube out. Be careful not to damage the tube-plate. Several handy appliances are now made for extracting ferrules.

38. *Grinding in Cocks.*—In case of leakage of the various cocks, a boiler attendant should be capable of setting them right by re-grinding, unless they are very much worn, when they should be renewed. If the plugs are worn irregularly, draw-file them first of all with a smooth file as true as may be, then take either flour of emery or powdered glass, and mix with oil, and grind in the plug till it is a true fit, but not too tight, or it will be more apt to stick when expanded by the heat. Do not use a file unless absolutely necessary, and grease the cocks well when replaced.

39. *Firing Steam Boilers.*—The economical working and longevity of a steam boiler depends, in the first place, largely on the following points:—(1) The type of boiler employed; (2) how it is fixed; (3) the fuel and feed-water used. In selecting a boiler, the chief points to bear in mind are what kind of water and fuel it will be necessary to use. The feed-water should in all cases be tested, and, if found impure, of course a simple form of boiler, easily cleaned, should be selected. In any case, for economical firing—whatever type of boiler is selected—the author recommends the employment of a fire-box or combustion chamber of ample dimensions. There is little doubt that hundreds of boilers are in use in which the combustion chambers are far too cramped; consequently, to keep up a fair head of steam, excessive firing has to be resorted to, the result being the reverse of economical, both as regards the consumption of fuel and the longevity of the boiler.

Having selected the best type of boiler for the special purpose to which it has to be put, the very important question presents itself, which is the best way of firing it—or, in other words, the best way to consume the fuel employed—so as to ensure perfect combustion, at the same time securing the largest possible amount of duty from each ton of fuel employed? The effective combustion of fuel may be said to depend chiefly on the following points:—

(1) Construction of the combustion chamber or fire-box. (2) The admission of the right quantity of air to the furnace. (3) The proper regulation of the draught. (4) Regular and even firing. (1) Many Cornish and Lancashire boilers have been built in which the combustion chamber has been made much too shallow and of too small cubic capacity, with intention, probably, of bringing the fire as near the boiler as possible, and thus extracting more heat from it. This idea must be held to be altogether wrong, as in the confined space the draught is much increased, and the heat, therefore, is carried rapidly away. The small size of the furnace also will not alllow of the perfect combustion of the various gases; and, lastly, the fire itself comes in direct contact with the boiler-plates, which should be avoided. (2) The admission of the right quantity of air to the furnace is a matter of great importance, but one often neglected. In the first place, care must be taken that sufficient air space between the fire-bars is allowed. It is impossible, however, to lay down an absolute rule as to what is the proper amount of air space to secure the most perfect combustion, as much depends on the nature of the fuel and the velocity of the draught through the flues; but, roughly speaking, an area of from five to six square inches for each square foot of grate surface should be provided. The air admitted through the fire-bars is not, as a rule, sufficient to promote efficient combustion, and air is usually admitted through the door or bridge of the furnace. The author is of opinion that hot air admitted from the bridge is efficacious in promoting combustion and preventing smoke, and several very excellent plans for supplying and regulating the hot air are in use. Forcing a boiler has a tendency to produce smoke; the great factor in perfect combustion I take to be plenty of grate area and combustion space. It must be borne in mind that when fuel in a furnace is in a state of combustion, it burns of the carbon it contains only an amount proportionate to the amount of oxygen that is brought in contact with it. In order to enable that combustion to take place, the oxygen must be raised to a high temperature before it will combine with the fluid carbon. If it does not combine with the fluid carbon, it drives the latter before it until it reaches the outside air, and disperses in the form of carbonic oxide or carbonic acid gas, as the case may be. Where the atmospheric air (or oxygen) is admitted through the door and front bars of the grate, the velocity of the draught is usually such as to drive the atmospheric air straight over the bed of the furnace, and, before it has reached a degree of heat high enough to enable it to combine with the fluid carbon evolved from the coal, it is driven over the fire, and, consequently, instead of combining with the fluid carbon, it drives it to the upper air unconsumed. Various systems of mechanical stoking have been introduced during late

years, in some cases with considerable success; but exigencies of space prevent more than a passing notice here. Whatever kind of stoking is pursued, it may be taken as an axiom that the shallower the combustion chamber is, the lighter should be the fire in proportion.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

BRAZING FRAME—BRAZING WITH FIRE—BRAZING WITH BLOW-PIPE—BRAZING WITH FIRE AND PIPE—BRAZING: HOW DONE—SIMPLE BRAZINGS—SOCKET JOINTS—PRECAUTIONS IN BRAZING—BRAZING LUG OF HANDLE-BAR—BRAKE WORK.

WE have now arrived at the brazing of our frame. By brazing is meant hard soldering—or brass soldering, as it is called. Brass solder is not merely brass filings, as many imagine, although soft brass filings may be used for that purpose. Brazing metal is specially prepared for brazing, and the proportions, as given in "Spon," are: copper 2 parts, zinc 1 part. Brazing may be done with a fire only, with a blow-pipe only, or with both in combination. For my own part, I use a charcoal fire only, raising the wind with a small fan worked by a lever. The forge, with its wheel gear and 7 in. fan, cost me £3 5s. Charcoal is preferable as a fuel, as it gives greater heat than coal, and has little or no smoke.

The mischief of brazing with a fire only is that the under side of the part being brazed gets more heat than the upper, whereas the heat should be equal all round. The mischief, therefore, to guard against is the burning of the tubes on the under side before the upperside is sufficiently heated to make the brazing metal or spelter run. If a tube, which is at best but $\frac{1}{16}$ in. thick, gets partially burned, or even blistered, it is practically ruined for its purpose, and had better be thrown aside. To braze without a fire requires a good strong blow-pipe, with a gas supply of not less than $\frac{5}{8}$ in. pipe, inside measure. The blow-pipe, as most folks are aware, is fed with gas (common house gas) and air in combination, the air serving to intensify the gas flame; the air blast is produced by a bellows, and the blast must be sufficiently strong to make the most of the gas combined with it in producing heat.

To braze with a blow-pipe only, a carbon brick or a lump of good charcoal is placed beneath the joint to be brazed. The blow-pipe, if efficient, will heat up the metal to a proper degree in a few minutes, also the charcoal block, thus practically heating the metal all round. This is the cleanest and safest method of brazing, as the upper side is, if anything, heated in a higher degree than the under, and if it is removed as soon as the spelter runs there is no danger of burning; the heat also has been concentrated on the desired spot, and a much less length of the article has been heated than with the open fire.

To braze with the fire and the pipe in combination is the speediest, but great care must be taken that the fire does not heat the under side to burning before the pipe which is operating on the upper side has made the solder run. Brazing by this requires, of course, the fan forge, and also a separate bellows for the blow-pipe, which means a lot of money, and need not be adopted if the blow-pipe alone is of sufficient capacity. Thomas Fletcher, of Warrington, supplies a blow-pipe and foot bellows suitable for bicycle work, the price for the two being about 50s. He also sells the carbon bricks. Now, as I use only the charcoal forge for brazing, I will describe the process usually followed.

Suppose you are ready to begin brazing, you provide yourself with spelter and borax, the borax, which is bought in a powdered state, being used to aet as a flux to make the spelter penetrate the joint. We will take the simplest joints first.

Fig. 24.

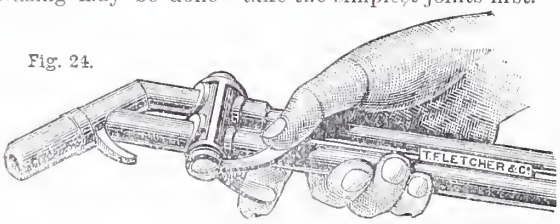
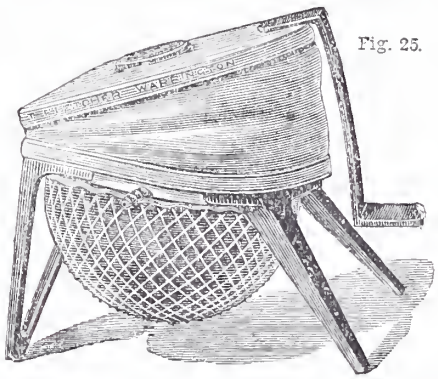



Fig. 25.



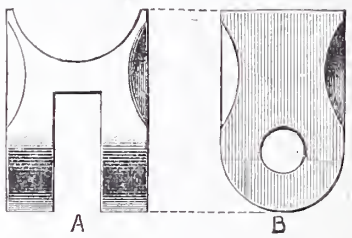




Fig. 26.

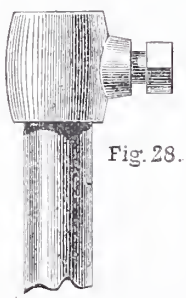


Fig. 28.

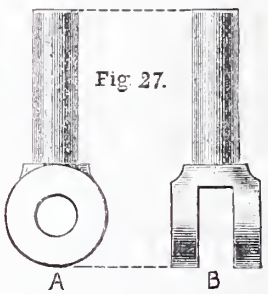



Fig. 27.

Fig. 24.—Fletcher's Blowpipe. Fig. 25.—Fletcher's Bellows. Fig. 26.—Brake Lever Lug: full size.
Fig. 27.—Fork Ends for Brake: full size. Fig. 28.—Collar for Brake Tube: full size.

We will go back to Fig. 1, which accompanies the first paper of this series (page 33) and where the parts are all lettered, or if you have a working drawing prepared and lettered, as directed in a former paper, you will find the tubes E and F converge at the rear forked stamping. Here we have two joints which are about the easiest to braze in the whole frame. There are a pair of these V-shaped parts of the frame, and, assuming that they are properly fitted, both set at the same angle, and pinned ready for brazing, fill all screwed holes with moistened clay—pipe-clay will do; tie a bit of No. 16 soft brass wire round both tubes just over the joints, moisten a little of the powdered borax in a dish with water to the consistency of thick cream, drop a little of this into each tube, along with as much spelter as a threepenny-bit would lift, and let them settle on the solid tenons inside the tubes. Having made a small clear fire of charcoal, place the work over it, heat up the parts a little, and put some of the moistened borax just over the brass wire at the joints; the steel should be hot enough to make the borax fizzle, and it, in conjunction with the borax inside the tube, will run in all over the parts to be brazed. Now provide a bit of pine wood to burn over the joint; this is the substitute for a blow-pipe: its purpose is to help heating the upper side of the work, which it does surprisingly well if properly managed. Now place the work over the centre of the fire, and blow, not too strongly; apply a little dry borax over the wire, and take care to hold the work so that the solder inside the tube does not run out. Now, while blowing, place the bit of wood over the joint, when it will burn fiercely, and throw its flame downwards on the work. When the under side gets nearly up to white heat, turn the work over, and apply more borax to the upturned side, and keep the wood still burning. In a few minutes the wire will run and disappear, and a yellow flame will indicate that the spelter inside has also dissolved. The instant the wire disappears lift the work from the fire, and hold it so that the spelter inside will settle in the bottom, which is the solid tenon. Throw a little common salt over the heated part, then scrape off all scale with a bit of iron, which will leave the work much easier to file up afterwards. To cool the work, it should stand till the red heat disappears; then it should be dipped in and out of water several times, or water allowed to trickle on to it till nearly cold. If it were left to cool without water, the thin tube would be cold long before the solid part at the joint, and the tube would be found to be hard and brittle; so in cooling with water the object is to cool down the solid parts as quickly as the tube. The two joints on this part of the frame would both be brazed at onee, as, being so near each other, there is no difficulty in heating up both at once; the thing to watch is to have both up to the same degree of heat, so that the wires on both will go simultaneously. Another simple brazing joint is the T-piece to the handle bar. This, of course, must previously be set to the angle shown in Fig. 1, formed by K, the extension tube, and L, the handle bar. Here there are also two joints, but they are so close together that they are brazed as one. The extension tube, K, must be pinned to the T-piece, and that piece to the handle bar; bits of wire are tied round as before, and spelter and borax applied in the same way. Care should be taken to tilt the job in such a way on the fire that the wire on the handle bar will run into the joint. This part will heat up and braze very quickly, there being hardly any solid metal. A rather more difficult brazing is the triple joint at the front fork crown. The two fork ends (Fig. 20, page 308) should first be brazed into the lower fork ends before pinning on to the crown piece. These ends, after being brazed, should also be filed up and bored for the axle, after which they may be pinned to the crown piece, as also the steering tube, G (Fig. 1). These three joints will be heated

id brazed all at once, with the forks lying
the fire edges up, and the steering tube
mewhat elevated, so that the solder inside
may lie at the bottom, where it is wanted.
he two forks, which are now closed at their
wer ends, should have each a small ventilat-
g hole bored, and before pinning on, each
rk should have some moist borax and
elter placed inside; the vent holes are
allow the steam to escape. Tie bits of
ire round all three joints as before, and
ve a bit of wood at least 3 in. broad to
rn over. Turn the job upside down, as
fore, to prevent burning, which would be
re to happen before the upper side was
t enough to dissolve the wires. The
ject of turning over is to get the cold side
ated up, as the other, the upturned hot
de being kept so by the aid of the burning
ood. With a blow-pipe all these joints
ould be done separately, one after the
her, and no wood used. I would strongly
lvise any one attempting the brazing of a
ece of work such as this, if he can at all
ford it, to provide himself with a good
low-pipe and foot blower. There is then
risk of burning, the work is much cleaner,
d much easier filed up afterwards. In
e illustrations accompanying this chapter,
ig. 24 is Fletcher's No. 8 C blow-pipe,
rice 10s. 6d. This pipe, with a sufficient
pply of gas and air, is ample for all the
azing of a bicycle frame.

Fig. 25 is Fletcher's 9 C foot blower, No. 5,
r supplying air to the above blow-pipe.
is priced in his list at 35s.

We have two small simple brazings in our
ame before we tackle the socket joints—
mely, the two small cross-pieces on the
rward ends of the lower rear tubes, E.
hese pieces are not at right angles with the
bes, but slope a little backwards, as will
e seen by reference to Fig. 1, and in detail,
ig. 5 (page 168). These two pieces should
e brazed into their tubes before the latter
re brazed into the rear fork stamping. Now,
to the socket joints. We have six of these
-two at the steering barrel, two at the bot-
m braeket, one at the top of tube D (Fig. 1),
d one on the front of seat pillar socket.
our of these joints are $1\frac{1}{8}$ in. tube, let into
e sockets, and two are $\frac{7}{8}$ in., also in sockets.
he inside of all the sockets should be bored
ut clean, and the tubes outside, for an inch
f their length, cleaned by filing; also when
he tubes are all fitted in their places, that
art of the frame, when laid over the full-
ize working drawing, should coincide ex-
ctly. Before pinning these joints, care
ust be taken that the frame is out of twist
-that is, the barrel part and the bent tube,
part must be in line or in the same plane.
When setting the frame, it is as well to have
he front steering tube with fork in its place
n the barrel. The frame may now be
xamined as to twist, and the joints may be
inned by inserting a screw through one
ide of each. In brazing these joints no
pelter is put inside the tubes; a bit of brass
vire is tied round each on the tube, close up
o the socket end, and the same operation is
one through in brazing as before. These
oints will heat up quickly, as there are no
olids inside the tubes. When the borax
laced over the wired joints melts and looks
icky, a little spelter may be added over the
vire, in case the wire should be insufficient.
There is no need to turn over the work in
razing these socket joints, as the burning
vood over them is sufficient to heat up from
he first.

A precaution in brazing is to protect all
inished parts as much as possible from the
ire, all screw holes or sockets being filled with clay. The steering barrel should be filled, at least at the ends, with it, as also L-pin socket and the two ears (Fig. 9, page 168) that receive the rear tubes, F.

We have still one or two small brazings; one of these is a lug (Fig. 26, A B), which is brazed to the underside of the handle bar, some four inches to the right of the T-piece. The hollow end is neatly fitted to the bar, then fixed with a screw, and brazed. Its purpose is to hinge the brake lever, it acting as a fulcrum.

Coming to the brake work we have a tube, M, some 9 in. long, and $\frac{3}{8}$ in. diameter; this has a brazing at both ends. On the lower end is a small fork (Fig. 27, A B). The shank of this is let into the tube, the tube being filed on the end to fit close. The upper end of the tube has a small split collar, or a collar with a snug on the back, as Fig. 28, for a set screw. It is used for the adjustment of the brake rod along with the handle bar, which will be noticed when we come to fit our brake work. Our frame being now brazed up, the filing up has to be gone into. All parts that have seen the fire will give most labour in filing. The rough scale should be removed from these parts with a used file, then better files may be employed; all parts that have seen borax must be filed up clean, as borax left on will soon show itself on the finished machine, even through the enamelling. If the tubes have a good clean surface they need not be filed in their length; a good rubbing with emery and oil will be sufficient, but for a nice job, when enamelled, all parts filed should be as smooth as the body of the tubes, for enamel is not intended to cover up rough work. I never use any other than files and emery to finish up frames for the enamel; for the parts to be polished for plating I use emery wheels of various grades. The emery wheels are wooden discs covered with leather, and coated with emery. Three or four of these wheels are sufficient; and for the final finish a wheel with pumice-stone or Tripoli powder, if a very fine finish is wanted. The emery wheels have each a spindle of their own, and they are mounted one at a time in a frame similar to a knife-grinder's, driven by two treadles. I use also an 8 in. grindstone in this frame, which is very useful for taking down rough parts, as well as for grinding small tools, twist-drills, &c. Having filed up our frame, which as yet is in three parts—the part in front of the driving wheel and the two V-shaped parts which constitute the rear portion. To fit these portions together we fit the upper ends of the tubes F into the lugs prepared for them. If the tubes have been cut the proper length and set aright, the forward ends of the lower tubes, E, should abut neatly against the edges of the bottom bracket, when they may be marked for boring the $\frac{5}{16}$ in. bolt holes. When these are bolted secure in their places and the upper ends of the tubes F fixed by a small flush set screw each, our frame may be considered finished and ready for the various attachments, such as brake, mud-guards, L-pin, &c., which I will treat of in my next paper.

In the meantime, if the reader has already started on making a bicycle for his own use, he may profitably occupy his time in studying what I have said about brazing, and in endeavouring to make himself a proficient in the art. Nothing can be effectually done in manual work of any kind without practice, and this is the reason why many a well-intentioned amateur fails in competition with the professional. He cannot have sufficient practice.

## SOME SUGGESTIVE SCRAPS OF STONE CARVING.

BY ARTHUR YORKE.

THE accompanying illustrations of architectural enrichment were sketched by the writer in the Chapel of the Velez family, Murcia Cathedral, Spain, and to carvers both in wood and stone they will probably suggest some departures from the beaten track.

In plan, the Chapel of the Velez differs in no respect from many chapels attached to foreign cathedrals, nor does it in the leading lines of its architecture; but in the ornamental details of its carved stone-work a style has been carried throughout which

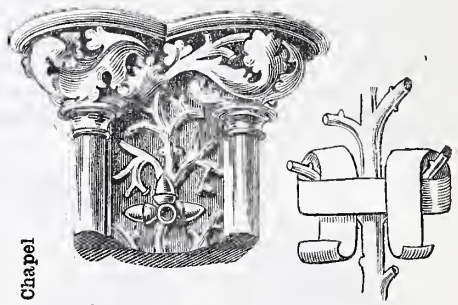


Fig. 2.—Ribbon on Leafless Twig.



Fig. 3.—Ribbon on Leafless Twig.

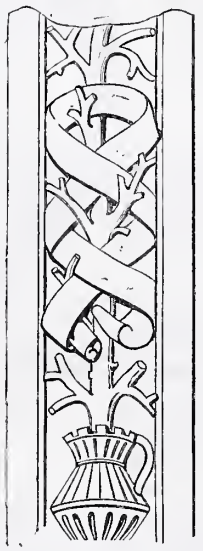
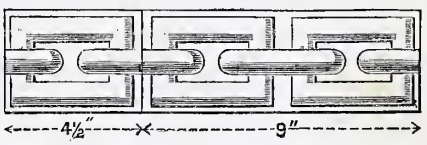


Fig. 1.—Capital and Shaft of Column in the Velez Chapel Murcia Cathedral.

Fig. 4.—Example of Chain Moulding.




stamps it as the work of no mere copyist. In architectural decoration generally, foliage, either natural or conventional, has been depended upon for the purposes of enrichment, but in this instance the designer has almost entirely discarded leaf-work, and boldly relied upon stems and branches for his effect, foliage being reserved either for string-courses or else for capitals, as in the example (Fig. 1). To avoid monotony, and give the eye that pleasure which results from variety of form, he has hung here and there upon the bare twigs which shoot from the stems, ribbons arranged in various ways, examples of which may be seen in the lower part of Fig. 1 and in Figs. 2 and 3. He does, indeed, occasionally use a leaf, but it appears much like an exception put in to prove a rule. Even corbels are in many cases formed entirely of branch-work, the

interlaced twigs being generally cut out clear of one another, except where contact was required for the sake of strength.

The style of the Velez Chapel is Transitional, of the time when late Gothic was merging into the Renaissance, as may be seen by the shape of the vases and the treatment of some nude figures introduced here and there. Grotesques occur in places, but these are by no means "strikingly expressed in fancy," as are those of about the same date found in our own country. On the outside of the chapel, however, is a string-course of very unusual design: it takes the form of a gigantic stone chain extending all round the building. The visitor is told that a chain was the badge of the house of Velez, and hence its introduction. Be that as it may, it might suggest an unhackneyed enrichment in stone carving apart from any such motive; or with still better effect, perhaps, it might be produced in moulded brick-work. Fig. 4 shows the pattern divided for this latter purpose into a "header" and a "stretcher."

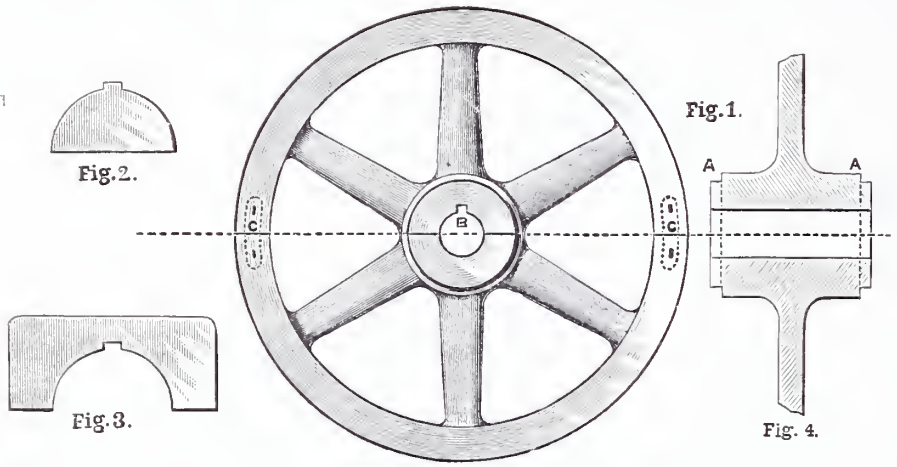



Fig. 1.—View of Wheel showing Keyway at B, and Dowels and Tapered Keys at C, C. Fig. 2.—Gauge to be fitted to Wheel. Fig. 3.—Gauge by which Key is to be fitted. Fig. 4.—Section of Boss, showing Recesses for Hoops at A, A.

## SYSTEM OF FITTING FLY-WHEEL TO SHAFT.

BY T. R. BLACKETT.

KEYING BY SUNKEN KEY IN SHAFT—TURNING AND BORING WHEEL FOR SHAFT—CUTTING KEY-WAY—GAUGES—TWIST IN KEY—PLANING-DOWN KEY—SAVING OF TIME AND LABOUR BY PROPOSED METHOD.

AT the present time, when severe competition is the order of the day, it behoves workmen to acquire methods by which they can turn out their work with dispatch and accuracy to compete with the market.

The fitting of a heavy fly-wheel (say one of about 6 tons weight) is a job that has to be carefully done, so as to ensure an accuracy that we can depend upon.

Many engineers design fly-wheels with the arms keyed to the boss, the arms in their turn to be keyed to the rim of the wheel.

Let us consider as an example that we have to key a fly-wheel of 12 ft. diameter and about 6 tons in weight, cast in two pieces, and to be fitted to a shaft 14 in. diameter by a sunken key bedded into the shaft (Fig. 1).

After the faces of the wheel that go together have been turned up or planed, the rim is secured together by dowels and tapered keys, after which it can go to the lathe to be turned.

It will be as well to remark here that after the four tapered keys have been properly fitted, temporary keys are to be substituted while the wheel is being turned.

In the hands of the turner the wheel is turned and bored out to fit the shaft, as well as two recesses (A, A, Fig. 4) turned down at each side of the boss to take two wrought-iron hoops, which are shrunk on when the wheel is permanently fixed in position on the shaft.

Having been turned, the wheel is now taken apart, and the key-way slotted out (B, Fig. 1) in the strongest part of the boss of the one half wheel.

Assuming that the key-way has already been cut in the shaft, and the key made an accurate fit, but not caulked in, we now proceed to fit the wheel to the shaft.

Many of our mechanical readers are perfectly aware that while a key-way is being cut or slotted out in a wheel, there is a certain amount of spring on the tool, which will be rather considerable in the case of a boss some 14 in. or 15 in. in thickness. This has now to be removed.

We proceed to make a gauge similar to Fig. 2, and fix it to the deepest part of the key-way, which will be the side that was lying upwards on the slotting machine. With the assistance of a crane, we lay the fly-wheel in its rim with the boss upwards, and with a file file out the key-way so that the gauge will be an accurate fit from one end to the other.

Having satisfied ourselves that this is done, and that the corners are also nicely squared out, we go about making a second gauge, which is, so to speak, the negative of the other (Fig. 3). I may here remark that before cutting the key-space in this gauge, the gauge itself should be made a good fit to the shaft, or, better still, rough out the key-space, and finish it after the gauge has been fitted to the shaft.

We now take the first gauge that we have made, and make the second one (Fig. 3) an accurate fit to it. Having done this, we try our new gauge on to the key and shaft in the position the wheel will have to go, and perhaps we find that some $\frac{1}{8}$ in. or so has to come off the top of the key.

By this method we will see if the key has any *twist* or not, and whether it will fit the wheel. Supposing, however, that we have only $\frac{1}{8}$ in. to come off the top of the key, we fit the key to the gauge: that is, we cut the key down at each end for the space of $\frac{1}{2}$ in. along until the gauge is a perfect fit to both shaft and key.

We now take the key to the planing machine and get it planed down level from one end to the other, but not to go below the spaces at each end. Having gone through this process, we place it finally in its seat or bed and caulk it up: that is, caulk the edges of the key-way in the shaft all round the key.

Having tried the gauge on, and making sure that it fits accurately all the way along, we take off the sharp arris and try on a half-wheel, which, if the foregoing instructions have been properly carried out, will be an accurate fit.

What I have endeavoured to point out in this paper is the great advantage of a good method or system. Making a pair of gauges for a job like this out of $\frac{1}{16}$ in. sheet iron would take very little time and trouble, and in the end would prove a great deal handier than using callipers. If we had had to try the half wheel (some 3 tons) off and on while we were cutting down the key, we would have taken at least three times the time, as well as incurred an unnecessary waste of labour.

## OVAL AND CYLINDRICAL VESSELS IN SHEET-METAL WORK.

BY R. ALEXANDER.

CYLINDRICAL VESSELS—WIRE BAIL FORMER—FISH KETTLE AND OVAL BOILERS—SIZING OF ARTICLES—TURNING AND SHAPING—DRAWING PATTERNS—COVERS—CUTTING OUT COVERS—OTHER STRAIGHT-SIDED WORK: WATER POTS, BOILER FILTERS, AND TOILET CANS—WIRING WATER-POTS, ETC.—HANDLES.

*Cylindrical Vessels.*—The method of making a saucepan described in Vol. II., pages 468 and 661, will serve as a guide to the making up of other articles of a cylindrical form such as camp kettles (Fig. 1). These are exactly the same in shape and size as sauce pans; the difference is that, instead of a handle, boss, etc., they have two ears and a wire handle or bail. The mode of putting on ears has already been described: the bail should be of a length sufficient to drop one-third of the depth of the body when hooked in the ears; the ends of the bail should be annealed if they are of hard wire and then bent round on the tip of the extinguisher.

*Wire Bail Former.*—A useful tool for bending wire bails quickly and truly is the wire bail former (Fig. 2). Care should be taken in fitting on the ears to keep them well out from the body, or when the bail is in it will be a difficult matter to get the cover on and off. The rims of the covers should be tacked a shade looser than the saucepans, as there is no handle to aid in taking the lid off to examine the contents whilst cooking—a loose-fitting lid is a fault that may be called a good one, but a tight lid is detestable.

*Fish Kettles, etc.*—Very similar in process of manufacture are fish kettles and oval boilers (Figs. 3 and 4). These are both of a similar shape: a kind of flattened ellipse or oblong, with rounding corners; Fig. 5 shows the correct shape, though it may be varied slightly in the case of the oval boiler by making the side a little more rounding (see dotted lines), but in the fish kettle the sides must be straight. Boilers or oval camp kettles are cut deeper than fish kettles, as a fish does not need a lot of water to cook it, and nothing else is cooked with it, whilst the boiler is often used for meat and vegetables at the same time, with, perhaps, a pudding into the bargain.

*Sizing of Articles.*—The following are

the usual sizes for oval boilers, with the way of cutting the stuff: 2 gallons, 2 single lengths and piece, 2¼ in., depth, 8½ in.; 2½ gallons, 2 single lengths and piece, 3½ in., depth, 9 in.; 3 gallons, 2 single lengths and piece, 5 in., depth, 9 in.; 3½ gallons, 2 single lengths and piece, 7 in., depth, 9½ in.; 4 gallons, 3 single lengths, depth, 9½ in.; 5 gallons, 3 middle lengths, depth, 10¾ in.; 6 gallons, 3 double lengths, depth 12 in. These measures of capacity are only to be taken as approximate. Fish kettles are not stated as holding so many gallons or quarts, but run by numbers, as Nos. 1, 2, 3, and so on; the smallest size made is 2 single lengths cut 5 in. deep, and they may be made up to any size required, as follows: 2 middle lengths, 5½ in. deep; 2 double lengths, 6¼ in. deep; two 20 in. lengths, 7 in. deep; 4 double breadths, 8½ in. deep; and so on. It will be seen that these articles are sized to cut the stuff out nearly full, thus avoiding waste and simplifying the remembering of sizes. In the making up, all the directions previously given for the saucepan apply equally to these articles as far as "wiring."

*Turning and Shaping.*—In turning and shaping, several ways may be adopted; they may be turned in the roller to a smaller circle than would be found necessary if rolling round a saucepan (see Fig. 7); the part A is then pressed against the bench to flatten it in sufficiently; this releases the part B, which is flattened in the same way; this brings the article to the same shape shown in Fig. 8; it must then be placed on a stake, and the part C rounded in a little till D and E meet, when it can be grooved together and the shaping finished, when it should be as Fig. 9; if there are two seams, they should be at the two ends A and B; if four, they must be as A, B, C, and D. It is important to get the seams of these oval articles in the proper position; that is, supposing the sides are parallel. A line drawn from the seam at one end, parallel to one side, should pass through the other seam. Fig. 10 shows seams in wrong position, but exaggerated for clearness; it will be seen by the dotted lines where the seams should be; of course, if these end seams are wrong, the side ones will also be wrong (this refers to articles in four pieces). Another method that is adopted—especially where there are no rollers—is to work the bodies into shape on the block by placing the wired part over a hole, and striking it with a block hammer, commencing at the ends and then the centre; they can also be bent on the former.

*Drawing Patterns.*—To draw the pattern of any oblong with semi-circular ends, proceed as follows (see Fig. 10 A): Draw a line, A B, of any length longer than the longest diameter of the article, and through the centre of the line, and at right angles to it, draw another line, C D, of greater length than the shortest diameter. From the point of intersection of these two lines, set off F and E, equal to half the length of the pattern. From F and E, with radius equal to half the shortest diameter, describe the arcs H and G, and with the same radius, from G and H, describe circles, or arcs of circles, I J K L and M N O P. Produce diameters R S and T U through each circle parallel to C D; two straight lines joining them and touching the circumferences of the circles at ×, ×, ×, ×, complete the figure. In all patterns cut the true pattern first and allow for fold; turn up, wire, or lap afterwards. The edging, putting on bottoms, soldering, etc., will be much the same as previously described. I might remark here that it is rather difficult to turn up the edges of the bottoms in the jenny, as the sides being straight, they have a tendency to run out of the machine. The handles can next be put on; some have swing-bail handles and ears, some end handles.

*Covers.*—The covers next call for some explanation; the articles being oval, the rim that would do for a saucepan will not do for a boiler or fish kettle, because if flattened at the sides it would rise, and so not touch the body at that part. Some get over the difficulty by making the rims perfectly straight and tacking them very slack, and throwing off a wide edge; but this is not workmanship. The way to make them is as follows: let us suppose Fig. 11 to be a plan of the top; the parts of the rim from A to A and from B to B must be cut straight, and the other parts cut from the flue rim; and in tacking the rims they would have to be tacked as follows: one straight piece would be laid on the tacking-board along the straight line, and then a curved piece tacked to it, following the curved lines; draw this over to the curve on the left side of board, take another straight piece, and lastly the other curved pieces; it would then look like Fig. 12, and when folded and turned round, would be tapering inwards all round, and when edged laying level round the wire.

*Cutting out Covers.*—In cutting out the covers for oval goods, it must be noted that an allowance must be made different from that of round covers. In allowing for a round cover, there must of necessity be the same allowance for hollowing all round extra to the size of the rim, or it would not be a round cover. But in the case of an oval it is different: it is found in practice that in hollowing up an oval or oblong the sides contract, as it were, and that if extra allowance were not made at the sides, the hollowed up cover if laid upon a flat surface would leave at the side a space of about ⅜ in. from the table or surface on which it was placed; to obviate this, so much extra must be allowed on the pattern, as shown by the dotted lines in Fig. 11; also in hollowing up, the ends must receive the most attention; the sides will want very little (comparatively speaking), and should be hollowed over a shallower place in the bench than the ends. My father used to say "Hollow up the ends well, and the sides will look after themselves." The remainder of the process for the cover will be the same as for saucepans.

*Other Straight-sided Work: Water Pots, Boiler Fillers, and Toilet Cans.*—Water pots are usually round, though there are several registered designs that are oval in shape; boiler fillers are round, and toilet cans oval (see Figs. 13, 14, and 15); and notice difference. Fig. 13, the water pot, is round, with a hollowed top, longish spout with a rose at the end, cross and back handles. Fig. 14, the boiler filler, is round, with hollowed top, cross and back handles, but with a short spout fixed higher up the body, and with a bent nozzle. The toilet can (Fig. 15) is oval in shape, cross and back handles, with hinged cover, and a spout similar in shape and position to the boiler filler. So much for their shapes. Now a few words as to construction:—Each is made in varying sizes—the toilet can and boiler filler in about three or four; water pots in perhaps a dozen. Cut as in the previous example, as full out of the stuff as possible, as follows: Water pots, half a single, 14 × 5; half a middle, 15 × 5½; half double, 17 × 6¼; half 20, 20 × 7; middle in halves (middle plate cut in two pieces, 17 × 7½), and double in halves; two singles, two middles, and two doubles, and so on. Boiler fillers and toilet cans usually only the three last sizes. The marking-out, cutting, and notching will be the same as previously described; then, supposing there were six in number being made, which would be twelve pieces of stuff, six of them must have a hole cut in them for the spout; find the centre, and draw a perpendicular line through it from top to bottom, then two-thirds from the bottom (for toilet cans and boiler fillers), and one-third from the bottom for water pots is the proper position. Punch a hole with a large hollow punch, and flatten down. Some punch a hole and a half.

*Wiring Water Pots, etc.*—This class of articles are wired differently to those just described. They are what is called "sunk-wired." Figs. 16 and 17 will show what the difference is. This necessitates the bodies being grooved together in a different way. Instead of the folds for the wiring being uppermost on the tool, it must be turned down, so that when the wire is sunk it will be on the right side—the exception to this is when the grooving of the seams is to be inside, in which case proceed in exactly the way described for examples already given. The object of sinking the wire is for convenience in soldering on the tops. The wire can be sunk as it is put in by wiring over a suitable size crease in the crease-iron, or it can be plain wired first and then sunk, either in the jenny or crease-iron; turning, seaming, edging, etc., as before described. After the bottoms and studs are put on, the next thing will be to make and put on the back handles. Fig. 18 shows the shape of the flat pattern; Fig. 19 the flat pattern of the boss for same. The boss is bent on the beck iron or in the boss former (Fig. 6), which saves a lot of time in making up a lot.

*Handles.*—Handles for water pots are wired differently to those for toilet and boiler fillers. In the two latter the wire is cut off at the ends as short as possible; but in the case of water pots it is left out at the large end an inch (each side, of course). Fig. 20 shows the handle bent round into shape, and with the wire bent in position for putting on to the can. To put them on, mark a central line between the two seams, and punch two holes with an awl—one each side of the line, and the width apart of the handle. Push the wires through, and draw them tightly over the wired edge of the pot, and nip close with the flat-nose pliers. The bottom part is then riveted and soldered, and the iron just drawn across at the top part.

Toilet cans and boiler fillers have the back handles riveted on. They are first tacked at the top along the wiring of the cans, and then two rivets are put in the top part and one in the bottom, and the bottom part soldered. All back handles are "sunk-wired," and all have bosses, which are soldered in before they are put on to the cans, and all have thumb-pieces. Figs. 21 and 22 show flat pattern of same, and bent into shape.

Particulars of spouts, top, covers, roses, etc., will be given in my next paper on the subject. Sufficient has been said here to employ the mind and hands of each who reads these articles until the next of the series appears. The illustrations to which reference has been made above will be found grouped together on the next page on a sufficiently large scale to show very clearly the mode of procedure to be followed by readers who wish to be sheet-metal workers.

Fig. 1.

Fig. 2.

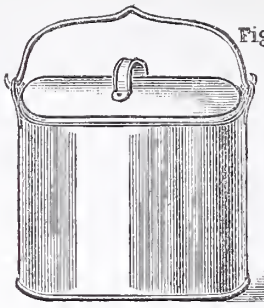


Fig. 3.

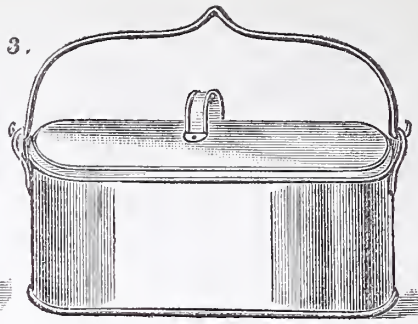


Fig. 4.

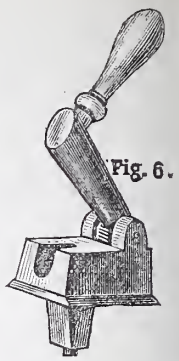


Fig. 6.

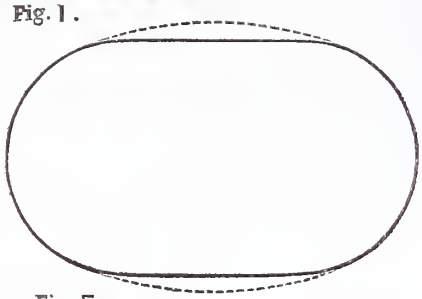


Fig. 5.

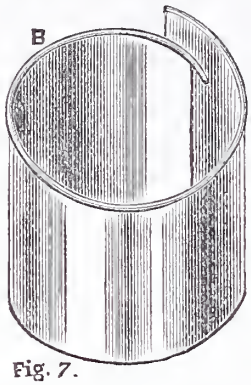



Fig. 7.

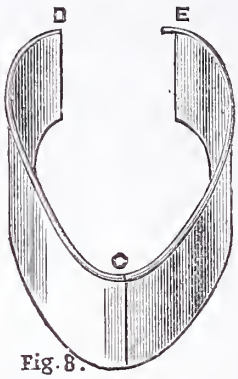



Fig. 8.

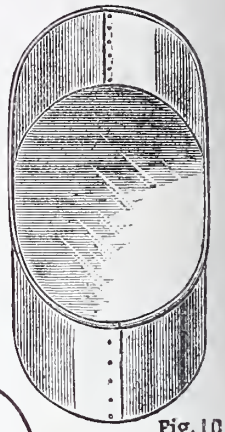


Fig. 10.

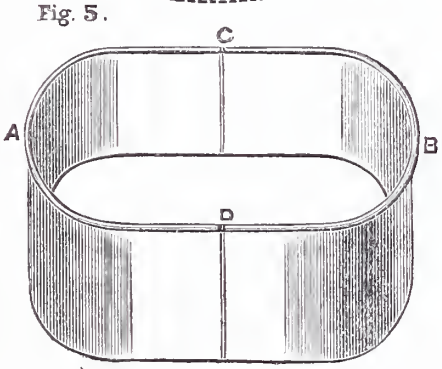



Fig. 9.

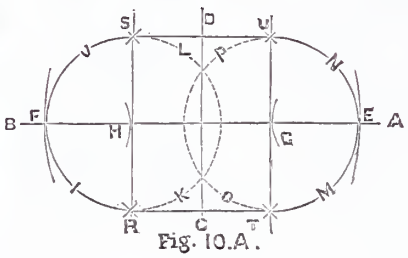



Fig. 10.A.

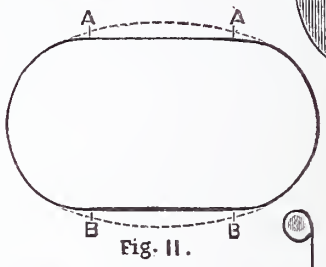



Fig. 11.

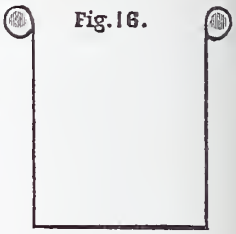


Fig. 16.

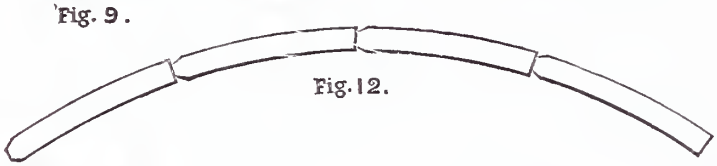


Fig. 12.

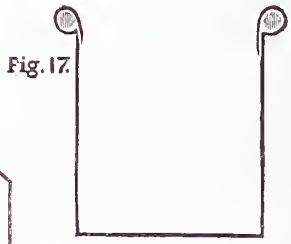


Fig. 17.

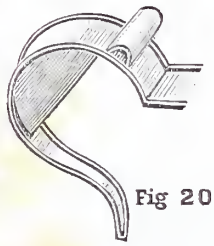


Fig 20.

Fig. 18.

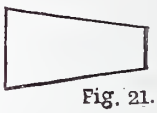


Fig. 21.

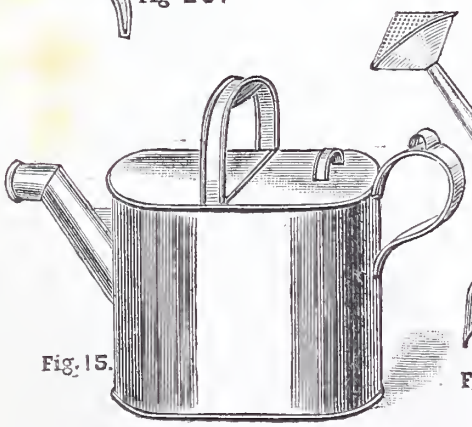


Fig. 15.

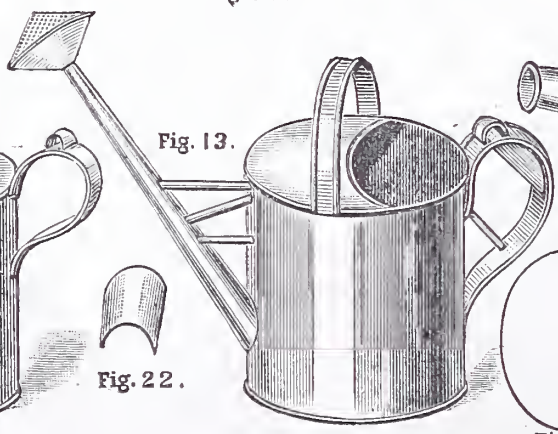


Fig. 13.



Fig. 22.

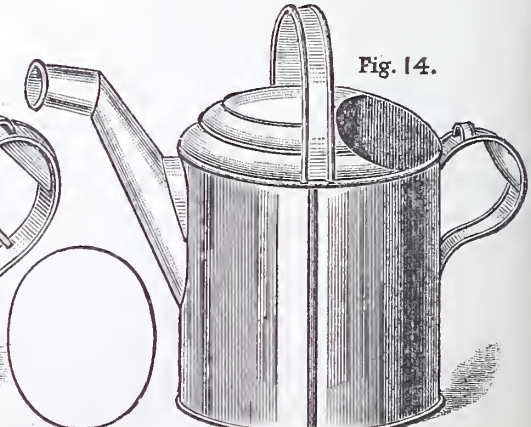


Fig. 14.



Fig 19.

Fig. 1.—Round Camp Kettle. Fig. 2.—Wire Bail Former. Fig. 3.—Oval Boiler or Camp Kettle. Fig. 4.—Fish Kettle. Fig. 5.—Proper Shape of Kettles. Fig. 6.—Boss Former. Figs. 7, 8, 9.—Shaping of Boilers, etc. Fig. 10.—Sketch showing Seams in wrong Place. Fig. 10 A.—Diagram of Pattern for Long Boiler with Rounded Ends. Fig. 11.—Plan of Bottom to illustrate Directions for cutting Lines. Fig. 12.—Sketch of Rim tacked together. Fig. 13.—Water Pot. Fig. 14.—Boiler Filler. Fig. 15.—Toilet Can. Figs. 16, 17.—Sections of Wiring. Figs. 18, 19.—Sections of Handle and Boss. Fig. 20.—Handle Shaped and ready for Fixing. Figs. 21, 22.—Thumb Pieces Flat and Shaped.

# NOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

## TIES AND LASHINGS.

EDDING KNOT, OR TIE—CHAIN KNOTS—CROSS LASHING—NECKLACE TIE—PACKING KNOT—FINISHING OFF AND WHIPPING — NIPPERING, OR RACKING—WEST COUNTRY WHIPPING—SECURING BLOCK TO ROPE—CATSPAW.

IG. 68 is a "Wedding Knot" or tie, used r fastening together the eyes at the end of wo ropes. It is made by passing rope-arn or marline through the eyes backwards nd forwards until it is strong enough; it s then fastened by taking several turns ound the middle and fastening the ends vith a reef knot. This forms a sort of inge between the ropes.

Fig. 69.—"Chain Knot," for lashing to a par. A clove-hitch is first formed round he spar, and as many single hitches as equired are then made. It may be finished ff with any secure knot.

Fig. 70 shows another and better way of naking the "Chain Knot." In this case an verhand knot is formed at each turn, and onsequently it is much more secure than Fig. 69. This is used for bending yachts' sails to the gaff. As each turn forms a knot if the cord parts, the remainder holds firm, and does not necessarily come adrift, as it would be almost sure to do if fastened as in Fig. 69.

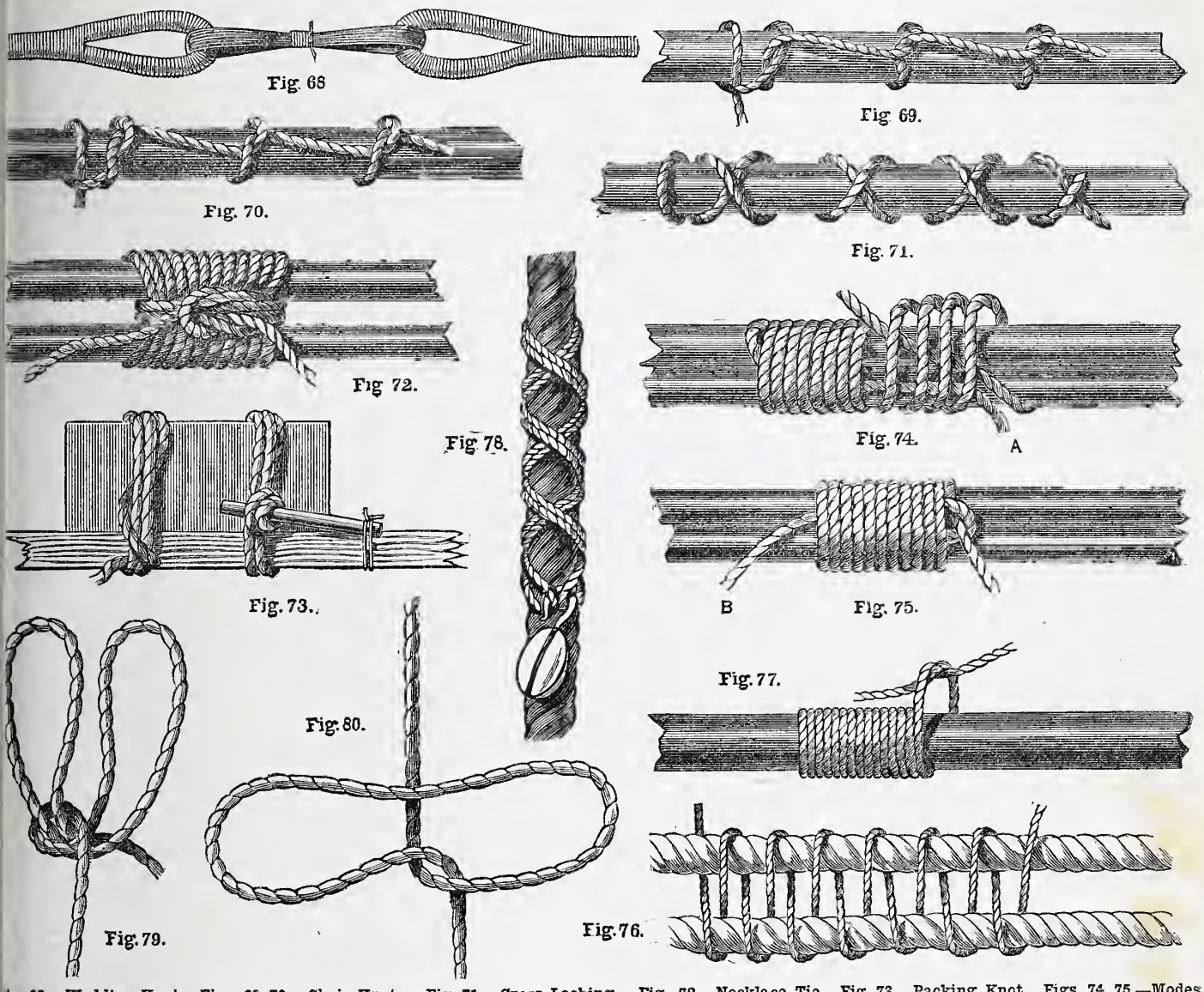
Fig. 71 is a "Cross Lashing," used when a lever is used to a rope. After several turns round the rope, the lashing is crossed round the lever and fastened with a reef knot. All these lashings are used when several men are required to haul on large ropes at the same time.

Fig. 72 is the "Necklace Tie." Several turns are taken round the spar to be joined, then two turns round the lashings, and it is secured with a reef knot. When this is used as a lashiug for shearlegs, the crossing of the two legs puts a strain on the knot, and effectually secures it. For this purpose it is called a Portuguese Knot

Fig. 73 is a "Packing Knot," used for securing large pieces of timber together. It is much employed in the neighbourhood of stone quarries in holding the blocks of stone on to the carriages on which they are taken to their destination. Fig. 73 represents a block of granite secured to a trolley with packing knots. Two or three turns are made somewhat loosely with cordage round the block and its carriage; a stout piece of wood is then inserted under the coils, and twisted round until all the slack is taken out and the cordage is taut. The end of the lever is then secured with twine to the side of the carriage, as shown in the right side of the figure. The other lashing is supposed to be already for tautening up. We have often to lash two things together where an external knot to finish off with would be objectionable, as it would spoil the smoothness and neatness of the work—as, for instance, in whipping the two parts of a broken fishing-rod together.

Fig. 74 shows one very common method of finishing off whipping without showing any knot. In commencing, we lay one end forward, as shown at A, then pass the other end round and round a sufficient number of times—hauling taut as we go; three or four loose turns are now made, and the end passed under them backwards; these are worked down into their places, and when the ends are hauled taut and cut off the job is completed. The end A need not come so far as shown in the figure, but may be hidden under the coils.

Fig. 75 is another method of accomplishing




**ig. 68.—Wedding Knot. Figs. 69, 70.—Chain Knots. Fig. 71.—Cross Lashing. Fig. 72.—Necklace Tie. Fig. 73.—Packing Knot. Figs. 74, 75.—Modes of Finishing and Whipping. Fig. 76.—Nippering. Fig. 77.—West Country Whipping. Fig. 78.—Securing a Block to a Rope. Fig. 79.—Catspaw. Fig. 80.—Ditto, Commencement.**

the same end. Instead of a single end, as in the last case, a bight of the seizing stuff is laid along the part to be whipped, and the turns passed over it; when these are completed the end is passed through the bight, as at A. The end B is now hauled upon, which has the effect of bringing the bight and the end of the rope snug under the coils. We have now two loops interlacing at the centre of the work, and which cannot come undone. When the ends A and B are cut off close to the turns, the whole is as fair and smooth as one can wish. This is the method I generally adopt myself in making fishing gear.

"Nippering," or "Racking," is shown in Fig. 76. This is a method of securing two ropes together with cross turns; these are hauled taut, jambing the ropes together, and they are further secured by round turns over all, with a reef knot at the ends.

Fig. 77.—"West Country Whipping." Whether it was invented in the West or not I do not know, but I certainly never heard of it until I came to reside in the "west countrie." It is an excellent method, and deserves to be oftener practised than it is. Bring the middle of the material used under the part to be whipped, raise the ends up and tie an overhand knot, lower the ends and tie another underneath; continue tieing a single knot above and below alternately, finishing with a reef knot—or a round turn or two may be taken and the ends secured, as in Fig. 65; but a reef knot is the most usual way of fastening off this whipping. This is not quite so neat-looking a method as Figs. 74 and 75, but it is very strong and trustworthy, and is an excellent way of fastening large hooks, such as those used for cod or conger, on to a line.

Fig. 78 shows the way a block is often secured to a rope with a selvage strop. The middle of the selvage is placed against the rope, and cross turns taken until the bights come together, when the loop of the block is put through them.

A "Catspaw" (Fig. 79) is used for attaching a rope to the hook of a tackle. Fig. 80 gives the manner of commencing it. A loop is first made, and laid over the standing part so as to form two bights; these are rolled over two or three times from you, and the hook inserted in them. When the standing part is hauled upon, the hooks take the form shown in Fig. 69, and will not slip.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 56.—The "Electrician" Primers.

The "Electrician" Primers are published by the "Electrician" Printing and Publishing Company, Limited, Salisbury Court, Fleet Street, E.C. They are a series of tracts, if I may be permitted to use the word in reference to them, or helpful papers on electrical subjects for the use of students and general readers, and they are comprised in two volumes, each in a paper wrapper, and sold, each, at 2s., or 2s. 2d. post free. Of the two volumes, Vol. I. deals with theory, and Vol. II. with practice; but before proceeding further, I may add that the volumes may also be had in strong cloth bindings at 2s. 6d., or 2s. 9d. post free, and single primers at 3d. each, or 3½d. post free. It is not possible for me to give a list of the primers in detail, as it would take up too much space; but lists of the subjects treated may be easily obtained on application to the Company, whose address is given above. In Vol. I. there are twenty primers devoted to a digest of such subjects as Ohm's Law, Electrolysis, Influence Machines, Thermopyles, etc., and various electrical instruments, as the Galvanometer, the Wheatstone Bridge, etc., the methods and modes of making some of which have been described in these pages. In Vol. II. there are eighteen primers relating to the management, principles, and uses of various machines, including Submarine Cables, the Telephone, Dynamos, Motors, Transformers, Lamps, Meters, etc., and the action of the electric current in deposition, welding, etc. The object of these primers, which are clearly written and all that can be desired in the form of enunciation and explanation, are, to quote from the preface to each volume, "to briefly describe in simple and correct language, the present state of electrical knowledge. Each primer is short and complete in itself, and is devoted to the elucidation of some special point or the description of some special application. Theoretical discussion is, as far as possible, avoided, the principal facts being stated and made clear by reference to the uses to which they have been put. Both volumes are suited to readers having little previous acquaintance with the subject. The matter is brought up to date, and the illustrations refer to instruments and machinery in actual use at the present time."

### 57.—The Silico and Club Black Enamels.

Some useful specialities, possessed of more than ordinary value to the amateur, have been recently produced and sent into the market by the Silico Enamel Company, 97, Hampstead Road, London, N.W., the most important, perhaps, being the Silico Enamel itself, from which the Company takes its name. This is a thin, liquid enamel, which is easily applied to any polished surface and bright metals of all kinds, and when applied in the proper manner, according to the instructions given and under the conditions named, forms a smooth and transparent film on the surface of the metal which not only protects it from rust or tarnish, but makes its original brilliant appearance to be preserved and maintained unchanged under any circumstances. All cyclists possessing good machines, of which parts are nickel-plated, know how difficult it is to preserve the lustre which these parts present to view when the machine is first sent out from the works or the depôt for sale, and they will accordingly welcome this preparation, which will save them an infinity of labour in rubbing up the bright parts and keeping them in a presentable condition. Further, it is useful for all metal articles or ornaments—be they what they may—that are exposed to the action of the weather. Equally good and desirable for cyclists is the Club Black Enamel, which is suitable for application to all metal surfaces requiring japaning, whose enamel has become chipped or injured in any way, and which it is needful to renovate. The Club Black Enamel is hard, bright, and durable, dries quickly—that is to say, in an hour or thereabouts—without the intervention of heat, as in the case of enamel, which requires to be stoved, and presents not only a hard but a brilliant surface. In fact, it is a "special hard drying" preparation, and this is pointed out and emphasised on the label of the jar, on which the words, in inverted commas, are printed in red. Both of these articles seem to be making their way in public favour very rapidly. Samples of either, with full directions for use and brush for application of the enamel, may be had, in bottles or stone jars at 1s., from the wholesale agents, Messrs. W. B. Fordham & Sons, Limited, York Road, London, N., and at all cycle depôts, ironmongers, stores, etc. In putting on the enamel care must be taken to move the brush in one direction only, and not backwards and forwards.

The Editor.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Artificial Stucco-Work.—A new idea, which will be welcomed by amateurs anxious to decorate their ceilings without calling in the aid of the builder or plasterer, has been suggested in a trade journal by Mr. L. Bridger, of Old Manor House, Walton-on-Thames. In place of real stucco, he uses ordinary wood mouldings, about 1¼ in. deep, costing about ½d. per foot, which are mitred together at the joints, and pinned in place with French nails driven into the joists. Plaster-of-Paris is then rubbed into the joints and interstices, and painted white, the whole being then whitewashed. A very rich effect is thus produced if a sufficiency of moulding be used. The *Paper Record* points out that the use of a substance resembling papier maché, which permits of being moulded so as to form circular or curved designs, was not unknown in the reign of Queen Elizabeth, being finished off much in the same way as the wooden mouldings above described.

Spontaneous Combustion on Board Vessels.—Ingenious minds have a promising field in the way of providing against spontaneous combustion on board ship. The recent serious fire at sea on board an Allan Line steamer, which was not extinguished until the vessel had been taken into dock at Liverpool, shows that, despite every reasonable care, certain cargoes, such as cotton, are dangerous. That this material—rags, wool, etc.—will spontaneously ignite under certain circumstances is well known, but in what way this can be prevented is still uncertain. Even the means now adopted to extinguish such fires are unsatisfactory. On board the steamer in question, which was well provided with steam jets in the hold, the steam was found only to check the progress of the fire. There are thus two points for consideration—how to prevent, and how to absolutely extinguish such fires in cargo. Some apparatus which would utilise carbonic acid gas under pressure would probably meet the necessities of the case as regards putting fires out; but any one who can devise a means of preventing any such necessity from arising will earn the gratitude of, and, it may be hoped, something more substantial from underwriters and ship-owners.

Fire Extinction on Board Ship.—The comparative failure of steam jets to extinguish the fire in the hold of the s.s. *City of Richmond* has drawn public attention to the necessity of devising some effective means of dealing with the spontaneous combustion of cargoes. Various propositions have been laid before shipowners—notably one by Professor Lewis, in which the release of carbonic acid gas stored in breakable vessels is the principal feature. The whole matter, however, requires the exercise of much thought and ingenuity. The heat generated by combustion is relied on by Professor Lewis to set the carbonic acid gas in action, but captains of vessels do not seem to think this sufficiently sure. A simple apparatus, worked from the deck, which would at once discharge the gas if needed seems to be wanted.

New Games, etc.—Two things are remarkable in connection with new inventions in this line—the great difficulty in getting one to "catch on" with the public, and its immense success, financially, when that desirable end has been obtained. A similar remark applies to toys, large fortunes having been made by penny articles of this class sold in the streets. Both new games and new toys are just now in demand—cheapness of production being essential.

Perpetual Electric Clocks.—A Leeds scientist states that electric clocks can be constructed without the aid of batteries—as generally defined—by simply burying the plates in the earth, which would otherwise be excited by an acid solution in an ordinary battery, these, of course, being connected to the driving mechanism in the ordinary way adopted in electric clocks. The idea is very fascinating, and many will feel inclined to experiment in the same direction. As the statement has appeared in technical journals of repute, it is probably based on fact; but we have not ourselves had an opportunity of testing the apparatus described.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Constructive Strength in Metal Work.**—An Engineer writes:—"I have been considerably amused in reading an article in Work of May 30th, on "Constructive Strength in Metal Work," by Mr. Harland (p. 162), and it has set me wondering where he has got his information from, as much is contrary to all ordinary practice. Perhaps you or he could inform me in the column 'Shop.' In speaking about girders, he says: 'Sometimes a second though smaller flange is made at the bottom.' I have always found that wrought iron and steel (rolled) girders have equal flanges, and that cast-iron ones have the flange in tonsion two or three times the area of the one in compression; in ordinary girders the bottom flange is the largest, thus not I He also mentions that sometimes in bridges the top flange is straight and the bottom arched, while the web is pierced. If he were to look at any such, he would find that the so-called girder was merely an ornamental casting to give a finish, that there were C.I. or W.I. girders (most likely arches) to take the weight, and this was bolted to the face of the outside one, and the bottom flange was merely to stiffen the web or spandrel. Later on, he talks about a girder being more weakened by holes in the web than the flange. So far as I have ever heard and done, the calculations for girders are taken on the basis that all shearing is borne by the web, and all bending by the flanges. The webs are always far stronger than necessary, *according to calculations for shearing*, for constructive reasons; so a hole does not make any difference, excepting a very large one, or, perhaps, at the ends or under a concentrated load where the shearing force is greatest and the excess of area the least. The bending place or moment in a girder can be resolved into a tension in one flange, and a compression in the other; and usually these are calculated closely; so any hole reduces the area and puts more stress on the rest, and thus diminishes the strength of the flange. Further on he says: 'The broader the base, the lower the centre of gravity will fall.' Will Mr. Harland kindly explain how the method of support affects the centre of gravity? I have always understood it was the point in which the whole weight may be supposed to act, irrespective of the means of support. In speaking of the A support for lathes, etc., he says that alterations of length, due to ehange of temperature, are alike on both sides; are these so much as to affect *anything* besides a sum in expansion by heat for some schoolboy? I know that bridges of 40 ft. to 50 ft. span, designed by first-class engineers, have often no allowance made for it. I should like to hear what Mr. Harland has to say, as, if he is right, I shall have to alter my methods."

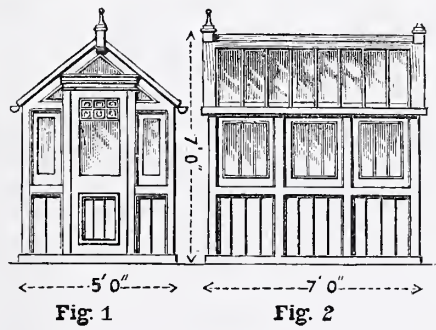



Fig. 1 Fig. 2

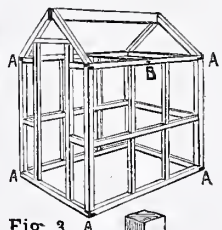



Fig. 3

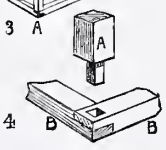



Fig. 4

Span Roof Greenhouse.

**Cycloidal Curves.**—An Old Edisonian writes:—"I cannot endorse the statement of C. E. in his reply to C. C. (*New Cross*), pages 237-8 of Work, Vol. III. The speed of any point on the surface of a revolving disc is proportional to its distance from the centre, and to say that the lower part of any wheel travels more slowly than the upper when rolling in contact with a plane surface, is an error of judgment. The fact that the path of any point on the periphery of a rolling wheel takes the form of a cycloidal curve, proves nothing beyond the simple fact that, although the wheel revolves on its axle it does not do so in a circle. Now let a wheel or dise be rotated upon its axle, and at the same time moved along a plane surface, but without actually being in contact with it, and at a speed corresponding to that at which it would move if it were rolling thereon, what becomes of C. C.'s contention? Cycloidal curves would be formed from any point of its periphery in precisely the same way, but the under edge of the wheel must move at the same speed as the upper, no matter what that speed might be." [The fact of your not being able to endorse the accuracy of C. E.'s reply does not affect its soundness. Will you demonstrate, as clearly as C. E. does, the argument you adduce to controvert the conclusion he arrives at?—Ed.]

### II.—Questions Answered by Editor and Staff.

**Model Electric Lights.** — J. H. (*Wolverhampton*).—The carbon plates for the small box battery described in Work, November, 1890, should cost about 4d. or 5d. each. Try J. Steen & Co., or Mr. A. J. Hartill, 53, Worcester Street, in your own town. If you fail these, you can have them sent by post from Mr. Bottone direct, or from any other dealer in electric sundries.—G. E. B.

**Electric Coil.**—J. E. W. (*Burslem*).—A series of articles on Coils is now in the Editor's hands. The last of the series will deal with medical coils, and you will learn from it how to construct a coil with several powers. For six powers you will require five separate lengths of wire in the construction of the secondary coil, the finish and commencing end of each length being brought out to a separate stud on the base of the coil. Or you may use one length and one size of secondary wire if you bring out a loop of the wire at the end of each fifth layer; twist the wire into a cord, and fasten each bared loop to a separate stud. Then, one wire from the primary to represent the first power, and one each from the five sections of the secondary, will form the six powers. I do not know of a book dealing with electric coils generally. The articles I have written for Work will give you much information on the subject.—G. E. B.

**Span Roof Greenhouse.**—T. N. (*Dalston*).—I give sketches of front elevation, Fig. 1; side elevation, Fig. 2; general view of framework, Fig. 3, and detail of joint at angles A, A of above. This makes rather a short doorway, but that can easily be altered in the making. I should make the sills of 2½ in. by 4½ in. oak, the four corner posts of 3 in. by 3 in. yellow, and the rest of 3 in. by 2 in. yellow. Either of the sashes along the sides can be hung for the purposes of inlet ventilation. And the space over door at one end, and the gable end of the other for outlet ventilation. Do not attempt to open the sashes at the top, for this not only entails a great deal more work, but it is a constant source of annoyance, unless it is done very nicely, and by putting the tie bolt through the top rails of frame-work, as shown at B, Fig. 3, you do away with the necessity of any intermediate rafters. The sashes need only be beaded on the outside, but do not put any beads at the bottom of sashes or match-lining in the front, but simply weather the rails to allow the water to run off; the match-lining being thinner than the sashes will allow of your beading them on both sides. The top rails of top sashes are mitred together, and a piece of ridge roll bird's-mouthed over them. The space in "Shop" is wholly inadequate for a thorough description of a greenhouse, but you will find the matter exhaustively treated in Nos. 12, 14 and 15, Vol. I., under the heading of "The Tenant's Greenhouse."—E. D.

**Watch Springs.**—Clips.—(1) Try the effect of cooling between two plates of iron smeared with oil; if after this they go wavy, your only course is to set them true by careful hammering. (2) It depends on size partly, but generally they are heated in a charcoal fire, and hardened in oil and blazed off. You can get spring steel of Pfiel, St. John's Street, Clerkenwell.—J.

**Whitening Stains.** — Anxious. — When old stained plaster work or woodwork is coated with whitening-wash, the stains invariably work through, no matter if you give it a dozen coats. The why and wherefore is a lengthy matter, and no practical advantage would accrue to you to discuss it here. To remedy the trouble, remove all old whiting, and coat the stains with oil paint, or try a wash of plaster-of-Paris and water—the latter *may* answer, the former is *sure* to. Have you tried Alabastine?—F. P.

**General House Repairs.**—A. F. S. (*Hackney*).—There is a very useful waistcoat-pocket price book, published by Spon (London), which I think would suit you, but I should advise you to call and see them, or else write for catalogue.—E. D.

**Aquarium.**—A New Subscriber.—An article on the construction of an Aquarium appeared in Part 31, Vol. I. of Work. Should this be too elaborate for your purpose, you could leave out such details as you did not desire. The instruction for any part of the design will hold good.—C. M. W.

**Sewer Gas.**—E. T. (*Burntcliffe*).—It is impossible for me to give you a test for sewer gas unless I have a rough plan and a slight description of your system of drainage, as there are so many ways by which sewer gas can find its way into a house. The ways it can do so are, for instance—1. Through defective joints, either caused by bad workmanship, settlement, or general decay. 2. Through any overflow, waste pipe from sinks, baths, gutters, etc., which, although so-called trapped, are in direct communication with sewer. 3. If there is no proper interceptor trap cutting off the house drainage from the main sewer. 4. If the house drain and soil pipes are not subject to a constant current of fresh air by means of inlet and outlet ventilators. 5. If all traps that are in the least way subject to syphonage are not relieved by an air pipe, etc. etc. I could continue for some time giving examples of how it can get into the house; but how to test when and where it gets there is useless to speculate upon without being more fully informed as to the state of things at present. There are several ways of testing if a drain leaks; by putting some nauseous or strongly smelling chemical down the drain by means of the w.c., and seeing if it can be detected anywhere about the house. I have heard of a plan by which a chemical strongly resembling the smell of cats' urine is put into the drain, and it is then left to the delicate (or otherwise) sense of smell of the domestic feline to trace the point of escape. But all these means are purely theoretical, and give nothing else but dissatisfaction, and I should certainly not think of recommending them. The remarks I have made above as to the ways the gas can enter a house may appear to you too technical, but they are not so; for if you find them difficult to understand, I feel convinced that you would not be able to give me a sufficiently clear description to enable me to be of any service to you. If this is so your only way is to call in an *expert* in sanitary matters, and let him make an examination, and give you a specification of what is necessary to be done to put your premises in thorough sanitary order, for which he should not charge you more than £2 2s. If, on the other hand, you feel confident you can give me a clear description, I shall have much pleasure in telling you how to go about finding any defects there might be, and the cheapest way to remedy them when found. But I must say this, that the appliances necessary to make a thorough examination and test are, in many cases, more costly than paying an expert to examine the drains and remedying the defects afterwards. I should have liked to have given a description as to testing a drain as it would interest so many readers; but, in order to do so, I should have to lay down a purely imaginary system of drainage for example, and perhaps this description would be a very long way from meeting your case.—E. D.

**Carpentering.**—T. G. W. (*Clapham*).—I am not aware of any book suitable for an amateur that is in any way superior to the various articles in Work. Of course, magazine articles vary; some are suitable for well-advanced students, and some for young beginners. It is beyond my province to encourage T. G. W. to hope for a weekly column—if it ever be done it must be graduated better than T. G. W. suggests. I can only advise that you watch the advertisements in local papers. My classes are at the N.W. end of the town.—B. A. B.

**Draughtsman.**—G. B. (*Poplar*) wishes to know the qualifications of a draughtsman, and asks for advice as to books and classes. One qualification of a draughtsman is undoubtedly the ability to make a drawing, more or less finished and elaborate in style according to the class of work he has to deal with; another, and in most cases a much more important qualification, is that he shall understand what he has to draw. For the draughtsman is generally called upon to invent what he draws; if he be an arcbitectural draughtsman called upon to design, say, such a comparatively simple thing as a sash-window, most likely the only data given him to work from will be the height and width of the window; it is for him to decide on the sizes, shapes, and construction of the window-frames, window-sashes, architraves, thickness of glass, and all other details necessary to make the working drawing complete. If he be a mechanical draughtsman called upon to design an iron roof, probably all the requirements that will be put before him are that it shall cover so much ground, and shall be covered with corrugated iron or slates, as the case may be. It is then the draughtsman's duty to say what style of roof-principal shall be adopted, the size and material of every member—rafters, struts, tension-rods, tie-bars, purlins—with sizes and shapes of all joints and connections, as well as the sizes and strengths of the supporting columns. So that G. B. will see that draughtsmanship, or the art of drawing, is only one of the minor qualifications of what is generally known as a "draughtsman." Before commencing to make mechanical drawings (I assume from G. B.'s letter that he is a mechanical engineer), I would strongly recommend him to work through some small book of plane geometry—there are plenty published at 6d. which are suitable—and familiarise himself with the bisection of lines, drawing parallel lines, erection of right angles under various conditions, finding centres of circles, and other simple problems. A knowledge of these will save him much future trouble.

After this, let him make copies of simple mechanical drawings, so as to get accustomed to the methods of using the instruments and the uses of sections, plans, and elevations, conventional colours for different materials, etc. After a little of this work, he should make freehand sketches of some simple piece of machinery or joinery, measure it up, and figure the dimensions on his sketches, and from these dimensions try to make a proper working drawing. He will most likely find that the dimensions are not sufficient for his purpose; that although he has taken twice as many measurements as are necessary, he is still short of some that are absolutely needed to make an accurate drawing. Only practice can cure this, though the knowledge of the geometry above recommended will assist him in deciding which are the right dimensions to take. The first drawings should all be big and bold—not "finicky"—to full size or as big a scale as possible. Draw with strong lines, but, on the other hand, let the colouring be rather pale, except in such parts as are in section. Good lettering, or "printing," and general artistic finish to a drawing are very desirable, and in some drawing offices a necessity; but there are thousands of working drawings sent into the shops with the dimensions and particulars merely written on them in ordinary handwriting. I can recommend no better books than Cassell's Technical Manuals, which are advertised in WORK at the end of "Shop." "Drawing for Machinists," price 4s. 6d., is the one that will probably suit G. B. best. Crosby Lockwood & Co. also publish "Engineering Drawing," price 3s. 6d., one-third of which might be useful. If possible, try and attend a night class under some science and art teacher. —A. B.

**Life Buoy.**—W. J. C. (*Surrey*).—Write to Messrs. P. B. Cow & Co., Indiarubber manufacturers, Cheapside, London, E.C.

**Coal Vase.**—BLACK DIAMONDS.—If you purchase No. 36 of WORK, price one penny, you will find, on p. 571, particulars of how to make a cheap coal vase; also, if you refer to the Indexes of Vols. I. and II. of WORK, several other references will be found relating to coal boxes.

**Overmantel and Coal Vase.**—G. A. H. (*Islington, N.*).—Particulars of a simple, cheap coal vase were given in WORK, No. 36, p. 571. For overmantel designs procure Nos. 5 and 22 of WORK.

**Electric Lighting Replies.**—AN OLD EDISONIAN.—Thanks for your criticisms. The pages of "Shop," Section I., are open to you, or any reader, to question the accuracy of anything you light upon in WORK, and which may not seem quite clear. G. E. B. will reply to you through "Shop." In the meanwhile, reference has been made to his "copy," and in each instance complained of he wrote *Watts*, not "volts," so that it is a printer's, not an author's, error.

**Blunders in Replies.**—AN OLD EDISONIAN—The blunders noticed by you in my reply to J. C. H. (*Dublin*), on p. 172, are manifestly either slips of the pen or printer's errors. Of course it is most unfortunate that they should have got into print, but it is evident to all, except a mere tyro, that the word "volts" is a misprint for "Watts." The sentence should, therefore, read: "Your ten lamps, of 8 c.p. each lamp, will take 280 *Watts* of current to light them. Twelve lamps will take 336 *Watts* of current." No one in his right mind would think of running ten 28 volt lamps in series from a set of accumulators, as this would involve the employment of one hundred and forty cells in series at the least. In the next sentence but one of the reply, the mistake is repeated. It should read: "Multiply the *Watts* of current by the number of hours the cells are wanted; divide this by the voltage of the cells to be used, and you will then find the desired capacity of the cells to be employed." For instance, supposing we take twelve 8 c.p. lamps. These will take 3½ Watts of current per candle power; then $3\frac{1}{2} \times 12 \times 10$ will give us 336 Watts of current as being necessary to light the lamps. I think the querist wished to know the least number of cells he could use, and the longest time he could use them. Now, if he wished to use the lamps for a twelve hours' run, and the resistance of his lamp circuit is 18 ohms, the figures will be $336 \times 12 = 4{,}032$, $\frac{4{,}032}{18} = 224$ ampère hours as the required capacity of the accumulator cells. As the eleven plate E. P. S. cells have only a capacity of 220 ampère hours, I deemed it best to have the fifteen plate size, which has a capacity of 330 ampère hours. The merits of a reply in "Shop" can only be judged by comparing it with the question to be answered. These are sometimes of such a character, as to be calculated capable of puzzling a Transatlantic lawyer.—G. E. B.

**Brass Lacquer.**—J. K. W. (*Liverpool*).—A good golden-coloured lacquer for brass is described on p. 83, No. 58, Vol. II. of WORK. You will also find recipes for brass lacquers in "Shop" (see p. 28, No. 54, Vol. II. of WORK.) As a rule, it is cheaper to buy brass lacquer ready made by professional makers. A good cold lacquer for brass is sold by Messrs. J. & E. Hartley, 13, St. Paul's Square, Birmingham.—G. E. B.

**Insulating Compound.**—J. K. W. (*Liverpool*).—I cannot just now place my hand on any recipe for making an insulating compound of gutta-percha with other substances. Gutta-percha can be dissolved in bisulphide of carbon, chloroform, and ether, and the resulting pasty mass be employed as an insulating compound. Perhaps some of our readers can describe an insulating compound of gutta-percha with other substances.—G. E. B.

**Dry Battery.**—E. W. (*Euston Road*).—Dry batteries have been and are used for working portable medical coils, but I cannot say whether the dry battery described by F. A. (*Portsmouth*), on p. 174, would be suitable or not. The mixture appears as if it would work, but I cannot say anything about the constancy of such a battery. Perhaps F. A. will oblige us with his experience. If you wish to try the mixture, use it in cells made of thick sheet zinc. Canisters 6 in. in length by 3 in. in diameter are a convenient size.—G. E. B.

**Electric Bell Battery Repairs.**—C. R. (*Mayfield*).—I cannot recognise the battery from your description of it; possibly it is a dry silver chloride battery. If so, the wire coil is a silver wire, and this has been immersed in a paste of silver chloride, separated from the zinc by a canvas or cloth partition. The zinc must be cleaned and the silver chloride renewed. I have not a high opinion of these batteries, so should advise Leclanché or Gassner cells instead.—G. E. B.

**Electrotype Copy of Hound's Head.**—C. F. (*Sherborne*).—As you have modelled the head in clay, and have taken a copy of this in plaster-of-Paris, your course is quite clear. Get a copy of WORK for August 9th, 1890, and read therein the article on "Electrotype Copies of Busts." This will give you details of the process to be followed in getting an electrotype copy of the hound's head. Of course you have the plaster mould in two or more pieces. Soak them well in linseed oil, and bake them afterwards, to make the plaster insoluble in the electrotype solution. This should be done several times. The insides of the two halves of the mould must then be coated with blacklead, as directed in the article on "Blacklead and Blackleading," in WORK for October 5th, 1889. These must now be treated as directed in the article above mentioned to get an electrotype copy, and the two halves of this copy soldered together. If you meet with any difficulty, please let me know and I will advise you in "Shop." We do not send replies by post.—G. E. B.

**Fungus.**—E. G. P. (*London*).—The only remedy for the above is the removal of the cause. The causes are generally want of ventilation. Confined air without moisture considerably assists the fungus. Too much moisture will prevent its growth, but if dampness is combined with warmth, and without ventilation, it assists its growth; in fact, all kinds of stoves increase its growth if the parts are in any way damp. Linoleum or oil-cloth is frequently the cause of dry rot, by preventing access of air and retaining the damp. The best way to treat it is to cut out all the diseased timber, and substitute thoroughly seasoned material in place of same; ventilate the cellar, and lastly, but not least, thoroughly brush away all signs of the fungus; for one of its peculiarities is that the germs of the fungi are carried in all directions in a building where it shows itself, without necessity for actual contact between the affected and sound wood.—E. D.

**Gas Meter Index.**—C. C. (*Oxford*).—You will find this question fully answered on page 541, No. 34, Vol. I. of WORK, with the correction that where it says, in brackets, "bear in mind it would have to go right round to be 1·090," "read bear in mind it would have to go right round to be 1·000."—E. D.

**Iron Roof.**—PLUCK.—There is no doubt that galvanised corrugated iron, of at least No. 20 Birmingham wire guage and properly galvanised, is far preferable to black iron sheets for your purpose, and one great consideration in its favour is, that being corrugated this enormously increases the stiffness and strength of the sheets, consequently there are less intermediate supports required. This, I think, does away with the necessity of answering your other questions.—E. D.

**Cement.**—GLASIUS.—I think you will be able to succeed with plaster-of-Paris. If it sets too quickly, mix sugar with it; alum water used to mix it with makes it set very hard, or you might use Parian cement, which would not set so quickly. I am trying some experiments, and will let you know the result if you do not succeed, and will write again.—W. E. D., JR.

**Glass Silvering.**—ANXIOUS B.—You cannot have a cheaper method than that by nitrate of silver; and as you say you have read those described in WORK, you will, of course, have seen there are many things that would account for those in the trade being able to make and sell at a cheaper rate than an amateur can produce. To mention one obvious one, all their materials are bought in quantities, and, therefore, very likely at less than half price; and it is quite right that it should be so. They have to live by their trade. A true amateur does things for the love of making and the knowledge gained, and not to compete with the trade, nor to make a profit on his work; in fact, in that case, he ceases to be an amateur. If, therefore, you want to make one or two cheaper than you could buy them, you will find it cannot be done; but if, as I said, you wish to do it for the love of it, and the knowledge gained, try the recipes given in WORK.—W. E. D., JR.

**Bicycle Enamel.**—W. L. (*No Address.*)—Get enamel paint, any colour, from an oilman. State what it is for. The enamelled plates used in advertising soaps, etc., are baked in an oven; the process is patented. Stoving enamel for bicycles would stand under water, but you would not get it white. You cannot melt the edges of glass so as to make watertight joints. Join the edges with cement used for glass work; cement of Pompeii will do.—A. S. P.

**Stains out of Books.**—BOOKWORM.—You ask how to take a water stain out of a book. I am very sorry that I cannot tell you how to do this; a stain halfway up every page is a serious affair. I am afraid your book is hopelessly spoiled. There are a few things you might try, but you would have to take the book to pieces and treat every leaf separately, and, of course, such a procedure entails no small degree of labour, besides the chance of making matters worse through the want of experience in your manipulation. A very weak solution of oxalic acid might be used as a bath, every leaf placed in separately, and allowed to remain for some time, and afterwards placed between sheets of blotting to dry. I would really advise this BOOKWORM not to attempt this. I am sure he will only make matters worse.—G. C.

**Engine Valves.**—PASSIL.—In No. 110, Vol. III. of WORK, and page 89, you will find a diagram and drawings of a plain slide-valve and its action. The description of the practical method of setting the same would take up too much space of "Shop"; it would also be impossible to mention a book treating of all the different forms of valves as desired, and, as the methods of working the same are as numerous as the valves themselves, it would want an encyclopædia on the subject to afford the information desired, and as the method of setting them would vary for each alteration in gearing, you will see that it would be an impossibility for one book to contain all the information desired. I herewith give a list of a few books relating to engine valves:—(1) "A Treatise on Valve Gear," by Zeuner; published by E. and F. N. Spon. This book deals solely with the theory, and is considered a standard work on the subject of which it treats. (2) "Sink Motion and Expansion Gear," by N. P. Burgh, published likewise by E. and F. N. Spon. This gives a pretty complete account of several kinds of valves, including Corliss motion. (3) "Valve Gears," by Spangler, published by John Wiley & Sons, 53, East Tenth Street, New York. (4) "The Steam Engine," by D. K. Clark, published by Blackie & Son, Limited. This is a costly work, as it contains four volumes; there is some useful information on valves in it. (5) "Steuerungen der Dampfmaschinen," by Emil Blaba, published by Julius Springer, Berlin. I give this as, should you be able to read German, it seems more of the style of book you want. It gives both diagrams and drawings of a great number of valves and motions for same. There may probably be an English translation of same, but I have not seen one. When you ask for the methods used in setting the valves, I suppose you mean the practical way which will most probably vary to a certain extent in each shop you work in. I do not know of any book which treats of the subject. All books on valves give the position of the eccentric, or the method of obtaining it for the various valves treated of.—P. B. H.

**Mildewed Glass.**—T. W. (*Loughboro'*).—I am afraid you cannot restore your glass. Mildew is a fungus growth, and to destroy it would destroy the silvering. To re-silver, kindly refer to articles in WORK, Vol. II., No. 55, p. 44; No. 75, p. 373; No. 78, p. 422; No. 83, p. 503; and No. 85, p. 536.—W. E. D., JR.

**Aphengescope.**—G. S. R. (*Tewkesbury*).—The above instrument is not a patent, and you can make either of those which have been described in WORK.—C. A. P.

**Silvering Glass.**—MIRROR.—The formula you quote is generally, I believe, called "Drayton's Process," and is given correctly, except in one important particular. After you have floated on the glass a few drops of a mixture of oil of cloves and spirits of wine (in the proportion of oil of cloves one, spirits of wine three) should be dropped in different places, or diluted oil of cloves can be added to the solution before it is poured on the glass; the more oil of cloves the quicker the deposit, but do not add too much. To remove the old, if by quicksilver process, use wood naphtha on a rag and rub hard.—W. E. D., JR.

**Ferrotype Process.**—W. J. H. P. (*Cookstown*).—The ferrotype process is simply the wet collodion process on metal plates—ferrotype plates being thin sheet-iron covered with a dark varnish, usually of a chocolate tint, and may be purchased at the photographic dealers in dozen or gross packets of the sizes generally adopted for dry-plates. They may be trimmed with a pair of scissors to any shape. There is no special way of treatment differing from ordinary collodion positive work, and any collodion and developer that will work well on glass will do the same on ferrotype plates. Their advantages are in comparison with glass, less weight and liability to breakage; and the disadvantage is, not so true a surface, and the image is reversed, which is not of much importance with the class of work usually done on them. Of course, by aid of a mirror or reversing prism, the reversal might be remedied, but it rarely ever is.—D.

**Umbrella Materials.**—EYRE.—The following are the names and addresses of the firms in Liverpool and Manchester who sell all kinds of umbrella materials:—McKenzie Bros., Bold Street, Liverpool; W. Walmsley, Victoria Buildings, Victoria Street, Manchester; Hughes Young, Deansgate, Manchester.—W.

**Lady's Work-box.**—W. J. (*Portsea*).—Work-boxes offer very little opportunity for originality. As you intend it for a present, I advise you to make it diamond shape. Join each of the four large sides to the narrow sides as in plan (Fig. 3), the grooves, etc., extending from top to bottom. Great strength is not particularly necessary. It might answer if you screwed or dowelled a green-cloth covered bottom board into position. It will be preferable to make the reel and needle boxes bodily removable. Construct a shallow tray, and join three divisions across its width, and a desirable number of partitions between these. For firmness, tongue the ends of each cross-piece into the divisions it meets with. See back numbers for descriptions of these joints. There is a feature about the

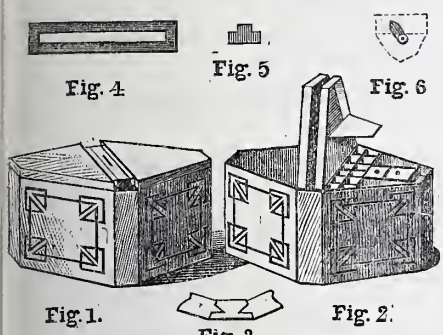


Fig. 4. Fig. 5. Fig. 6. Fig. 1. Fig. 2. Fig. 3.

Lady's Work Box.—Fig. 1.—Box Closed. Fig. 2.—Box Open. Fig. 3.—Plan of one Corner. Fig. 4.—Plan of fixed Top Board to which are hinged the Lids. Fig. 5.—Section of Removable Top Piece shown between the Lids in Fig. 1.—Fig. 6.—Fastening for the Flaps in Lids.

double lid which will not recommend it to an impatient lady. Mitre and screw four narrow pieces to a whole board. Fill the space of it partly up with a fixed board, and to it hinge a companion flap, the latter with a fastening (Fig. 6) attached. This makes one lid. A rail, in section like Fig. 5, is needed to retain the lids as in Fig. 1—nothing more, unless to provide against dishonesty. Have a fixed slotted rail (Fig. 4) across the top of the box, and screw two narrow pieces to the backs of the lids, as in Fig. 1, to enter the slot, and you will find that, by removing the cross-rail, the lids can be opened as in Fig. 2. In my limited space I cannot show how the ends of the removable cross-piece must be cut, nor the distance apart the lids must be hinged; but a little thought will make it all clear to you. Arrive at best size by cutting and arranging cardboard. Place in our hands another query concerning covering of small lids.—J. S.

**Rubber Stamps.**—A NEW SUBSCRIBER—Full directions for making rubber stamps are given on pages 594 and 630 of Nos. 38 and 40 of Vol. I. of WORK. Some modification of the process may meet your case, but evidently no suggestions can be given unless the specific purpose be clearly stated.—QUI VIVE.

**Imitation of Granite Stone.**—J. B. (*Devonport*).—This process is one of the minor and elementary divisions of the Art of Marbling. Space will not permit an exhaustive lesson here, but I give you a few concise directions which will probably serve your present purpose. For a staircase wall, either a pink or grey granite would suit—that is, assuming you require something "everlasting" and sanitary, and not a "modern" decorative treatment. Remember grey walls will give a cold sensation, pink a warm and cheerful effect. For the former, paint the walls with grey paint of a "leaden" hue; then, when dry, with a small piece of honeycomb sponge, apply the spots of pure black and white, and finish with a light varnish. For pink granite, mix your ground with white lead paint and a little Venetian red in oil. Put in the black and white spots as for grey. A skirting of "black and gold" marble beneath this would be best in your case. Banisters would look well and consistent if painted a deep bronze green, then coated with hard-drying varnish. Before this gets set, rub a little gold bronze-powder on the prominent parts with a little piece of unwashed wash-leather.—DECORATOR.

**Black Enamel.**—J. M. (*Wanstead*).—Slate mantel-pieces and similar goods are enamelled and stoved on the principle of Japanned ware. Hence it is an operation not suitable for a novice to attempt. "Aspinall's" is an enamel, doubtless, equal to the majority of largely used brands; but black enamels of this type, even if one has sufficient ability to make a good job of applying it, cannot be compared for wear to the proper process. Varnish-making firms prepare these enamels especially for stoving. The best result an amateur is likely to obtain on a flat surface of any size, would be by coating the article with one or two thin coats of finely-strained "dead black," made from ivory black ground in turps, a little oil varnish or Japan gold size to bind it, and then thinned to working consistency with turps. Use a flat camel-hair brush, and spread barely and quickly. When hard finish with two or more coats finest copal varnish. Parts near the fire should be coated with Brunswick black.—F. P.

**Model Electric Motor.**—W. G. C. (*Taunton*).—Your model motor is a very tiny affair indeed, only having an armature ⅜ in. by ⅜ in., and field magnets ⅜ in. square. Fill the armature with No. 32 silk covered copper wire, and wind as much of this wire as you can get in the fields. As you have not given me the full dimensions of the wire space at your command on the magnet cores and the armature, I cannot tell the quantity of wire you can get on the model. The replies are published only in "Shop" for the general benefit of all readers.—G. E. B.

**Books on Drawing, etc.**—L. G. (*Falmouth*). The following books may help you—"The Principles of Perspective" (Trobridge), 2s. 6d.; "Cassell's Course of Geometry," by E. A. Davidson, price 5s.; "First Book of Experimental Geometry," by Paul Bert, price 1s. 6d.

**A Squirrel's Cage.**—HUGH.—In making a cage for squirrels, or, in fact, a cage to keep any of the rodents or gnawing animals in, one thing has to be borne in mind, namely, keep the woodwork protected from teeth. The cage illustrated in Fig. 1 is made of ⅝ in. angle bar, zinc bottom and false bottom, the only wooden parts are the round discs for the wheel. These are of ½ in. mahogany, covered on the inside with tin. A small brass tube forms the bearings of the axle. The branch of a tree is not fixed to the bottom, but is suspended from the top,

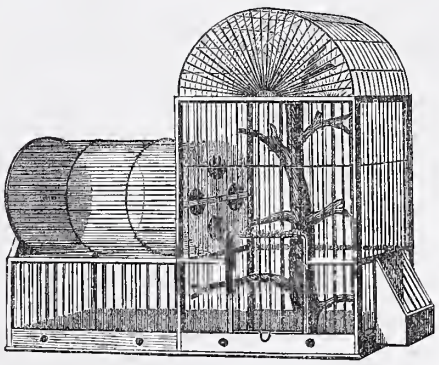


Fig. 1.—A Squirrel's Cage with Branch of Tree and Revolving Wheel.

and can be removed with a little trouble. The trays at the bottom are 1½ in. deep, and draw right out; and the compartment under the wheel can be made dark by a covering. The door opens upwards, and can be closed with a slam, or by its own weight if the fastener (Fig. 3) works easy. The top of the food-box opens and fastens in the same way as the

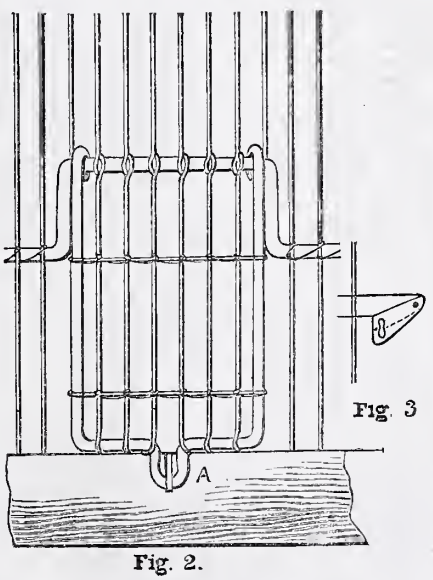



Fig. 3

Fig. 2.

Fig. 2.—Door for Fig. 1. Fig. 3.—Fastening for Door at A, Fig. 2.

door. I need not give full details of construction. I think a glance at the illustrations and the article on "Bird Cages," page 20, Vol. II., No. 54, will be quite sufficient.—F. H.

**Aquarium.**—F. W. B. (*Sunderland*).—The best book on the Aquarium is published by Upcott Gill, 170, Strand, W.C., price 1s.—C. M. W.

**Speculum Grinding.**—W. B. (*Bruntcliffe*).—Detailed notes on this subject will eventually appear in the ordinary columns of WORK. Meantime, I sufficiently answer your queries to enable you to go on. The rough edges may be taken off the glass disc either with an ordinary grindstone, using plenty of water, or with a lathe. In the latter case, cement a piece of wood to each face of the glass disc, and mount the whole in the lathe so that it runs true. Get a piece of soft sheet-iron about 18 in. by 3 in. Bend it as in Fig. 1, and clamp it by the part marked A to the tool-rest of the lathe. Bring it under the glass, as in Fig. 2. Feed sand, or coarse emery and water down in the direction of the arrow. The cutting substance will imbed in the soft iron, which will spring to the irregularities of the glass edge, but at the same time cut them away. As the edging approaches completion, the other end (C) of the iron band may be secured, and the disc may

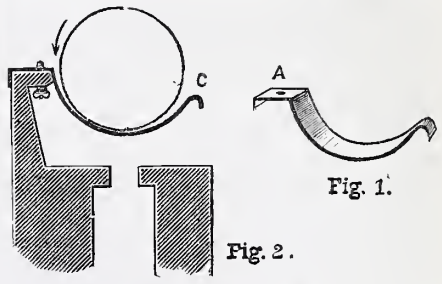



Fig. 1. Fig. 2.

Speculum Grinding.

then be easily cut to a perfect circle. Force nothing—do all easily. The only way to succeed in glass-grinding is to fully grasp the fact that the continuous removal of almost microscopic particles is the speediest and safest method of working. If the discs have been well chipped at the warehouse, and you are without a lathe, you might work your first experimental mirror unedged. For the rough grinding you need nothing but washed sand, or coarse emery and water. The best motion for the rough grinding is a straight stroke, which exposes one-third of the diameter of the lower disc at each stroke. Meantime the operator should walk continuously round the post or bench, and should also revolve the speculum disc under his hand. Let the straight stroke preponderate. Otherwise, an occasional systematic irregularity is an advantage. The time necessary to rough out a speculum will be from three to five hours continuous. Afterwards, the time necessary depends on the character of the work done. When you have roughed the disc out, or if you get into any difficulty, you must come to the editor again.—E. A. F.

**Fastening Glass Balls.**—F. K. B. (*London*).—There are several good cements in the market that you might use to fasten the glass balls to your looking glass, and the balls being ground flat on one side will greatly facilitate matters. You might use "Coagiline," warming both glass and balls as much as they will safely bear (in fact, making the articles hot enough is the great secret of success with all cements); or I can from experience recommend "Le Page's Liquid Glue," or, if it is likely to stand in a damp place, the following may be tried, as it is said to resist water. Dissolve ten parts of pure dry gelatine in a hundred parts of water, add ten parts of a concentrated solution of bichromate of potash, and keep in the dark. When used the light causes a chemical change to take place, and the film of cement becomes extremely tough and durable.—W. E. D., JNR.

**Opal Glass Letters.**—J. P. C. (*No Address*).—I do not know of any machine to cut out opal letters. Do you wish them like those sold? If so, they are not cut out; but seeing you wish to utilise the waste, I can only suggest that you make templates, and cut out with a diamond; but perhaps some other subscriber seeing this reply may be able to suggest a better method.—W. E. D., JNR.

**Triunial Lantern.**—L. J. K. (*Dublin*) wishes to know whether the lid of a piano ¼ in. thick would be sufficient substance for the body of the lantern described in WORK. Most certainly yes, as your piece of stuff is sure to be thoroughly well-seasoned. The issues in which the above articles appeared are Nos. 83, 87, 91, 96, and 100. You will also find additional information on lantern matters in the "Shop" columns of the above issues.—C. A. P.

**Safety Bicycle.**—A NEW SUBSCRIBER.—The numbers of WORK in which the articles on Safety Bicycles appeared are Nos. 107, 111, 115, 119. You can get these numbers of WORK through a newsagent, or of the publishers, Cassell & Co., London, E.C.

**Sign Writing and Lettering.**—W. S. M. (*Brixton Hill*).—The articles upon this subject will be found in the following numbers of WORK:—Nos. 1, 2, 4, 11, 13, 17, 19, 23, 30, 34, 39, 43, 44, 45, 47, 49, and 51. These and any other of the back numbers, together with the Indexes to Vols. I. and II., are procurable through any bookseller, or of the publishers, Cassell & Co., London, E.C.

**Sign Writing.**—N. H. (*Longley*).—We do not give the addresses of contributors. Any stamped and sealed communication forwarded here shall have the address completed and posted.

**Skiver Leather.**—J. H. B. (*Moseley*).—The term is as I have written it, not *skiva*. You ask for instructions for the preparing the above leather to blocck in imitation gold, and what varnish to use after. There are many methods by which this is done. Wash the leather over with paste-water, and afterwards give two coats of glaire, allowing the first coat to dry before applying the second. Lay on the gold in the usual manner, blocck, and wipe off. Another, wash the leather with glue-water, and, when dry, lay on the gold and blocck. Another, use dry powder, such as resin powdered, gum sandrac powdered, dust over the leather, lift the gold on the block, and block as usual. Afterwards varnish with shellace varnish or Zaehnsdorf's bookhinders' varnish, to be had from the maker—Cambridge Circus, Shaftesbury Avenue, London, W.C. In all of these methods, the press must be hot while blocking. For further information, see many back numbers from the first.—G. C.

**Phonograph.**—F. W. W. (*Hastings*).—I cannot give instructions in "Shop" for making wax cylinders for this instrument for several reasons, the chief being the want of space. The information would he of little use to you without drawings of moulding apparati. The cylinders are not made entirely of wax, but of a composition in which wax forms a part. In some forms we are informed that "wax is not in it!" There has been no article on the phonograph as yet in WORK.—W. D.

**Ash Bar Hole.**—T. M. G. (*Hoddesdon*).—Although I do not know the plan adopted hy the makers of gymnastic apparatus, yet I may say that the essential conditions are well known, namely, the boring tool must revolve, and the bar must revolve in the contrary direction. This at once indicates a lathe or similar contrivance. Were it not for the fact that the grain of the wood is likely to influence the direction of the bore, you might bore from both ends. I believe that with a Morse twist-bit, as modified by the co. for wood, you could venture to do so. If not, you will have to have lengtbening bars made to the boring tool up to 8 ft. long, and such tools are so special that, no doubt, you will have to have them made to order. Unless you expect to have many bars to bore, I should strongly advise obtaining the bar ready, which you may do of the gymnastic apparatus manufacturers.—B. A. B.

**Safety Bicycle Rims.**—CONSTANT READER.—Rims 30 in. by ¾ in. crescent, 3s. pair; hubs, plated and tapped for spokes, from 11s. to 21s. (The above are prices to the trade.) Price lists of tbe above, and all other materials and fittings, can he had of Brown Bros., 7, Great Eastern Street, London; also St. George's Cycle Company, Upper Street, Islington; also W. A. Lloyd & Co., Lionel Street, Birmingham.—A. S. P.

**Restoring Leather Chair Seats.**—ANXIOUS.—To re-dye worn and faded leather seats is, I believe, an operation which upholsterers admit that they have no satisfactory way of doing. When seats reach this stage, the only sound thing to do is, it is said, to give them new coverings. Something may, however, be done in the way of brightening up the faded material. White of egg will do this, or French polish ligbtly laid on so as not to saturate tbe leatber.—S. W.

**Patent.**—E. W. G. (*No Address*).—A person who has ohtained provisional protection for something, is simply assured tbercby that no *later* applicant can obtain the grant of a patent that will give him a prior right. The great danger in putting the invention before the public, prior to the patent heing scaled, is that there may be a provisional protection of earlier date for a similar thing, with a similar title, in force, and which may be wide enough to admit of what E. W. G. may sbow being included in the complete to follow such provisional, in which case E. W. G. would be nowhere, unless he could *prove* that the prior applicant had appropriated his invention, and that his provisional did not fairly comprise it. It is not needed in a provisional to give all the details that are absolutely essential in a complete, but merely such a general description as shall satisfy the examiners of the idcntity of the invention described in the complete. According to the "popular" idea, any inventor or intending patentee is at once qualified, having made an "invention," to know, understand, and carry out all the proceedings needed to obtain a sound and valid patent, in the right and proper manner required for this purpose. It is needless to assure E. W. G. that this—like most "popular" ideas—is very far from the truth; and we can only pity those who are foolish enough to be led away by such erroneous notions.—C. E.

**Repairing Barometer.**—MERCURY.—You did not go far wrong in your attempts to clean and refill the tube with mercury. Your difficulties arose more from want of practice and the knack acquired only through this, tban from mistakes in the process adopted. It is only when a tube appears to be smeared with mercury, and has a grey, metallic appearance inside, that is is necessary to clean it with dilute nitric acid. The acid should be diluted with distilled water, and the tube rinsed with distilled water. When this has heen done, and the water drained out, introduce a little pure alcohol and drain this out; then warm the tube carefully, beginning at the closed end, and drive out all traces of moisture with the last few drops of alcohol. The mercury, when dropped on a clean china plate, should run about in bright round globules without soiling the plate; if the drops drag, and leave a grey trail bebind them, the mercury is not pure, nor clean enough for the purpose. There should be no scum on the surface. The mercury should he filtered through fine pinholes made in chamois leather after it has heen cleaned and dried, unless it is pure and freshly distilled. After this, it should be heated in a glass beaker to expel the last trace of moisture before it is introduced into the warm tube. As the mercury has to expel air from tbe closed end of the tube, it must be introduced to this part drop by drop, so as to allow the air to escape. You did quite right in shaking the mercury in warm. The last traces of air are expelled by heating the closed end of the tube over a spirit lamp, and boiling the mercury, inch by inch, throughout the tube. The process will go on more smoothly as you acquire skill by experience.—G. E. B.

**Price of Dynamo Castings.**—AMATEUR.—Apply to Mr. S. Bottone, Wallington, Surrey, or to Mr. G. Bowron, 93, Praed Street, London, W., for price of 20 c.p. dynamo castings. You will get them as cheaply from those gentlemen as from any one else in the trade.—G. E. B.

**Brass Bearings.**—CARDIFF NO. 2.—Brass is not used by good engineers, or considered satisfactory for bearings. Gun-metal is the term applied to the compound used for this purpose, and in many cases the "brasses," as they are technically termed, are "bushed" or lined with white metal, such as what is known as "Babbitt's" metal, or other nearly similar compounds, and, if carefully looked after, are found to give very satisfactory results in practice. The production of bearings for machinery of the required hardness is obtained hy the materials used for the purpose and the proportions employed of each. Gun-metal may be made of the following materials in or about the following porportions: Bristol brass, 112 lbs.; zinc, 14 lbs,; tin, 7 lbs.; taking care to put in tbe most fusible of the metals last. Common brass used for casting consists of 20 lbs. copper, 1¼ lbs. zinc, 2½ lbs. of tin. Yellow brass is made by melting 30 lbs. zinc with 70 lbs. copper. Hard brass for casting consists of 25 parts copper, 2 parts of zinc, and 4½ of tin. Yellow brass for turning is made of 20 parts of copper, 10 parts of zinc, and 1 to 5 ozs. of lead, which is the best metal put into the pot. Ordinary "pot" metal is made of 3 parts of lead added to 8 of copper. White metal s made by melting 24 lbs. zinc, 4 lbs. copper, 8 lbs. antimony; and, when these proportions are melted add 72 lbs. tin.—C. E.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Chuck.**—IGNORAMUS wishes to know the best and cheapest way to go to work to make an oval chuck for wood turning in an 8 in. lathe.

**Hair Oil.**—X. Y. Z.—Could any reader give me a recipe for making a good cheap hair oil for sale?

**Bread Cutter.**—JEAN writes:—"Will any of our readers kindly tell me bow to make a loaf-slicing macbine?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Xylonite.**—L. S. M. (*Bishop Auckland*) writes in reply to BEAVERSTOWN (see page 286):—"I have got this in small quantities from C. F. Mearing, 33, Sidmouth Street, Gray's Inn Road, London. If he does not now supply it, you can get it through a chemist."

**Glacial Decorations.**—M. (*Bishop Auckland*) writes in reply to J. H. (*Salford*) (see page 286):—"I have removed these by sponging with hot water, and scraping them off. They will require a little time to soften."

**Camera.**—R. M. (*London, S.E.*) writes, in reply to BOY SORTER (see p. 206, No. 117, Vol. III.):—"I would advise BOY SORTER to invest in a Lancaster's 'Mervcilleux' camera set, at 21s. This is the best value for the money I know of, the set being well turned out, and consisting of camera, slide, excellent achromatic lens, and stand with brass top. To get anything cheaper than this would be false economy. (2) I can recommend Hepworth's "Photography for Amateurs" (Cassell & Co., Ltd.) and "Burton's Modern Photography" (Piper & Carter). Both books are published at one shilling. For a beginner the former is, perhaps, the better, as, besides being very lucidly written, technical terms are avoided. (3) As to what are the best dry plates, opinions may differ. Personally, I use Ilford's, and am very satisfied with them."

**Sealing Wax.**—M. (*Bishop Auckland*) writes, in reply to J. C. (*Chelsea*) (see p. 206, No. 117, Vol. III.):—"This is made by melting together four parts of white or bleached shellac, one part of Venice turpentine, and one part (or more, if required) of white lead. Stir well together, and when melted, roll upon a marble slab (heated underneath) with a picce of hard wood till nearly of the right size, and finish by rolling between two marble slabs (cold). To polish the outside, slowly turn the sticks between two charcoal fires till the outside melts. For square or oval shapes, cast the wax in steel moulds."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. L. (*Lincoln*); F. M. (*Portsea*); W. J. E. (*Salford*); A. E. S. (*Wootton Bassett*); C. T. (*Edinburgh*); REARER; T. J. S. (*Durham*); S. T. (*Sevenoaks*); H. F. B. (*Barking*); STENCIL; MICRO; J. M. (*Hebburn-on-Tyne*); C. T. (*Edinburgh*); A. R. (*Scorrier*); J. W. (*York*); J. S. (*Pimlico*); A WOULD-BE DECORATOR; H. H. (*Finsbury, E.C.*); C. C. E. (*Lincoln*); CURVE; YOUNG; F. M. (*Portsmouth*); H. B. (*London, W.*); T. R. B. (*Blaydon-on-Tyne*); C. & M. (*London, N.*); PHOTOGRAPH; E. T. (*Handsworth*); J. T. S. (*Sheffield*); J. A. S. (*Enfield*); J. O. H. (*Wandsworth*).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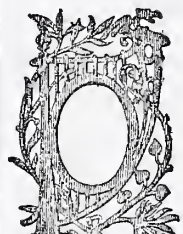

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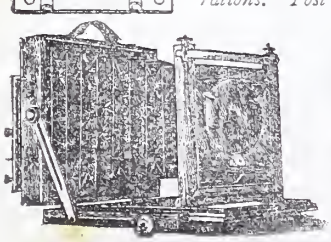

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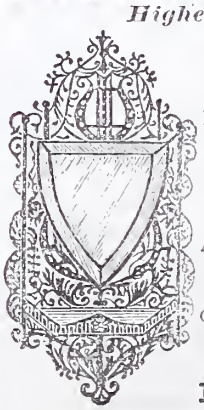

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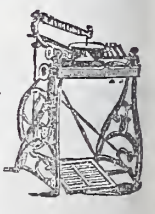

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# WORK

## An Illustrated Magazine of Practice and Theory

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VOL. III.—No. 128.] SATURDAY, AUGUST 29, 1891. [PRICE ONE PENNY.

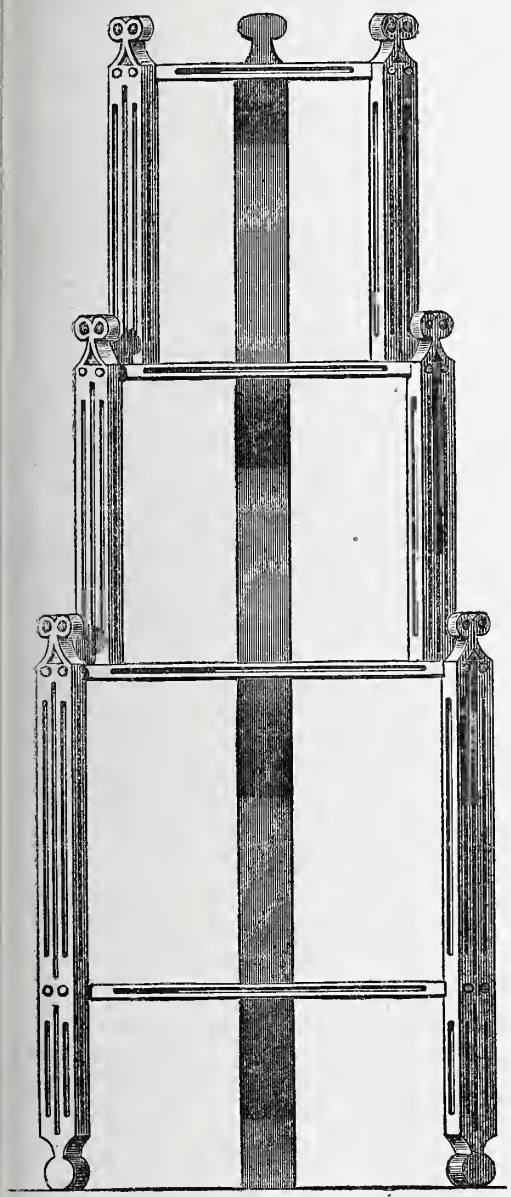


Fig. 1.—Front Elevation of Whatnot on 1½ in. scale.

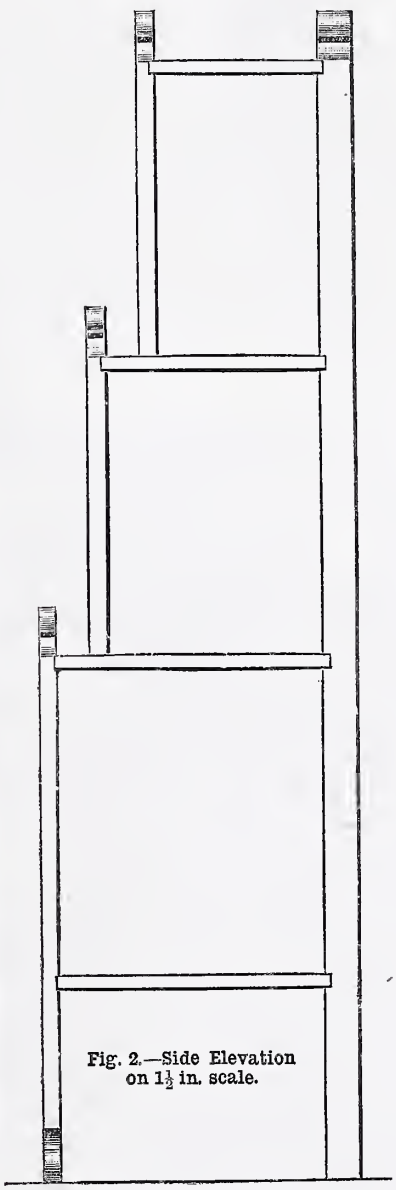


Fig. 2.—Side Elevation on 1½ in. scale.

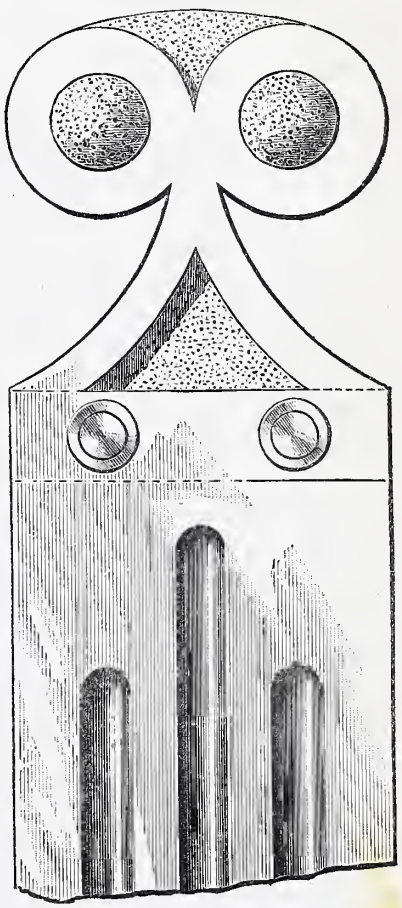


Fig. 4.—Detail of Uprights (full size).

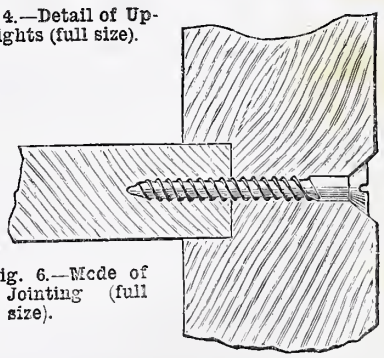


Fig. 6.—Mode of Jointing (full size).

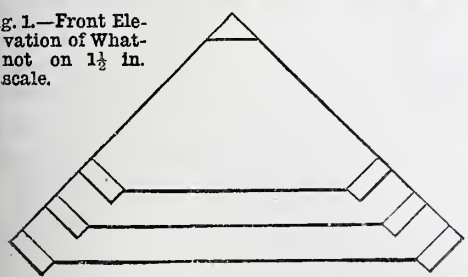


Fig. 3.—Plan on 1½ in. scale.

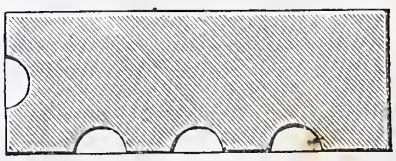


Fig. 5.—Section of Uprights (full size).

## A WHATNOT FOR AMATEURS.

BY H. J. MARK.

INTRODUCTION—JOINTING—UPRIGHTS—SHELVES—BACK-PIECE—ENAMELLING—FINAL REMARKS.

*Introduction.*—In submitting to the readers of WORK this simple, yet useful, little article of furniture, I do not do so claiming for it any special merit, as I am but an amateur myself. It is my own design, easy to make, and fills a corner very effectively. To those who, like myself, are not yet so far

advanced as to be able to tackle a hall-stand or bookcase, it may prove useful as a study, if only in the use of the square.

It is made entirely of deal, and finished in two colours of enamel and gold paint. Other woods, of course, might be used, setting aside the enamel and gold, but it would then become more expensive, and expense is a thing we have all more or less to study.

It must be borne in mind that the wood should in all cases be quite dry before working, as if used in a damp state, twists and warps will soon set in, and the work be spoilt. I make it a rule to keep my wood in the house some weeks before using; and by buying it a bit every now and again, I have always a dry piece ready to go on with.

*Jointing.*—In adopting the manner of jointing shown in Fig. 6, I have done so for the following reasons:—

(1) As I live in apartments, I must make my furniture so as I can take it to pieces readily for packing purposes. (2) As each piece is enamelled more easily and better by being done separately than if done when fitted up and put together.

As a consequence, I have not used any glue, and as stability is the main thing to be desired, I consider my method to be the best; glue is a messy substance at all times, and unreliable as a joint unless applied by practical workmen. And I consider that if more screws were used in putting together our modern furniture, and less glue, we should have far stronger articles for our money.

For all the joints out of sight I have used $1\frac{1}{4}$ in. screws; for the joints in front I have used fancy brass-headed $1\frac{1}{4}$ in. nails, as shown in Figs. 1 and 4. In driving in the nails the head of the hammer should be covered with a piece of soft leather for the protection of the brass heads. The bare hammer will flatten and scratch them, and spoil their appearance.

*Uprights.*—The uprights are $\frac{3}{4}$ in. thick, and, of course, cut out of one piece of stuff, taking care to allow for the recessing into the shelves. All the recesses need not be more than $\frac{3}{16}$ in. deep. The heads and two feet I shaped out with a fret saw, the speckled portions shown in Fig. 4 being a little diaper work punched over. The grooves are all cut with a $\frac{1}{4}$ in. gouge: at least, that is the way I have cut mine, but those who have a suitable plane or "scratch" could, of course, use it to advantage. After cutting the grooves, to get them smooth I rounded off a piece of wood to fit them loosely, and by its aid and sand-paper rubbed them down. Fig. 5 is a full-size section from which the gauge may be set for marking them out.

*Shelves.*—Fig. 3 is a plan giving sizes of shelves ($1\frac{1}{2}$ in. scale), the two bottom ones being of the same size. These can also be set out on and cut from one piece of stuff, and are $\frac{1}{2}$ in. thick, taking care as before to allow for recessing into back-piece, the grooves on their front edges being worked the same as for the uprights. They are recessed into uprights as well, care being taken to get the uprights perfectly square within the shelves, or when put together they will stand lop-sided.

*Back-piece.*—The back-piece is a triangular piece of wood, as shown in plan, 4 ft. long, and with a 2 in. face, the two sides forming a right angle, so as to fit the corner of a room. The head-piece I have not diapered, as it would be hidden by a vase, etc. For the same reason I have not shaped the foot.

*Enamelling.*—After having fitted the whole together, taken to pieces, and thoroughly sand-papered the parts, give a coat of size and whiting mixed as a filling; when dry, sand-paper again, and proceed to enamel. I use about three dessert-spoonfuls of whiting to half a pint of weak size. All the grooves, with the exception of the middle ones of the uprights, are coloured in turquoise blue. The middle ones, together with the diaper work, are worked in gold paint; the rest of the whatnot is done in Arabian brown. Two coats of each is sufficient. I have used Blundell, Spence & Co.'s enamel and gold paint, and find it very good; I prefer it to others, as it dries with a higher gloss.

*Final Remarks.*—If nicely finished, with one or two vases and like ornaments placed upon it, it will, I am sure, give satisfaction. On my own whatnot I have hand-painted flowers, etc. The enamel colours may be left to one's own taste and inclination; those I have chosen look well, the blue contrasting nicely with the rich brown, and the gold giving a very finished and artistic appearance.

A further improvement might be made by converting the middle portion into a cupboard with folding doors, having either carved, fret, or painted panels. For instance, the two panels of the iris and narcissus by Mr. Gleeson-White (see WORK, No. 60, page 125); or gesso-work might be utilised.

One word more: don't be afraid of using the square too much. It is a maxim that an old friend of mine, a carpenter, gave me, and one by which I have profited.

## NOTES ON SAW SETTING.

BY M. POWIS BALE, M.I.M.E., A.M.I.C.E.,
*Author of "Wood-working Machinery," "Saw-Mills," "A Handbook for Steam Users," &c.*

SWAGE SETTING—SPRING SETTING—HAMMER SETTING.

IN very few things is there more difference of opinion than in sharpening and setting saws. On the present occasion I propose to discuss briefly the different methods of setting, noticing some of the advantages and disadvantages of each method.

*Swage Setting.*—Swage setting—called also "upsetting," "jumping," and "spreading"—is more largely practised in America than in this country. In this case clearance is obtained for the saw by widening the points of the teeth, usually by means of a crotch punch arranged with two V notches, which are driven on to the points of the teeth by a hammer or weight. The second notch in the punch is rounded, and spreads the teeth points out. We think this plan, especially for circular saws of stout gauge, has much to commend it, more especially if the wood is cross-grained and knotty, as swaged teeth will stand up to the work, while spring-set teeth are apt to dodge the knots. Swaged-set teeth will also stand a quicker feed than spring-set, all things being equal; they, however, take more power to drive—probably about 20 per cent.—and unless the setting is carefully done ridge marks are left on the log. I think swage setting is, on the whole, more adapted for soft than hard wood.

It is claimed by the users of swaged-set teeth that swaging condenses and hardens the steel at the points of the teeth: but if this is so, with saws correctly tempered it would, I take it, be likely to be detrimental, and cause the points to crumble. Another trouble found in swage setting is the difficulty of getting perfect uniformity of set, without which no saw can be pronounced to be in first-rate cutting condition. Swage setting does not sharpen the teeth of the saw, as some may suppose.

When a saw is set or spread by means of a punch and a blow from a hammer, care should be taken that the points of the teeth only are spread, and that the tooth itself is not bent or strained, and that the blow given and the hammer used are not too heavy. The teeth should be carefully tried with a straight-edge on both sides and points, and be exactly in line. In swage setting, should a tooth point be broken by striking a nail, it can be lengthened slightly by raising the punch or swage when in the act of setting the tooth, and the point of the tooth will be upraised, and, if not too much broken, will take its share of duty with the rest.*

To "spread" set all the teeth as nearly as possible alike with a crotch punch, it is necessary to regulate to a nicety the weight or strength of the blow given by the hammer. In America a tool has been introduced to do this mechanically. It consists, briefly, in mounting the crotch punch on the end of a tube or rod, and arranging a series of movable weights, with holes through them, to slide up and down the rod. These weights are allowed to drop on the punch, the strength of the blow being regulated according to the gauge of the saw and the amount of set required. For saws of large diameter and thick gauge spread set can be recommended, as it is very difficult to spring set or bend the teeth of a thick saw with regularity.

*Spring Setting.*—This is perhaps the most general kind of setting, and, if regularly and carefully done, answers very well; the teeth, however, have a constant tendency to assume their original position. Saw teeth should not, under any circumstances, be set without a gauge, as it is a wasteful and stupid plan, producing rough work, and more rapidly wearing out the teeth which happen to be overset. In practice it will be found that a saw perfectly set will work much freer, cut smoother, and, at the same time, will waste less wood than an imperfectly set one; less set is also required on a truly and equally set saw to effect the desired clearance.

Several good mechanical saw sets, combined with gauges, are now made, and so arranged that when they are fixed to any desired set it is impossible to overset a tooth; consequently, the teeth are all set exactly alike, and, if they are equal in length, each tooth gets its fair share of work, the friction of working and waste of wood being reduced to a minimum. In working, it is found that the teeth of a saw wear at the side of the points, and if some teeth have more set than others, these are unduly strained, and, from the severe and uneven friction, are often heated, and are inclined to buckle and run from the line. In using spring set, it is necessary to somewhat overset the saw, to compensate for the tendency of the teeth, especially when worn or dull, to spring back to their original position.

I have recently seen a very neat form of American tool for spring setting by means of a cam-lever, by which a very even set may be obtained without unduly straining the saw teeth. The operator stands behind the saw, and the set is attached to the

* See "Saw Mills; their Arrangement and Management," by M. Powis Bale.

eth by placing a bed die on the point the tooth to be set, so that the point will oject beyond the die about one-sixteenth an inch; the cam-lever is then brought wn to a stop on the cam, at the same ne bending the teeth towards the latter. four-point gauge is fitted to the lever, d it can be adjusted to any amount of set sired by means of a thumbscrew. It is imed as an advantage of this arrange- nt that the bending power is exercised the tooth between two bed bearings, that the operator has only to bear down the cam-lever, and the more power applies the tighter he fastens the set the saw; and, at the same time, the bend a curve and not an angle, and that, erefore, the saw teeth are less liable to cture.

If a saw is allowed to get dull it will ring from the work, and increased power ll be required to force it through the od.

*Hammer Setting.*—The third system of ting I have to notice is hammer setting. e old-fashioned way of doing this was th a punch and a block of wood, and very brutal way it was, as it strained saw-plate, and sometimes broke the th; at the same time, it was impossible get the teeth to one uniform set, con- quently the timber was scored, and much wer consumed unnecessarily. If carefully l judiciously done, hammer-set saws will nd up well to their work. The best plan th which I am acquainted is to mount saw horizontally on a conical centre, l allow the teeth to rest on an adjustable el die made with a bevel edge turned entric, so as to allow of the right pro- tion of set for teeth of various sizes. th this arrangement any desired amount uniform set can be given to the teeth hout unduly straining them or the saw- te. Hammer setting is a fair test as to quality of the saw, as the teeth may ck or fracture if the steel is burnt or oo hard a temper, or bend readily if too t.

n conclusion, it must be borne in mind t whatever kind of setting is employed, successful and economical working *abso- e uniformity* is imperatively necessary. his is not secured, the work turned out of inferior quality, and wood and power wasted. It should also be remembered t setting does not increase the cutting ver of a saw, as a saw will cut faster h little or no set, provided the nature of wood will allow it to pass through with- binding. The amount of set required, refore, should be carefully judged by the yer, and no more set employed than absolutely necessary. For instance, in ring wet wood a sharp saw and a fair ount of set are required, whilst for hard otty wood very little set should be used.

## ACTICAL PAPERS FOR SMITHS.

BY J. H.

### PUNCHING AND DRIFTING.

the moulder cores holes in his work order to avoid altogether, or to en, subsequent labour, so the smith iches and drifts rough holes in his work the same purpose. Punching, drifting, l drilling are the three methods by ich holes are commonly made in the ithy. The first two are performed on red- iron and steel; the last, and sometimes second also, on cold metal. The present article will deal only with punching and drifting.

Iron and mild steel will stand punching to an extent that would be impossible in a crystalline material like cast iron. For much work punching makes a clean, finished hole, to which nothing is done subsequently, and is quite good enough for its purpose. In other cases, punching, like the coring of castings, takes out the bulk of the metal, leaving a certain small allowance for finishing with drill, rymer, or boring tool. Generally the details of the process of punching are as follows:—

The iron to be punched, being brought to a suitable full red or white heat, is laid across the anvil, and the punch (Fig. 12) is driven about half-way through by means of the sledge or hand hammer, from one or two to several blows being required, depending on the thickness of the material. The punch is then withdrawn, and the iron is turned over and laid upon its opposite face. A dark spot indicates where the chilling effect of the punch has taken place, and enables the smith to set the punch again in position for piercing the supplementary portion of the hole. The tool is then driven through—the holes meeting. During the formation of the second portion, the work is either laid upon a bolster of the form shown in Fig. 13, or over the hole in the anvil, and the punch then passes freely through.

If the hole is deep, the hot iron closes and tightens around the punch, and the latter is therefore withdrawn at every three or four blows. Further, the heat of the iron is communicated to the punch, and makes the latter very hot, so that after every three or four, or half dozen, blows, it is necessary to dip the punch in water to cool it.

These punches are made circular, square, oval, oblong, and wedge-shape in cross section. They are handled with hazel or iron rods, or with rigid wooden handles passing through eyes.

The methods of producing punched holes are varied according to circumstances. If it is desired to preserve the same, or nearly the same, amount of metal all around the hole, the hole is not punched absolutely, but partly punched and partly drifted or opened out. Obviously, when a hole is punched entirely with a blunt-pointed tool, like Fig. 12, the amount of metal removed is equal in area to the area of the point of the punch itself, and the width of the bar will not be perceptibly increased (Fig. 14).

But there is another way of making a hole without weakening the bar to any great extent. A conical punch—that is, one tapered down nearly to a point—may be inserted, and the hole be formed and opened without the removal of any appreciable quantity of material. Or if a hot set is driven into the bar half-way through from one side and half-way across the other (Fig. 15), then a punch or drift can be driven in afterwards, and the slit opened out into circular or oblong form, as may be required, and the metal on each side thrust outwards, the full area being retained, save and except only that due to the stretching of the metal. This is often done.

Thus, for example, take long slot-holes. These are cut in two ways. In one, holes are punched at each end of the intended slot equal to its width, and the metal between is cut out with the hot set, cutting from opposite sides in succession, the cuts meeting in the middle (Fig. 16). In the other case, holes are punched at each end, and a chisel cut put down the centre from hole to hole, and a drift inserted and the metal opened out (Fig. 17). In this way the flanking metal is thrust out sideways, and the bulk of its section retained. Such a slot-hole is finished by the insertion in the hole of a drift or mandrel of the correct section, and the hammering of the outside edges of the bar upon it.

When punching holes, it is necessary to take account of the direction of the fibre—a matter treated of in the last volume of WORK. Unless attention is given to this, the iron will become divided instead of spread out. In any case, punching puts considerable tension on the fibres around the hole, with reduction of area, and it is an operation, therefore, that requires to be done with judgment.

To punch slotted cottar ways in which the section of the iron is not enlarged, take a tapered oblong punch or drift of steel, like that shown at Fig. 18, A, with rounding ends. Raise to a welding heat, and properly support the iron, according to its shape, upon a bolster or upon a bottom tool, and drive the punch half-way into it. Turn the iron over, cool the punch in water, and drive it in exactly opposite to the first position until the openings meet at the centre of the bar. Since the punch is tapered slightly, the hole is doubly tapered. It is also rough. A parallel drift or filling-piece is then taken and driven into the hole. The outside of the iron is then smoothed and finished, and the hole accommodates itself to the form of the filling-piece. When the shape is completed the filling-piece is driven out. This method of finishing hollow work while a central punch, drift, filling-in piece, or mandrel remains in *situ* is one adopted in many classes of work.

Fig. 18 illustrates the punching a hole through a stout pin. The pin selected for this example is 3¼ in. diameter, and the hole measures 1½ in. by ½ in., and it is made at one heat. The punch is shown at A. Its body below the handle is about 6 in. long, and well tapered. The bar being brought to a white heat, the punch is driven from one side almost, but not quite, through. It is driven so far that the position of the hole when it nears the opposite side to that from which the punch is driven is indicated by a darker colour of the iron. Then the pin is turned over and the punch driven into that darker spot, and the hole completed. Of course, during the punching of the hole from one side nearly through to the other the tool has to be removed several times, from four to half a dozen, and cooled in water. Further, it is not so easy to make a deep hole in a stout circular bar as it is in a thin flat bar, and the smith has to look out to prevent the hole from running to one side, and to indicate to the strikers in which direction they are to apply their blows. Moreover, two strikers are necessary to get a hole through this depth at one heat.

At the first stage of making the hole, the pin lies upon an ordinary bottom swage. At the second stage it lies upon a bolster, B, in form like a hollow swage, but pierced with a central hole, through which the drift can find a clear way.

When the hole is thus roughly punched, the metal around it will be partly compressed, partly bulged; very little, not one-sixth, perhaps, is actually driven out and removed by the punch. The bulging of the bar is corrected by hammering between top and bottom swages, and then the hole is

finished by drifting, all being done during the one heat. The drift is shown in Fig. 19. It is slightly tapered. A few blows of the hammer are sufficient to send it through the hole, opening it out. It is driven from each side in turn, and in this way the hole is made practically parallel.

During the punching of the hole, whenever the punch is withdrawn to be cooled, the hammerman strews a little small coal in the punched hole. This burns up gas which would otherwise offer much resistance to the passage of the punch.

Holes that are punched smaller than the finished dimensions are, when not intended to be machined, almost invariably finished with drifts. These are tapered or parallel tools, whose cross sections are those of the finished holes — circular, square, oblong, elliptical, or polygonal in form. The drifts are smooth, and being driven through the punched holes while red-hot, both enlarge and smooth them. Two drifts are often employed: a first one with considerable taper lengthwise, for the purpose mainly of enlarging the punched hole; a second with the merest trace of taper, for imparting the precise finished dimensions. The latter is then called a filler, or filling-in piece, or mandrel.

There are several forms of drifts. When we speak of drifts, the boiler-maker's drift is not included. The function of that tool is the pulling of the punched holes in plates into line. The tool is very slightly conical in form, and being driven through overlapping holes in contiguous plates, it thus brings those holes into line by the stretching of the plates, and so permits the rivets to pass through. The blacksmith's opening or non-cutting drift is used not for the same purpose, but in like fashion, its object being the enlarging of holes in hot metal.

Drifting may thus mean either one of two operations. It may mean the simple opening out by internal pressure of a hole already punched by means of a smooth punch-like tool; or it may mean the cutting and shaping of a punched hole to a finished and accurate form by means of a serrated tool.

In each case, drifts, like the punches, may be of any cross section—circular, oval, square, oblong, rhomboidal, parallel, or tapered, to suit the work in hand, and there is scarcely a limit to the forms in which they can be made and used. In each case the main idea is to save more expensive machine work.

In consequence of the modern improvements in metal-working machines, the value of drifts as shaping tools has much diminished. Thirty or forty years ago they were very much used, and are even now in many country shops and smithies. There are many small shops in which there is no slotting machine, and in these the drift is still one of the most serviceable substitutes.

Smooth drifts are rarely or never perfectly parallel, because the shrinkage of the forging around a parallel drift would render its withdrawal from the hole a matter of difficulty. In any case, the sides should subtend angles of not less than from two to four degrees. Not that a smith measures such an angle; he simply judges by the eye, or perhaps tests with callipers, the slight amount of taper given.

The cutting drift partakes either of the nature of a sharp punch or of a file. It does not open out by tension, but removes material from a roughly-punched hole. It will not remove a large quantity of material at once, but merely smooths and finishes a hole already nearly to shape and size. Fig. 20 shows a drift of the first kind, and Fig. 21 one of the second. The first is suited to shallow holes, the second to those of considerable depth; they are shaped with files from suitable blanks, and then tempered to a plum colour, or the colour between a brown and a purple. Obviously, the cross sections of these drifts may differ to any extent to suit any class of work. For fine work the teeth of the serrated drifts are set closer together; for coarse rough work they are spaced farther apart. They are bevelled to allow clearance for the chips, being the equivalent of backing-off in other cutting tools. For hard metal the angle between the cutting edge and the face is greater than for softer metals, thus following the practice in all cutting tools.

Oil should be supplied to the edges of the drift and of the hole when driving it in, and the work should be bedded firmly on a block of metal. Care must be taken that the drift is driven straight, as it is apt to run to one side—a tendency to be corrected by driving it in the opposite direction. If the hole is deep, the drift must be withdrawn once or twice for clearance of chips, or to remove excess of metal by chipping.

If the hole to be drifted is much smaller than the finished size, it will be necessary to enlarge it by chipping in such parts as may require enlargement.

The serrated drifts are used for making round holes square, round holes oval, round holes hexagonal, and so on. It is better in these cases to work one half the hole at a time than to endeavour to cut on all sides at once. Thus in cutting a square hole from a round one, one-half the drilled hole would be filled up with a half-round bit, and a flat drift operated against the other half of the hole little by little, thin backings being interposed one after the other. When one-half was shaped it would be filled up and the other half treated similarly. An oval hole would be shaped in the same way.

The drift is serviceable not only for thoroughfare holes, but for holes that do not pass right through their material. It is difficult to shape such holes by any other means than with a drift. And with a drift any number of holes can be smoothed and finished all alike. Taking, for example, a rectangular hole to be smoothed in one direction, the drift in Fig. 22 could be used. The face, A, would remove a thin shaving. To take a second cut, a thin strip of metal would be placed behind the drift; to take a third cut, another thin strip; and so on.

Cutting drifts are also used for finishing edges of work, such as the teeth of wheels, ratchets, etc. In this case the resistance is obtained by means of a strap-like fitting attached outside the work, against which face the back of the drift slides.

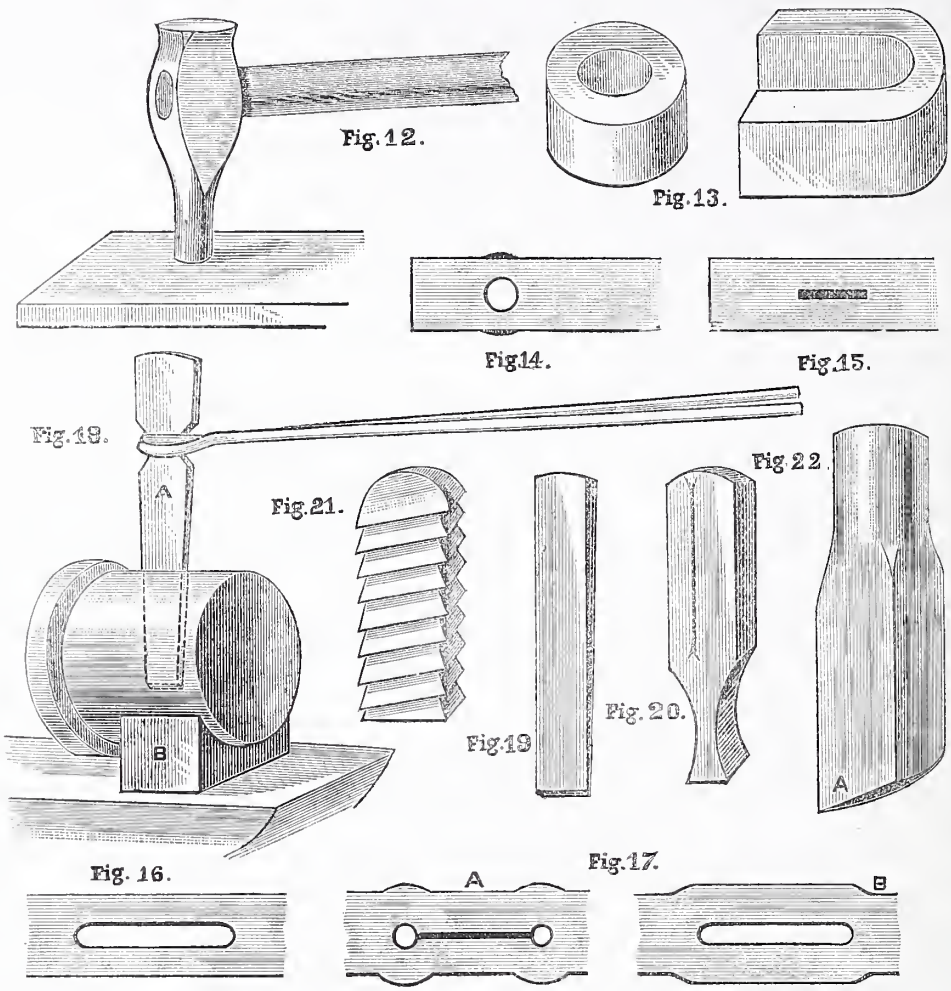



Fig. 12.—Round Punch operating on Thin Bar. Fig. 13.—Bolsters. Fig. 14.—Shows Removal of Material by a Blunt-pointed Punch. Fig. 15.—Shows Advantage of commencing Hole with Hot Set. Fig. 16.—Cutting of Slot-Holes in which Area of Bar is reduced. Fig. 17.—Cutting of Slot-Holes in which Area of Bar is retained: A, Commencement; B, Finish. Fig. 18.—Illustrates Punching of Hole through Stout Pin. Figs. 19, 20, 21, 22.—Drifts.

## WHEATSTONE METRE BRIDGE.

BY H. A. MILES.

USUAL FORM OF BRIDGE—PRINCIPLE—EXPLANATION—MATERIALS—DIMENSIONS OF PARTS—THE SCALE—METHOD OF DIVIDING—THE WIRE, BEST METAL—GAUGE—COMPLETION OF BRIDGE—EXAMPLE OF USE—DESCRIPTION OF MORE ACCURATE FORM OF BRIDGE.

*sual Form of Wheatstone Bridge.*—The Wheatstone Bridge" or "Balance," if ade in the form of a number of coils of ie wire of varying resistances, is a job ther outside the ability of the average nateur to construct; moreover, a certain nount of apparatus is indispensable, as a heatstone Bridge and Bridge Galvanoeter are absolutely necessary, in order that ie resistances of the coils may be accutely determined. The principle on which ie bridge is based is shown in Fig. 1. The Bridge," is shown by Fig. 3, and the parts are lettered, so as to correspond with the preceding illustration: A is a known resistance, D is the line to be tested, B C is a fine German-silver or platinum wire stretched between the two brass ends. The galvanometer is connected to the middle brass strip and to the German-silver wire, the exact point at which the contact is made being found by trial, and being the point at which no current passes through the galvanometer; then the two sides of the German-silver wire bear the same relation to each other as the known to the unknown resistance.

*Materials.*—The material used for the base may be of pine or any other wood, mahogany being preferable. The length will depend on the size of the scale. If this is a metre in length, the base should be fully 44 in. There is, however, no necessity for the scale to be exactly a metre long, as any length each end and holes drilled, both for screwing to the base and to receive the terminals. They should next be polished up, and lacquered with pale gold lacquer. The two short pieces should now be screwed down to the base, exactly 24 in. apart, and the long piece screwed on near the back edge.

*Dividing the Scale.*—To construct the scale, take a strip of cardboard, 25 in. long, leaving $\frac{1}{2}$ in. at each end of the scale to be gripped under the brass strips. The 24 in. should be accurately divided into a certain number of equal parts—five hundred will do very well—and numbered from each end, as shown in Fig. 4, which represents a portion of the scale. The divisions may be obtained by the method illustrated in Fig. 5, two lines being set out at similar angles from opposite ends of the given line, one above and the other below. If these are now divided into the

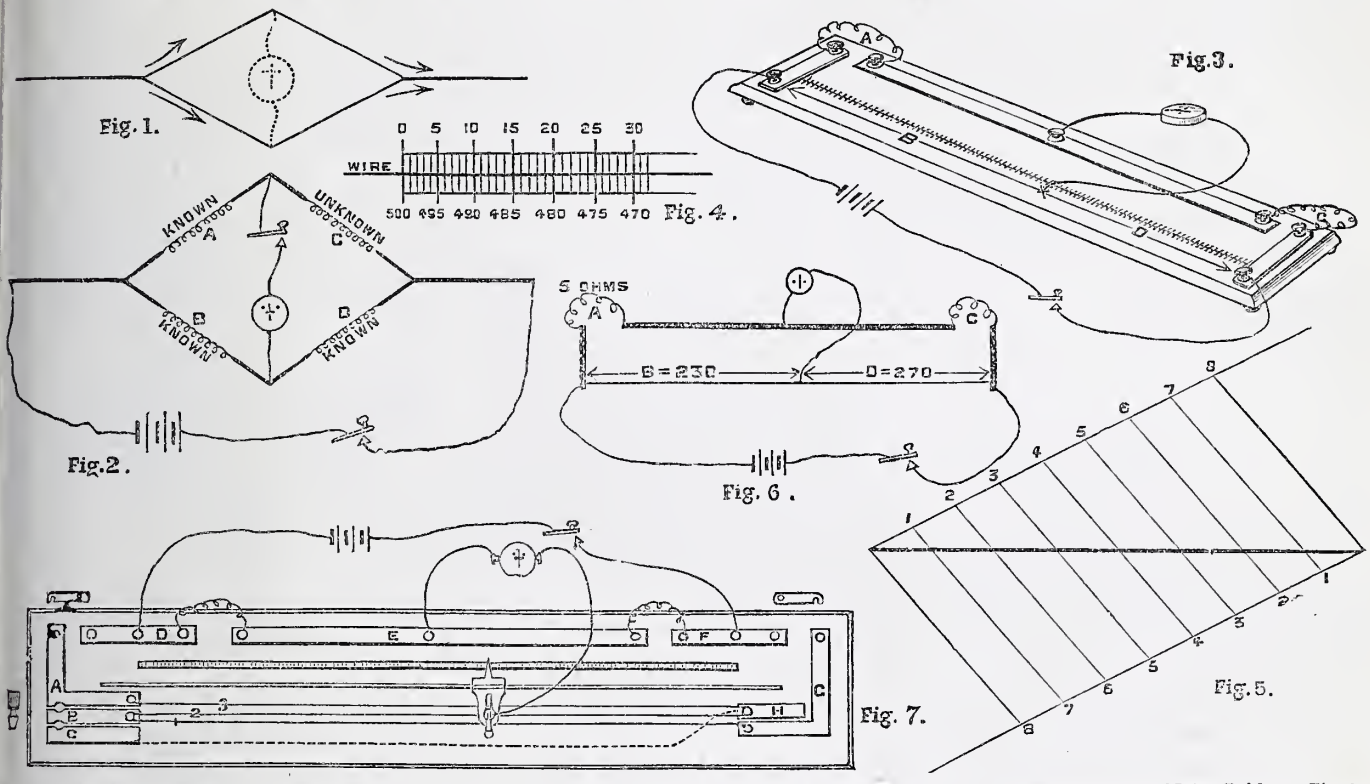



Fig. 1.—Diagram showing Principle on which Bridge is based. Fig. 2.—Method of testing Resistance. Fig. 3.—The Wheatstone Metre Bridge. Fig. 4.—Mode of graduating Scale. Fig. 5.—Mode of obtaining Accurate Divisions. Fig. 6.—Diagram illustrative of Example given of Use of Bridge. Fig. 7.—A better and more elaborate Form of Wheatstone Metre Bridge.

rrows denote the direction of the current lowing through the conductor, which is so livided as to offer two paths between certain oints. If the resistance of the two paths s alike, an equal proportion of current will low through each; and if a galvanometer e introduced between the arms (as shown y the dotted lines), no deflection would be bserved. If, however, one arm offered a greater resistance than the other, there would at once be a fall of potential, and a current would flow between the two arms hrough the galvanometer; and the deflection obtained would depend upon the amount f difference between the two.

*Principle.*—If the arrangement just described is still retained, adjustable resistances inserted in three of the arms, and the wire to be tested used as the fourth arm, it will be a simple matter to ascertain its resistance by varying that in the other arms until the needle stands at zero. (*See* Fig. 2.)

*Explanation.*—The design it is proposed to construct, generally called the "Metre can be equally divided into the requisite number of parts, but the longer the wire is the less liability is there for errors to arise. As a more complicated design is described later on for those who desire a better article, it is thought that the present one may be made with a 24 in. scale. Should anyone, however, wish to make it full size, no difficulty will be found in altering the dimensions to suit.

*Dimensions of Parts.*—Let us, then, start with the data necessary for a bridge with a 24 in. scale. The base will be 28 in. long, 4 in. wide, and $\frac{3}{4}$ in. thick. This should be planed up square, and a neat moulding worked all round the edge. A small turned knob may be fastened on under each corner as feet, and the whole French-polished or sized and varnished.

Some rolled copper or brass strip should now be obtained, a good size being $\frac{5}{8}$ in. by $\frac{3}{16}$ in. Two pieces 3 in. long (one for each end) and another piece 22 in. long will be required. These should be squared up at required number of parts to any convenient size, and parallels drawn as shown, the intersections of the horizontal line will be the required divisions.

When finished, the scale should be sized and varnished, colourless materials being used, after which it may be glued down to the base between the two brass ends, which should be temporarily removed. A better job may be made of it by cutting a shallow groove in the base, and thus sinking the scale in flush with the polished surface of the base. If this is not done, it will be necessary to scrape off most of the polish from below, to aid the glue in securing a good hold. A couple of small brass nails should now be hammered in the base, one at each end, under where the brass strips are fastened, and in such a position that a piece of wire stretched from one to the other would lie exactly in the centre of the scale. (*See* Fig. 4.)

*Wire—Best Metal—Gauge.*—The wire, which is preferably of platinum or platinoid,

though German silver does very well, is of No. 30 gauge, and should now be strained across from one nail to the other, bound round two or three times, and the nails then hammered in nearly flush. The brass ends may now be replaced and screwed tightly down, so as to ensure good contact with the wire. The terminals may be screwed into position, and the bridge will be complete.

*Example of Use.*—An example of its use is given here. A coil of wire, known to offer a resistance of, say, 5 ohms, is inserted at A, and the unknown length at C; then $C = \frac{D}{B} \times A = \frac{270}{230} \times 5 = 5{\cdot}85^{\omega}$, as shown in Fig. 6.

The bridge just described is of the simplest form. I shall now briefly show how a better one may be made on the same general principles. This is shown in Fig. 7.

*Description of a more Accurate Form of Bridge.*—In this case the scale had best be a metre in length, and divided into one thousand parts, additional facility for accuracy being given by the use of three wires and the insertion (if desired) of additional resistances, to increase the delicacy of the test.

The scale in this instance is more to the back of the board, and in front of it is a stiff brass rod, insulated, on which slides a wooden or ebonite key with a knife-edge contact point and an index pointer, both in line at right angles to the scale, so that the pointer indicates on the scale the exact point at which the contact is made. The contact point is adjustable, sliding in a groove, so as to touch either of the three wires as required.

For ordinary use the short-circuiting straps are kept in between A D and F G, but when extreme sensibility is required, additional resistances are inserted at these points. The wires are so arranged that either of them alone or two or three in series can be used.

If the plug is inserted between A B, No. 1 wire only is in circuit. If B C are plugged, wires 1 and 3 are in use; while if the plug is not inserted at all, the current passes through all the wires. The only connection not at once apparent is a stout copper wire connecting C and H beneath the base.

The same remarks as to construction apply equally to this instrument and the simpler form previously described. The base, however, would look better if made of stouter material. A bolder moulding should be run round the edges, and larger terminals used.

The value of the instrument would be much increased by the addition of a lid, which might have a glass top let in, if desired, and which would keep it in a much cleaner state than would be possible without, besides making it more convenient for transit.

The batteries are inserted between D and F, and the galvanometer between E and the sliding key.

If it is desired to obviate the necessity for loose wires over the instrument, all connections may be made underneath, and carried to terminals placed at convenient points on the ends of the base.

I have not attempted to go into the theory of the Wheatstone Bridge, but would refer any reader who wishes for information on the subject to Slingo & Brooker's "Electrical Engineering," or Ayrton's "Practical Electricity," in both of which the subject is well treated. It is also considered in the "Electrician" Primers, a useful series of tracts which have been recently noticed in "Our Guide to Good Things."

## DRAWER BEARERS, AND HOW TO FIT THEM.

BY DAVID DENNING.

Definition of Bearers—Object of Bearers—Nailing — Dowelling — Tenoning — Dovetailing.

It is very probable that many readers who know perfectly well what drawer bearers are may not recognise them by name, and of course, in such circumstances, to say anything about the way of fitting and fixing them would be comparatively useless. Without pretending to give any mathematically exact definition, it may suffice to say that the present paper has to do with the rails which are fixed between drawers in front, not with those which extend from back to front. If there is only one drawer, with, say, a cupboard under, the front rail separating the two is the drawer bearer, so that in a chest of, say, three long and two short drawers, there are three bearers; for though the bottom may in reality serve the purpose of one, we have nothing to do with it, as it is probably a solid board, or may be so, from back to front. The bearer then, so far as it concerns the object of the present paper, is merely the front one of three rails on which a drawer is supported, and does not refer to the solid boarding which is sometimes used instead.

It will readily be understood without insisting on the point that there are more ways than one by which the ends of these rails may be fastened into the carcase ends, and on a few of these I purpose offering a few remarks, which will no doubt serve to guide beginners in cabinet-making: or perhaps I should rather say those who have some mechanical skill, but are not so well acquainted with methods. From this it will be seen that a minute practical description of how to use the tools and do what is necessary is not in contemplation. I assume that the reader, theoretically at any rate, is acquainted with mortising, dowelling, etc., and even if he is not, he will have no difficulty in understanding the present article.

The object of bearers is primarily to separate drawers or to afford support to them, and secondly, to form a connection between the ends of the carcase, or outer casing, which they tend to hold together and render more rigid than they otherwise might be. It follows that the way they are fastened in is a matter worthy of consideration, and a few suggestions on the methods most commonly adopted it is hoped will enlarge the views of those who may have been in the habit of practising one or more, without thinking about anything more than the mechanical features of their work. It is assumed that everyone knows that the ends of a piece of cabinet work should be parallel with each other, and that the bearers should extend "square" across, or, to express it otherwise, the front opening between two ends and bearers ought to be strictly rectangular; for to those who think that the work may be done "anyhow" I have nothing to say, except that their ideas are not valuable, and that the sooner they alter them the better, if they wish to turn out good work. My remarks are addressed solely to careful workers who wish to excel.

Naturally, the simplest way of fastening the bearers in is by merely nailing them through the ends, but such a very primitive mode of working is seldom advisable, and would not be allowable in any but cheap common work. It may therefore be dismissed without further comment.

Then there is the better plan of tenoning the bearers, or the closely allied one of dowelling. Both of these are good methods, and are practised by equally competent cabinet-makers, some preferring one and some the other. Without expressing any personal opinion as to their respective merits, it will be sufficient to describe the chief characteristics, leaving readers to adopt their own course.

It is claimed for the mortise and tenon joint that it is stronger than the other, though for all practical purposes there is little difference in this respect. The tenon, or tenons—for perhaps two at each end of the bearer is the usual number—are left of the thickness of the wood, so that there is not the same risk of getting the bearers fixed other than straightly, as when dowelling is resorted to. When dowels are used, the holes, unless bored perpendicularly, will throw the bearers out of the straight line. Of course, when a really competent man is concerned, the assumption that he would make the holes in an improper way is rather a far-fetched one; but then, all workers are not proficients. With dowels it is often stated that there is greater speed and neatness of appearance, for the ends of the bearers need only be sawn square across for them to fit closely; on the other hand, those who prefer mortise and tenon do not allow that there is much difference in point of time, and that when properly done the joint is just as neat as the other. Beyond close fitting and glue, there is nothing in either of these joints to bind or clamp the ends together. The construction does not do so, for were it not for the top and bottom the ends could be pulled apart. In ordinary circumstances it is not necessary that the bearers should do more than they will if either dowelled or tenoned, but as a matter of theoretical good joinery, many may prefer that the bearers should bind the ends together, and occasionally it is an advantage to the work that they should do so. Of course, if we accept the dictum that good joinery consists in making the construction as firm as possible without using either nails or glue, it is almost necessary to adopt some other joint. Or if this is putting the matter too strongly, another form would be preferable, especially if absolute rigidity is required, rendering it practically impossible to pull the ends apart without destroying the bearers.

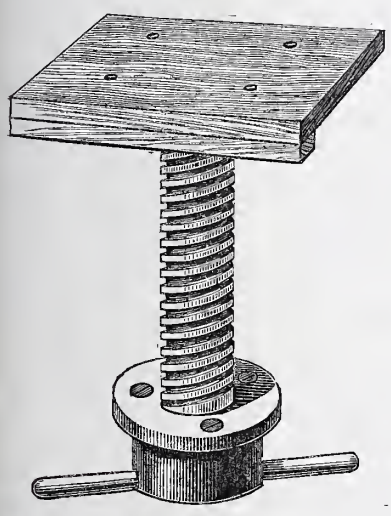
In such a joint the ends of the bearers are dovetailed, usually on the lower side only, and of course fit into corresponding sockets in the ends. In order to prevent the dovetails showing in front, they are cut back a short distance, say to the thickness of the facing slips which are so commonly employed, the sockets being stopped to an equal distance; the bearers are then driven in from the back. When the ends are thickened up in front, there is, of course, no possibility of a difficulty arising in doing this, as the sockets will only be in the thickening pieces, so that the dovetails can just be pushed into them. If the ends are of one thickness throughout, however, the case is somewhat different, as the groove must extend right to the back. When this is necessary it need not be of dovetail shape throughout, but merely in front for a space equal to the width of the bearer. For the rest of the distance it may be a plain channel of the thickness of the bearer, and will serve very well for the drawer runners to lie in. Instead of such a long groove, a

short one just behind the socket may be made, and not shorter than the width of the bearer which is let into it, before the ends are fastened up, and then pushed forward. The dovetail bearers may also be inserted from the front, if the appearance of the joint is not objected to, though even then they may be concealed by fastening facing-slips on afterwards. All this considered, if a really theoretically perfect joint is wanted, there is nothing better than the dovetailed bearers, though in practice any of the other methods are equally serviceable in most cases. The reader, however, will have little difficulty in deciding which form suits his purpose best, and with this I must leave him.

## MEANS, MODES, AND METHODS.

### A Suggestion for a Carver's Screw.

I do not think it is widely known, but a simple expedient to hold work while carving may be made as follows:—Obtain a music-stool screw (cost from one shilling), and a piece of any wood suitable in size for the work to be done. "Let in" the oblong plate of the screw flush to the underside of the piece of wood selected, and bore the screw-holes through the piece of wood. Select screws that will go through and project about ¼ in. beyond the top surface of the wood, and you have a useful block to



**Suggestion for Cheap Screw for Wood Carvers.**

fix the wood under treatment. If needful, a ledge can be fixed under the piece of wood, which, being in contact with the edge of the bench, will prevent the whole affair from turning. A hole in the bench and a turned block to which to fix the nut complete a cheap and useful carver's screw.

Several pieces of wood may be provided, and, if large, instead of screwing as advised, the piece of wood can be permanently fixed on the plate of the screw, and the carving fixed by any number of screws required round the margin. B. A. B.

### A Clean Method of Brazing.

This is sometimes a great desideratum. How often has a nice piece of work been destroyed by having the fire smoky just at the time it should not be!

A friend put me up to a wrinkle which entirely did away with this possibility.

It was to heat the article by putting it into a hot gas retort from which the charge had just been withdrawn.

It may not be known to everyone that coal-gas is made by putting the coal into a large metal box, or retort, which is brought to a high temperature, and thus separates the gas from the coke of the coal. The retorts are emptied periodically, and this is the opportunity for the brazier.

Having cleaned the surfaces to be joined and tied them together with iron wire, plenty of ground borax and spelter are put on the joint, and the entire piece of work run into the hot retort. Almost immediately it gets red-hot the spelter runs, and the job is done. Of course, this plan is not available for everybody, but I have no difficulty in inducing the gas-man to let me use his retort for a few minutes. J. L. D.

### Clearing Chimneys of Jackdaws' Nests.

If any of the readers of Work have had my experience in trying to clear out the masses of sticks and other rubbish which jackdaws pile into chimneys when nest-building, I am sure they will be glad of a wrinkle.

Having climbed to the top of a chimney with much fear and trembling, I spent three hours sitting on one chimney-pot, while with a heavy iron bar, used after the manner of a battering-ram, I tried to drive down a nest through the flue of another. It was all in vain. The nest, which was the result of many years' industry, resisted all my efforts, and was quite as springy and resilient at the end of the three hours' battering as before. At length, in desperation, I poured about half a pint of paraffin oil down upon the nest, and dropped some burning paper on to it. There was a grand blaze, and in a very few minutes the chimney was clear and a roaring wood fire in the grate.

This plan would not do in a city, and, of course, would be cruel if birds were in the nest. J. L. D.

## MASONS' WORK.

BY MUNIO.

Staircases—Arches Used in Masonry: Semicircular, Segmental, Elliptic, Pointed, Ogee, Tudor, Foiled, and Oblique Arches—Niches—Chimney-Pieces—Measuring.

*Staircases.*—Stone staircases are formed in various ways. In some the flights are straight, and sometimes they are divided by landings or half-paces; but as there is not often sufficient space for straight flights, they are formed with return flights, with landings or winders at the turns. The straight steps are termed fliers, and those which are narrower at one end than the other are termed winders. In turrets the steps are all winders, with a solid newel worked on the end, or they are fixed in a central newel of masonry.

The steps are sometimes supported in walls, and sometimes one end of the steps is fixed in the wall, and the other end supported by the step immediately under it. These are termed geometrical staircases.

In order to find the form of the steps for a geometrical staircase with winders, a plan must be made as shown in Fig. 43, from which the form of the steps may be obtained.

The steps are sometimes made plain, and sometimes moulded on the edge and the moulding returned across the end, as shown in Fig. 44. The rebated joint of the steps is squared from the slope underneath, and the steps should not be less than 2 in. thick at the thinnest side. The rise of the steps should be proportioned to the width, a wider step having a less rise than a narrower one. A step 12 in. wide should have a rise of 5½ in., and a step 10 in. wide a rise of 6½ in. To find the rise, divide the full height in inches by the number of steps. To find the bevel for working the underside of the steps, an elevation of each flight must be drawn, and also each set of winders, from which the bevels can be taken.

As the stairs are not usually fixed till the building is up, it is customary to form the grooves for the ends of the steps and landings by inserting bricks in the wall without mortar, and covering them with large flat stones; the bricks are drawn after the walls are up, leaving the grooves ready formed. The steps should be inserted about 9 in. into the wall at the end, and wedged firmly in, and a dowel inserted in the rebated joint near the other end. The landing has a similar joint where it rests on the top step. The landing is generally in one stone, but when in more than one the joints should be joggle-jointed. Mortises are cut in the ends of the steps in which the iron balusters are fixed, and run in with cement or melted lead.

*Arches used in Masonry.*—The arches principally used in masonry are the semicircular, the segmental, the elliptic, the pointed, the ogee, the Tudor, the foiled, and the oblique arches. The lowest portion of the arch is termed the springing, the top portion the crown. The stones forming the arch are sometimes termed voussoirs; the underside of the arch stones is termed the intrados or soffit, and the top side the extrados; the centre arch stone at the top is termed the key. Arches are plain on the face, sometimes chamfered or moulded on one or both faces. Inside arches of windows, doors, etc., are generally splayed; the joints of arches are sometimes rusticated.

Arches are turned or built on wood centres, which must be of proportionate strength to support the weight of the arch stones till keyed.

In setting a range of arches the quoins should be set up first, so that the face of the arch may be kept straight by means of a line or rule, and in walling between arches, when a line cannot be stretched, each course should be bevelled. Relieving arches are formed in the wall over lintels, door- and window-heads, etc.; they should always be turned from the outer end of the lintel or head. They are generally hammer-dressed, except in ashlar-work, when they are chisel-dressed.

*The Semicircular Arch.*—This arch is drawn from the centre of the springing line; the depth of the arch stones is then marked, and a second circular line drawn, which gives the line of the extrados. The key-stone is then marked, and the remainder of the arc divided equally, and lines drawn from these points, radiating to the centre, give the arch stones. Sometimes the extrados are not made parallel to the intrados, but are squared to join the wall stones. Fig. 45 represents a semicircular arch, half the arch stones being of equal length, and the remaining half squared at the extrados.

The stilted arch is a semicircular arch, with the sides carried downward in a straight line below the springing till they meet the impost or cap.

The horse-shoe arch is also semicircular, with the arc carried below the springing to the cap, which narrows the span of the arch.

*The Segmental Arch.*—This arch is less than a semicircle, and is drawn from below the springing line. The centre is found by dropping two perpendiculars from the centres of straight lines drawn from the rise of the arch to the springing on each side; the point of intersection of these perpendiculars is the centre from which the arch is drawn. The key is marked, and the arch divided in the same manner as the semicircular arch; the arch stones are sometimes squared at the extrados.

*The Elliptic Arch.*—This arch is half of an ellipse or oval, and is drawn from two centres on the springing line and one centre below the line; the key is marked off, and the arch stones found as previously described. The joints of each portion of the arch must be radiated to the centre from which it is drawn.

*The Pointed Arch.*—Pointed arches are of three kinds: the lancet, the equilateral, and the obtuse. The lancet is formed of two segments of a circle, the centres of which have a radius longer than the width of the arch.

The equilateral arch is formed of two segments of a circle, the radius of which is equal to the width of the arch.

The obtuse arch is formed of two segments of a circle, the radius of which is shorter than the width of the arch.

These arches are generally formed without a key, although in some cases a key is used. When the extrados are not made parallel to the intrados, they are cut as shown in Fig. 7 (page 97).

*The Ogee Arch.*—This arch is formed of four segments of a circle, the centres of two of which are on the springing line inside the arch, the other two being on the outside and level with the point of the arch, each side being formed of a double curve, convex below and concave above. It is generally used as a hood or label mould over another arch.

*The Tudor Arch.*—This arch is described from four centres, two level with the springing line and within the arch, and two below the springing. The arch stones are drawn in the same manner as the elliptic arch. For ordinary door- and window-heads it is often made in one stone, with a square hood moulding over it.

*Foiled Arches.*—These are of three kinds: the round-headed trefoil, the pointed trefoil, and the square-headed trefoil.

The round-headed trefoil is drawn from two centres on the springing line and one centre above. It is used chiefly as a heading for niches and blank arcades.

The pointed trefoil is drawn from two centres on the springing line and two above the springing. It is generally used for foliations in tracery work, within a pointed arch.

The square-headed trefoil (Fig. 46) is used for door- and window-heads. It is sometimes in one stone and sometimes in three, as shown.

*Oblique Arch.*—The oblique or skew arch is that form of arch in which the line of the abutments is not at right angles to the face of the arch. Oblique arches are of two kinds—one with plane joints and the other with spiral joints.

An oblique arch with plane joints is that in which the beds of the stones are in planes passing through the axis of the cylinder, the face being bevelled.

An oblique arch with spiral joints is that in which both the beds and joints form spiral surfaces. The arch stones are set square from the face, and consequently meet the springers at an angle; the springers are therefore made wider at one end than the other, the difference being generally equal to the width of the arch stones. They are used for the arches of bridges, and are generally segmental or elliptic in form.

*Niches.* — Niches are arched recesses formed in walls for statuary or ornamental purposes. They are generally semi-circular or semi-elliptical in plan, although other forms are used; the arched covering is of a semi-spherical form. When the openings are small, the arch is formed with one or two stones; but when the opening is large, the arch is formed in a similar manner to the semicircular arch, except that the arch stones diminish from the front to a point in the centre at the back of the recess, and the soffit is circular. In order to obviate cutting the arch stones to a point, a semicircular boss is placed in the centre of the recess, the face of which is worked to the curve of the soffit, and the bed is radiated. Upon this the narrow ends of the arch stones rest.

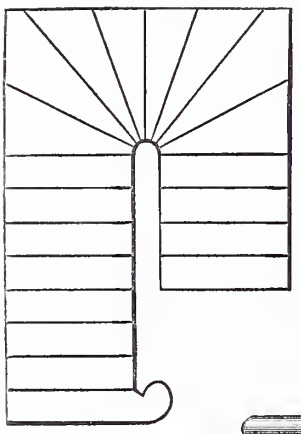


Fig. 43.—Plan of Staircase.

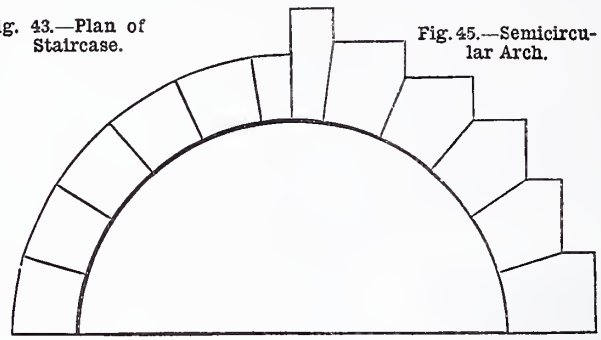


Fig. 45.—Semicircular Arch.

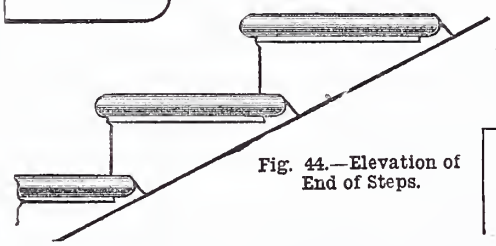


Fig. 44.—Elevation of End of Steps.

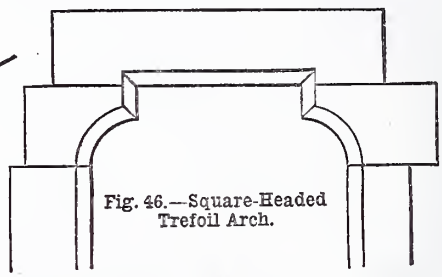


Fig. 46.—Square-Headed Trefoil Arch.

*Chimney-Pieces.* — Chimney-pieces are sometimes formed with solid jambs and mantels, from 6 in. wide and upwards. They are fixed in arched recesses left in the chimney breast, and the shelf is pinned into the wall; they are worked plain, chamfered, or moulded. Sometimes the jambs and mantel are formed of sawn slabs, from 1 in. thick. They are fixed by means of copper or brass cramps let into mortises cut in each stone; the shelves are pinned into the walls, and the angles are sometimes chamfered or moulded.

*Measuring.*—Masons' work is measured by the lineal foot, the superficial foot or yard, and by the cubic foot or yard.

Footings are measured by the superficial foot, the thickness being given.

Foundation walls above 2 ft. in thickness are measured by the cubic yard. Ordinary rubble walls up to 2 ft. in thickness are measured by the superficial yard, deducting the net size of openings.

Blocking course or hammer-dressed walling is measured by the superficial yard, deducting the openings, and giving the average width of the beds.

Ashlar-work is measured by the cubic foot for the stone, the face-dressing by the superficial foot, and the beds and joints by the superficial foot.

Reveals, splays, grooves, chases, throatings, chamfers, etc., are measured by the lineal foot.

Window-heads, sills, plinths, strings, and similar work under 9 in. thick, are measured by the lineal foot, measuring the girth for the dressing.

Arches, cornices, copings, parapets, etc., are measured by the cubic foot for the stone, and the dressing by the superficial foot. Moulded work is girthed by the tape measure, pressing it into all the members of the moulding.

Arches are girthed at the intrados and the extrados, and the two girths added together and divided by two for a mean girth.

To find the stone in an arch, multiply the mean girth by the depth of the arch stones, and this product by the length for the contents.

Paving and flagging are measured by the superficial yard, specifying the quality and thickness.

Kerb and channel are measured by the lineal foot.

Returned mouldings are measured round the ends, and the number of mitres given as either external or internal mitres.

Steps and thresholds are measured by the lineal foot, and girthed for the dressing.

Quoins are measured by the cubic foot for the stone, and the dressing by the superficial foot. Sometimes they are measured by the lineal foot in height, the size being given.

The practice of measuring varies in different districts; but it is trusted, from what has been given, that readers will understand the basis on which it is calculated.

## DESIGNS FOR FINGER PLATES OR PANELS IN REPOUSSÉ WORK.

BY ROBERT COXON.

THESE two designs are drawn especially to assist the brass worker in producing good work in repoussé, without demanding too much labour; and when carefully traced and worked out, will be found to produce charming panels, either for the purpose of door plates, or other panel work for furniture or wall decoration.

By first carefully tracing the drawing, by means of the ordinary carbonised paper, between the brass and the drawing—using a hard lead pencil or ivory tracer—you will

TWO DESIGNS FOR FINGER PLATES OR PANELS IN REPOUSSÉ WORK.

get a good line on the brass to commence with; and having secured it by screws to a stout piece of wood, about 12 in. by 6 in. and 1 in. thick, upon which previously place a stout piece of sheet-lead between the brass and wood board, commence by marking all straight lines first with the straight tracer, and the curved ones with their respective tools. Having done which, work out, with the blunt or rounded edged tools, the leaf, scroll, and beads, using as much care as possible in modelling these, as a great part of the effect depends upon this part of the work, and finish by working up the background to leaf work and centre scrolls with their respective tools.

This work may seem, upon the effect turned out, to be extremely difficult, but, on the contrary, it is very simple, many ladies and children having produced good results from patient work; and to those who have not tried it before, it can be recommended as something novel, and producing surprisingly effective results.

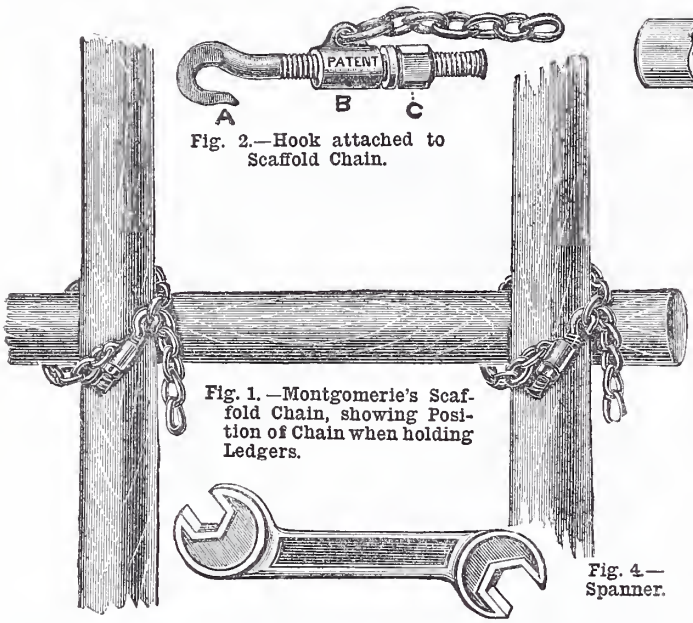



Fig. 2.—Hook attached to Scaffold Chain.



Fig. 1.—Montgomerie's Scaffold Chain, showing Position of Chain when holding Ledgers.

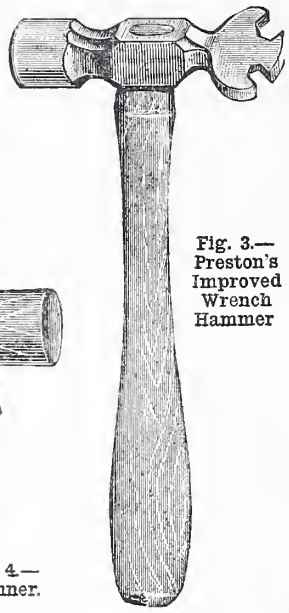


Fig. 3.—Preston's Improved Wrench Hammer



Fig. 4.—Spanner.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

58.—Montgomerie's Scaffold Chain.

Everybody who has paid any attention to workmen when engaged in the work of putting up a scaffold must have noticed the way in which the horizontal spars or ledgers are bound to the vertical poles by means of ropes, which are tightened by driving in wooden wedges between the timbers themselves or between the rope and the timbers which it holds together, in order to bring the tension of the rope and its binding force on the poles to a maximum. The use of ropes for work of this kind is now rendered unnecessary for all who are ready and willing to adopt other means, by the introduction of Montgomerie's Scaffold Chain, which has been submitted for notice, and is supplied by Mr. Edward Preston, tool and cutlery warehouse, 8, Snow Hill, Birmingham. The illustration of the chain given in Fig. 1 represents the position assumed by the chain when holding ledgers, but, as it has doubtless occurred to the reader, other connections, different to this, may be made in an equally satisfactory manner. Fig. 2 shows the manner in which the chain is used. First screw the nut, C, away from the hook end, A, until it is stopped by the flat head at the end of the screw. Then let the barrel, B, with chain attached, slip down to the nut; place the chain in the position desired, and insert the hook in the link which happens to be most convenient, leaving any links beyond the one into which the hook is placed hanging loose, after which screw the nut, C, towards the hook, A, until the necessary tightness is attained. Even if the nut be not screwed up tight, the chain will not slip down, as the ledger causes sufficient strain on it, or "drag," as it is technically called, to make it hold. The chain, as is very truly asserted, has great advantages, and entirely supersedes ropes, as well as chains or short pieces of chain with a spike at each end, and enables the builder entirely to dispense with wedges for tightening ropes, which is properly regarded as one of the chief disadvantages of the present system of scaffold building; the wear and tear of the ropes, owing to the great strain put on them by the wedges, being another, and one which points to the economy effected by the use of the chain, which is rendered still more palpable by the fact that when the screw gets worn, as it will do, by frequent use, it can be renewed at small cost. Further, the strength of the chain and its durability, when compared with the rope, and the fact that the action of the screw tends to make the grip of the chain on the poles far more tight and rigid than that of the rope even when wedged up to the uttermost, clearly indicate that by its adoption scaffold accidents through collapse of the structure will be reduced to a minimum. The chains are supplied in three sizes—namely, 30 in. long with links $\frac{1}{2}$ in. thick, tested to 5 cwt., at 24s. per dozen; 36 in. with links $\frac{5}{16}$ in. thick, tested to 12 cwt., at 28s. per dozen; and 36 in. long with links $\frac{3}{8}$ in. thick, tested to 22 cwt., at 33s. per dozen. Preston's Improved Wrench Hammer, shown in Fig. 3, and combining in itself two separate tools—namely, a wrench and a hammer—sold at 5s. 6d., will be found to possess special utility for tightening up the nut; and Mr. Preston also supplies for 1s. good spanners, taking 1 in. nuts at one end and $\frac{5}{8}$ in. nuts at the other.

Another advantage presented by the use of Montgomerie's Scaffold Chain, and one which has not yet been noticed, is the saving of time effected in putting up and taking down these temporary structures, for it will be seen at once that it will take far more time to adjust, secure, and wedge up a piece of rope than it will to put the hook into the most convenient link of the chain and screw up the nut. The Editor.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Envelopes. — Everybody knows the inconvenience of trying to introduce into an envelope just a little more matter than it will hold, while the domestic stationery case seldom contains any sizes larger than those used in every-day correspondence. There is room for a design which will suit either the ordinary note or the larger package of enclosures it is occasionally desirable to enclose. Such an envelope could not, of course, be gummed down to a fixed size; while it must look neat, no matter its spread. Such a device seems simple enough at first sight, but in reality requires some ingenuity to produce—the problem, however, being well within the range of ordinary ingenuity. As such an envelope is wanted by the stationery trade, a successful design would, in all probability, prove very remunerative.

Bicycle Tyres. — Despite the numerous patterns, pneumatic, etc., now on the market, manufacturers of cycles are asking for something which combines all the advantages of the pneumatic without its liability to be pricked so as to render it virtually useless. The solution will probably be found to be in some combination of metal and rubber, so as to render the latter independent of mere air support. All cyclists are agreed that, no matter how apparently excellent the patterns now in use, finality has by no means been reached. Whether existing lines should be followed, or a new and bold departure take their place, is a question just now exercising many ingenious minds. Meanwhile, our readers may be glad to have their attention directed to the matter.

Cycle Boots.—Apropos of cycling matters, we note that votaries of the wheel are asking for a boot or gaiter which, while not proclaiming its object so as to mark the wearer as a cyclist when walking about, shall, nevertheless, save the trouser-ends from dirt or injury. Bootmakers are (rightly) regarded as the most conservative of artisans, but, in view of the real want expressed, a suitable pattern would doubtless find a manufacturer.

Pencil and Paper.—A large number of people grumble, not mercly at having to sharpen the familiar lead pencil, but even at the slight trouble involved in keeping a pencil-case lead properly protruding and sufficiently sharp. Why should not such people be suited by the invention of an almost lasting *stylus* which would at once produce a well-defined mark upon prepared paper? The old-fashioned pocket-books, with their (literally) leaden writing instruments, were a step in this direction, but they were never liked. People like to see what they have written standing out in bold black characters; and an invention of this nature would probably take.

Smokeless Briquettes.—Every now and then the invention of an absolutely smokeless briquette (which, as most people know, is an artificial compound of coal-dust, pitch, etc.) is announced by some sanguine inventor, who invariably finds that, under some unforeseen conditions, his compound is a failure. There is a large field for inventive effort in this direction, and the lucky discoverer of a really smokeless fuel will excite the envy and admiration of his friends. It need scarcely be said that an open space for experiments is a *sine quâ non* to those who would essay an endeavour to discover the much-needed substitute for smoky coal.

Anti-Scale Preparations.—Despite numerous attempts to find a really satisfactory preparation that will prevent scaling in boilers, the field is still open to anybody who can discover the much-wanted substance. Eucalyptus oil, kerosene, vinegar, the sawdust of certain woods, and an infinity of other materials, have been tried, pronounced successful, and—failed under crucial tests. Very probably this has arisen because water derived from one source requires different treatment from that derived from another. The fact undoubtedly remains that while power users in some localities declare that So-and-so's mixture is perfectly successful, people at other places find it quite useless.

## SHOP:

### A Corner for Those who Want to Talk It.

**** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Rate of Circular Saws.**—B. A. B. (*Hampstead*) writes:—"May I say that I agree with CHOPSTICK (see WORK, No. 120, page 251), especially when he claims that for cutting thin stuff, grooving, rebating, etc., the advantages of a small circular saw are great. The great thing is to abolish 'slip.' Now, both the Britannia Co. and Barnes, of the United States of America, make circular saw benches which do away with slip, and I have no hesitation in saying that for small work, such as beehives and fittings, cameras and dark slides, book slides, and for preparing small things for turning, a hand- or foot-power circular saw, used with care and judgment, is a great advautage."

**Rate of Circular Saws.**—A. R. (*Scorrier Saw Mills*) writes:—"With pleasure I reply to CHOPSTICK (see WORK, No. 120, page 251). The letter he refers to in No. 116, page 187, emanated from me, and not from A WOODWORKER. CHOPSTICK asks if I could get a joiner to cut 3 in. deep with a hand rip saw, insinuating that it is almost impossible to find a man to cut 3 in. deep with a rip saw. This is absurd. Within a radius of a very few miles, I could, if needed, get not only one, but scores of joiners who would rip 3 in. deep in red or yellow pine, and even deeper than that. In fact, I have seen work done with a hand rip saw which it would be impossible to do with a circular saw driven by hand. I am acquainted with several workmen who have small circular saw-benches within two miles of my residence, and the men employed at each place inform me that they prefer ripping stuff from 2 in. to 3 in. deep with the hand rip saw to turning a wheel to drive a circular saw, which they term hard labour. CHOPSTICK may have a man who prefers turning the wheel for the simple reason that he is not a skilled mechanic. I am of opinion that nine out of ten mechanics would not accept such a job. All with whom I am aequainted prefer the hand rip saw for such work. Again, if you have a labourer to turn the wheel, a tradesman has to do the sawing, and, taking all things into consideration, I maintain that the haud rip saw in such work has the advantage. I agree with CHOPSTICK that where there is a deal of rabbeting and grooving to be done, the circular saw bench is very useful in grooving ⅜ in. and ½ in. deep. Not long since I ordered a ¼ in. grooving saw, and put it in working order for a friend who had a quantity of grooving to do, and the work was despatched in much less time than if it had been done with the plough-iron. But at the same place they preferred ripping above 2 in. deep with the hand rip saw. Again, not long ago a joiner came to me and said he had a deal of ripping to do in 2½ in. and 3 in. red pine, but his saw was cutting hollow and round. I looked at the saw, and found it was slightly bent. I sharpened and straightened it for him, and met him a day or two after, when he said (using his own words) 'he had been ripping two days with it, and it went *grand*.' Again, I pass a shop daily where there is a small circular saw bench, and if you were to go into the shop you could not see the bench, because it is buried with waste timber; and if they have not time to bring the timber to our works to be sawn, they rip it with the hand saw. A circular saw by hand in certain work is not work for a man; but I think the above will fully confirm my argument on page 187, Vol. III., of WORK."

**Varnish.**—H. L. (*Urmston*) writes:—"Referring to your reply regarding varnish to J. T. (*Nottingham*), in your issue No. 121, page 268, I have used a cold lacquer made by the Dalton Manufacturing Company, whose offices are at 12, Peter Street, Manchester, which I have found excellent for all kinds of metal. It dries quickly and becomes perfectly hard, and entirely free from the stickiness mentioned in your reply. It requires no heat or other preparation, and can be used by anyone. They make it pure crystal, also black, and in a great number of shades, all of which are transparent. It can be bought in shilling bottles, also in large quantities."

**Gilding on Glass.**—T. W. V. (*Leicester*) writes:—"Having seen both H. L. B.'s and BLINKER'S answer to YOUNG SIGNWRITER (see WORK, No. 121), with all respect to your correspondents, I may say that their description of gilding on glass is not the practical method. Having at times seen hints in WORK that have been very useful to me, I would like to give YOUNG SIGNWRITER, or any other aspirant in glass gilding, the practical way of doing it. This work is usually done on shop windows. Mark the design on the outside with wax, then go inside and clean the window. When this is done, size in the letters (size with spirits of wine is best—see H. L. B.'s instructions in WORK, No. 112). There is no need to be particular in the cutting in with size, but it is advisable to have as little size as possible in front of the leaf. Only size a letter or two at once. When the gilding is completed and dry, see to all pin holes. Then with japan black line the letters in (you will be able to see the wax line through the gold leaf). It is best to size the gold before blacking, but it is not necessary to do so. When all the letters are written, let the black dry; this will take only a few minutes. Clean out your brushes while this dries. Then, with a little warm water and sponge, wash all over the letters and window, and the gold outside your letters and size will come off. I will give a further bit of valuable information to the glass writer. Get some clear varnish and line ⅛ in. outside the letters, which will protect them from water. If you should prefer a stencil (which is very useful for facias), cut the letters out of paper, and stencil the black on gold leaf instead of writing with a brush."

### II.—Questions Answered by Editor and Staff.

**Monogram for Illuminating.**—A. C. (*Leicester*).—The following monogram, E. E., is in answer to the request of A. C. (*Leicester*). This correspondent omitted to mention the object for which his design was intended. This should always be

E E Monogram Design.

stated, as monograms for different purposes require different treatment. For instance, one drawn for fretwork, if used for illuminating, would present a very wooden and clumsy appearance, and *vice versâ* the result will be equally inartistic, therefore unsatisfactory.—A. C.

**Hall-Marking.**—J. H. W. (*Homerton*).—I fear that it is not possible to re-hall-mark your ring, but you can judge for yourself from what follows, and if you decide, after all, to have it done, the Editor will, on receipt of a note from you, endeavour to give you the name of a manufacturing jeweller who would do the job—that is, always providing that you do not know of anybody yourself in the line. First, then, you should know that it is necessary to obtain at least 12 grains of the gold from the ring itself, for the purpose of obtaining by assay the proportion of fine gold that there is in the article. That matter, however, is carried out at the Gold smiths' Hall; but you could not take it there yourself, for no work is received unless by firms that have already registered their name-punch. The hall-mark, being a trustworthy guarantee, is not placed on any work without a thorough test. So to prevent any cheating, the ring has to be cut open to show that the quality is the same all through, and it is partly laid flat to allow of the marks being struck. The authorities at the "Hall" have the right of scraping or filing or cutting the quantity of gold required from any part they choose of the work sent in. Now, in this case, where the ring has been in bad hands, it is very doubtful if it would once more pass the Hall; for even if the new piece put in is fully 15-carat, there will probably be more solder about it than there should be, and so the general quality will be lowered. The Assay Department of the Goldsmiths' Hall has the power of smashing any work that does not come up to the stated quality, although now I do not think they do so in all cases, but return it unmarked to the sender. I said that I would try and find somebody to do this job for you, but it is a very unthankful business; for no manufacturer likes to have his work sent back through being of inferior quality, nor will they run any risk of it, as a rule. It is almost a pity that you did not get skilled advice on this business, for then the dishonest jeweller who tried to pass off a piece of base metal in place of your gold could have been made to pay for his trickery; and I should be quite willing to have helped you to make him smart for damaging your ring and attempting to rob you of a portion of its gold. Thus, you see, to re-hall-mark the ring is an unsatisfactory job to take up; and even if successful it would cost from 5s. upwards before the ring is again in fit condition to wear. The hall-marking of a portion is distinctly forbidden. If you desire to know if it is 15-carat gold that has been put in, nearly any jeweller ought to be able to tell you that; but if you desire an authoritative opinion, you can obtain it from Messrs. Johnson, Matthey & Co., Assay Office, Hatton Garden, by sending 1s. 6d. and cost of return postage, with a request for them to make a "parting" assay of the back part of the ring. It will, as I have already said, damage it somewhat, for the half-pennyweight requires some scraping to obtain, and it would be simpler to cut a piece right out, which they very likely would do.—H. S. G.

**Reflecting Telescope and Eye-piece Lenses.**—E. G. S. W. (*Weybridge*).—I am glad to learn that your speculum defines well. Of course, you know that by using it without a flat you simply form an Herschelian telescope. In selecting the plate-glass for the experimental "flat," try and get a piece of an old good mirror—more care is likely to have been taken in the original polishing of such glass. The scratches on the eye-piece lens should not matter much for preliminary tests; and I fear the price asked by Wood, of Cheapside, is the price any optician will ask. I wrote on your behalf to Messrs. Lancaster & Son, of Birmingham, and their catalogue is likely to be of use to you or any other amateur. They express their readiness to supply any kind of lenses that may be required. The price they name for lenses for eye-pieces is—for low powers 3s. each set, and for high powers 4s. each set. The latter price, you will see, is the same as that asked by Messrs. Wood. Perhaps some reader in actual touch with the trade will come to our assistance, and tell us if reliable lenses for astronomical eye-piece work, edged and centred, can be obtained anywhere at a cheaper price than that given above. The firm I previously referred you to has, as you say, ceased to exist. I should strongly advise you to make an effort to buy from an old-established maker one complete eye-piece of medium power (say, 150 equivalent). This should cost you from 10s. to 12s. 6d., and, possessing it, you could be quite sure that any observed error must be in the speculum. This, as you will by this time know, means more than it sounds.—E. A. F.

**Upholstery.**—F. W. R. (*Harling*).—I am afraid it is useless to give you names of firms dealing in the class of articles you want, for if you cannot see them in the pages of the periodical you mention, I am almost sure you would overlook them in WORK. I do not think there is anything commonly used in the upholstery trade which is not advertised by some firm or other, and to make a selection between the merits of competing houses is not our province. Of course, you cannot expect each advertiser to give a complete list of all the articles they deal in, but you can surely use your own judgment, even if you have no personal knowledge of the trade. Thus, if you see a man advertising general hardware for cabinet-makers, etc., surely it will occur to you that he would be a likely one to apply to for tacks, gimp-pins, studs, etc., even though he does not say in his advertisement that he supplies these. To give you a complete list of everything used would take up more space than can be spared; but if you cannot avail yourself of the above hints, let us know, and state exactly what you want, and you will be helped. At present, even among those things you name, you are too indefinite. For example, you mention "stuffing materials." Do you mean hair, flock, wool, alva, fibre or other stuffing, or all of them? Then, do you want blind materials, bedding, and so on? Really, if inquirers knew how much more definitely they could be answered, they would not hesitate to be more explicit than they are. If it is worth while for the publishers to place at their disposal several columns of "Shop," and for members of the staff to devote their time and experience to answering questions on any branch of practical work, it ought not to be too much trouble for inquirers to tell us what they want to know. Too many, like yourself apparently, seem to think that the vaguest hints as to their difficulties and wants are sufficient to enable us to help them. If you and other readers will kindly note these remarks, and act on them, you may be sure that no trouble is spared in endeavouring to assist; but if you cannot state your wants, it seems hardly fair that valuable space and time should be taken up in giving you the attention expected. Inquiries cannot be answered privately through the post.—D. D.

**Fretwork Patterns.**—D. B. J. (*Dalbeattie*).—I am sorry that I cannot agree with your complaint that fretwork patterns are too dear. You must remember that the publishers must pay for designs, labour, and incidental expenses, as well as make a reasonable profit. Good designs and work cost money. The one you forward as a specimen of cheap work may be satisfactory to some fret-cutters, but I cannot imagine anyone who knows anything of design, or who is able to do good work,

wasting time and material over it. This is far from saying that it is not worth the money charged for it, for the price being so low very little can be expected; but it is in no way better, or even such good value as many of the most expensive designs which are issued. You might as well complain of wood, glass, hinges, and the other items you name being too costly to allow of your making a profit on your work as of designs. Of course, you are aware that when making up fretwork articles, especially if for sale, it is not economical to use a printed pattern for each, but is better to take a heelball rubbing, or adopt one or other of the well-known processes for reproducing designs. You want to know where you can get patterns for less than 2s. 6d. each; but as you have several catalogues, I am afraid you have not looked through them, for I do not know of any—and I am acquainted with all the chief ones—which has not several under this figure. However, to give you names, I may mention those of Harger, Settle; Skinner, East Dereham; Zilles, London; Busschotts, Liverpool. The latter two supply principally German and Italian designs respectively at low prices.—D. A.

**Camera.**—A. W. (*Paisley*) forgets that his very abbreviated descriptions are somewhat difficult to follow. He can scarcely expect any criticism on anything that is not actually explained, and that such and such things *may* be made in other ways than described, in order to meet objections, is altogether outside the question. Has A. W. actually made a working instrument according to his diagrams? If not, we should advise him to do so; for a thing may seem all right on paper, but in reality be very different. With regard to his box to be used as a dark tent, it seems to us inconvenient and unnecessary in these days of dry plates, when development is seldom or never done out-of-doors, and indoors a larger working room is desirable. With the wet collodion process, something of the kind was essential, and Edwards brought out his Graphogenic apparatus to meet the want where the development was conducted in a ruby glass box. Practically it was a failure, although no trouble was spared in the manufacture, and every supposed requirement was met. We can only reiterate that A. W. had better make the apparatus and try it, or let some *practised photographer* do so, in order to estimate its working value correctly.—D.

**Leclanchè Battery.**—D. A. R. (*Stockton*).—Your "electric battery" is known by the name of the Leclanchè battery. In answer to your questions—(1) The outer jars are charged with a mixture of sal-ammoniac and water. Sal-ammoniac dissolved in water until the water will dissolve no more. This is named a saturated solution. Dilute this with one-third more water to form the battery solution, and fill the cells to within one inch of their tops. (2) This charge may not need renewal for three years, or it may only last three weeks if the bells are rung continuously, or the circuit leaks. (3) You may compare the battery to a cistern of water if you choose to do so. You will then understand that you can get no more out of it than you put in the cells; but do not imagine that the electricity runs out as a liquid, and therefore empties the battery jars of the liquid with which they were charged. The liquid sinks in the jars because the water of the solution is evaporated and passes into the air. This takes place more rapidly in warm weather and in warm situations than in cold, hence the battery should be kept in a cool place. One jar may be warmer than the other, and this may cause "the water to disappear from it in much less time than the other." There is much less surface of zinc exposed to the solution when the jars are only half full, consequently there is more resistance in the battery, and less current available for the bells. As the battery does not furnish enough current to ring the bells, they stop ringing. Always keep the solution up to its first water line by adding a little rain water occasionally. (4) The "jars may be worked out" with a year's use if this has been excessive or the circuit has leaked. A Leclanchè battery is "worked out" when the peroxide of manganese in the porous cells has given up all its free oxygen and passed into the form of a sesquioxide. Take out the porous cells and soak them in warm water for two or three hours. Clean the zinc rods and the outer cells, then charge the battery with a fresh sal-ammoniac solution. If the battery works all right after this, the porous cells are not worked out. (5) Two small jars ("1s. 3d. size") are barely enough to ring even two small bells.—G. E. B.

**Black Stain.** — LITTLE JIM. — What kind of bracket is it? If it is of wood, then why wish to make it like black marble or enamelled-slate time-pieces? To use this effect successfully, your bracket must be devoid of ornamentation. In any case, if you wish a very *lustrous* black, use black enamel upon a coating of flat black paint. A less brilliant surface would probably look the best, for which ebonise and then French polish. Refer to Index, Vol. II.—F. P.

**Aquarium Fountain.**—J. P. (*Edinburgh*).—An illustrated article upon the above will appear in WORK in due course, but, pending its appearance, if you are in a hurry, you might with advantage study the description of a Self-acting Fountain in No. 69 of WORK. If you look at the diagram illustrating the working of the fountain, you will see that *the depth of the basin* would be the only material alteration required to make that particular design answer for an aquarium—the jet-pipe and filling-plug, of course, being raised to the necessary height. As to any fountain being "self-feeding," that is simply an idle wish. The only advantage in trying to make one that I know of is the certainty that the worker would leave the job much wiser than he started.—C. M. W.

**Bell-Ringer's Table.**—RINGER.—I give a sketch of a simple portable table which I have designed to fold up into the space required, viz., 3 ft. long and 1 ft. 8 in. wide, to be used as a handbell-ringer's table. It is composed of eleven pieces when complete, as the following:—Four pieces hinged in centre to form top, size when folded 2 ft. 9 in. by 1 ft. 6 in. (see Fig. 5); these pieces should be properly framed-clamped to make them flush on both sides; they will also be lighter made this way than if they were clamped with battens, for you can hardly have the top out of less than 1 in. stuff. Two pieces hinged in three places to form long rails out of 3 in. by 1 in., as in Fig. 4; these are secured to the uprights with thumb-screws. Two pieces hinged in five places to form struts or stiffening pieces, secured to the long rails,

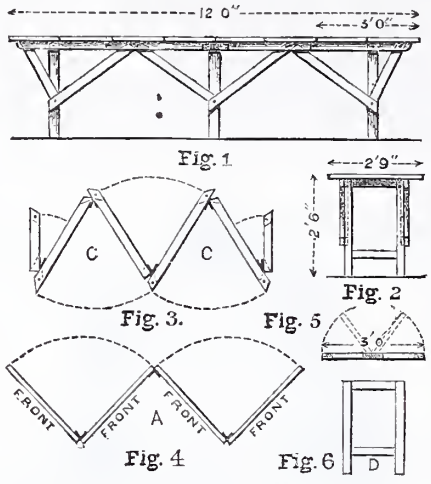


Fig. 1 Fig. 2 Fig. 3. Fig. 5 Fig. 4 Fig. 6

**Bell-Ringer's Table. Fig. 1.—Elevation of Table. Fig. 2.—End View. Fig. 3.—Struts, showing Method of Hingeing. Fig. 4.—Front and Back Rails, showing Method of Hingeing. Fig. 5.—Flaps. Fig. 6.—Framed Support.**

A, and the uprights, D, with thumb-screws (see Fig. 4); and three framed uprights, Fig. 6, with 2 in. legs and 2½ in. by 1 in. rails, making eleven pieces in all. The method of putting the table together is as follows:—First stand your uprights in position, open your two top rails, and connect the top rails to uprights with thumb-screws; next open your two stiffening pieces, which are halved behind the rails and in front of the uprights, and fix those in the same manner. These stiffening pieces should be 2 in. square, to allow of them being halved 1 in. behind rails and 1 in. in front of uprights. Now screw the four leaves directly on to the top of long rails and uprights with coarse wood screws; and, if properly made, I think you will find you have a perfectly rigid table, which I hope will suit you.—E. D.

**Pencil-Sharpener.**—J. M. (*Dorset*).—The knife-chisel pencil-sharpener which you forward is an ordinary knife cut in half crosswise, the piece remaining attached to the handle having the narrow edge caused by the severance sharpened in the manner in which a chisel is treated. I have given it an active trial for several days. I still prefer the method described on page 697, Vol. II., No. 95, of WORK. I have suggested one or two points as improvements. Your idea is certainly an excellent one for those entering a draughtsman's office, or for those who may not have become used to any other practice; and as you say you are an invalid, and wish to utilise the invention profitably, I should advise you to communicate with the different tool makers who advertise in WORK.

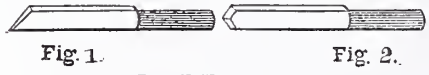


Fig. 1. Fig. 2.

Pencil-Sharpener.

The publication of this reply, of course, offers to all the opportunity of making a chisel-knife pencil-sharpener; but you must bear in mind that this will be the means of testing its usefulness, and, if found of service, this should be a very good reason for the wholesale manufacture of such an article, and the inducement of some firm to take the matter up. I will explain why I consider the adoption of my sketches as improvements on your sharpener, which has a chisel-edge at right angles to the long edge. First, I must say that the way to sharpen a pencil is to hold it firmly upon a board, and use the chisel-edge, cutting away from the operator. During these movements it is difficult to retain the edge parallel with the surface of the board, the consequence being that the right-hand corner of the knife digs occasionally into the board. With a chisel-edge as in Fig. 1 this is obviated.—J. S.

**Spindles.**—J. P. (*Woolwich*).—Like you, I have to send to the centres of the cabinet trade, and find Banks, wood turner, of 65, Holywell Lane, and Lyssow, of Old Street, suitable men for spindles and turnery goods. Lyssow sells bone knobs and carved panels, and a good assortment of other fittings. For ironmongery and brass work, H. Snuggs, 331, Old Street, E.C., is excellent—very large stock and moderate prices. While writing, I might tell J. P. that for veneers, stringing, marquetry ornaments, etc., McEwan, 282, Old Street, E.C., has been of great service to me when I have had repairs to do in ebony, ivory, etc.—B. A. B.

**Fretwork Patterns.**—H. R. (*Manchester*) desires a pattern showing a farmhouse. If any such is in the market, it is probable that he could be helped to it by applying to one of the large dealers in such things, such as Messrs. Zilles & Co., 21, Wilson Street, Finsbury, London, E.C.; Messrs. Harger Brothers, Settle, Yorkshire; or Mr. G. Busschotts, Park Lane, Liverpool.—M. M.

**Fine Lines in Fretwork.**—G. T. N. (*Finsbury Park*).—Mention was made in an early number of WORK of a *wire-thread fret saw*, introduced by Messrs. Richard Melhuish & Sons, 85 and 87, Fetter Lane, E.C. This is merely a steel wire jagged with saw teeth, and it would, I imagine, help G. T. N. out of his difficulties. One of his troubles is that the hole necessary to admit an ordinary saw spoils the effect, and this saw, of course, would require a relatively small hole—no larger, in fact, than the width of the cut. If Messrs. Melhuish are prepared (as they doubtless are by this time) to supply customers with wire saws of different sizes, they can probably supply suitable drills to use with them.—M. M.

**Damaged Dulcimer, etc.**—A PLAYER.—Please don't apologise for "any trouble you may give." The fact of such an experienced hand as yourself asking for advice is a striking proof that WORK is what it aims at being—viz., "a journal for *all* workmen, professional and amateur." You can certainly put a new soundboard in your dulcimer without pulling the instrument all to pieces, and to do so proceed thus:—Remove the damaged one by taking out the heading or moulding that runs all round; do this, if possible, without breaking it, as the same moulding will do again. Then bore a hole of about ¾ in. diameter at each corner close up to the blocks, but ¾ in. from the front and back; this will clear the braces. With a small saw you can now cut from one hole to another along the blocks, and also as far as the inner treble bridge at back and front. Here you had better stop, and commence again on the other side of the bridge, and so continue to the bass bridge. Having gone quite round, you will be able to remove the damaged board without trouble. Now remove the pieces that have been left on the tops of the braces, being very careful over this, or you will splinter the veneer from the tops of the facings. Then trim off the sides level with the blocks, leaving the grooves filled with the edges of the old board. You will not be able to fit the new board into these grooves, so you must get out two fillets ¾ in. by ½ in., and glue and brad one on each block, with its top edge exactly level with the *bottom* edge of the groove, and also with the top edge of the brace. You will now have a rebate all round, on which your new soundboard will rest. You say the old one is of cedar—I suppose you mean the scented or pencil cedar. By all means put in a new one of the same kind of wood if you can get it, but if not, put in one of pine. Having carefully fitted it, remove it and clean it up to the exact thickness of the old one; then cut the sound-holes and polish it. If of cedar, polish it in its natural colour; but if of pine, polish it black. It is now ready for fixing. To fix it, it need be only fastened with ¾ in. brads all round—brads about 2 in. apart. If you have been able to remove the moulding without breaking it, you can now replace it, and having put in the sound-hole rings, the instrument will be ready for re-stringing, after which it should be "as good as new." The second instrument about which you inquire, and of which you send a sketch, is a "bow or streich zither." It appears from your drawing to be a pretty good one. I presume the frets and stops are only approximate, as if they are copied exactly from the finger-board, it is incorrectly fretted. It should be strung as follows: 1st, No. 7 steel; 2nd, No. 8 steel; 3rd, No. 8 brass; 4th, steel overspun with copper. It is tuned the same as the violin. As its name implies, it is played with a bow, and should have on the underside three feet, with a small sharp spike in each, which serve to keep it steady on the table. As a rule, the tone is very poor and thin, and the instrument is being supplanted by the "viola zither" and "Philoméle."—R. F.

**Provisional Protection.** — PROTECTION. — If, under the circumstances named, B should attempt to obtain a patent, he can be opposed by C on the ground of his having obtained the invention from him. If, however, B has got a provisional protection granted to him before the date of A's application, and his title and provisional specification are wide enough to cover the plans of A, then it will be difficult for him to get redress. If it happens that A is before B, and completes his patent, B will be unable to use his improvements, except under a licence from A. It would be necessary, however, before either party proceeds against the other for an infringement, that he should possess the sealed

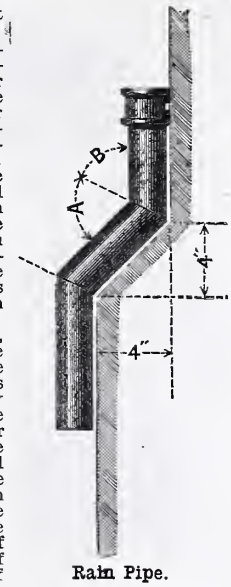
patent, as, until he has got it, he has no tangible rights to fight for, or to be infringed. Provisional protection merely assures him that no later applicant shall go before him in obtaining the right he seeks.—C. E.

**Invention.** — PATENT. —The extensive ignorance of the public in all matters relating to patents is very lamentable, and this is maintained and very greatly increased and rendered more difficult to enlighten, by the labours of, and opinions promulgated by, inexperienced, ignorant, and incapable amateur dabblers and others, who are so constantly found thrusting themselves forward with their crude and ignorant ideas and dangerous and ridiculous "advice" on the subject. The cost of a patent, like that of any other work requiring the exercise of skill, education, and experience, must entirely depend on the amount of work to be done in preparing proper documents and drawings. The Government fees do not—as the ignorant and inexperienced inventors or intending patentees so fondly imagine—cover any more than the charges at the Patent Office: in fact, they simply represent the stamps on a title-deed, a mortgage, an agreement, a lease, or other document which requires to be of a legal character in order to obtain legal support. An inventor or intending patentee may, of course, if he so chooses, do his own work himself and put in the papers he has prepared—just as a man may be his own lawyer, his own physician, his own architect, his own engineer, his own builder, or do any other work of the kind—and then the charge at the Patent Office for recording his application is covered by the £1 stamp, which he must have impressed on his petition. Then at, or before, the end of nine months from the date of his application he must file a complete specification and drawings, etc., embracing all the particulars required by the law to be done, to make a document the law will support, and on this there must be three impressed stamps of £1 each, so that when the patent is granted he has obtained what is generally considered by most inventors to be "a valuable exclusive privilege"; and all this, under these circumstances, for the moderate sum of four pounds! This will hold good for four years from the date of his application, at, or before, the end of which period he will have to pay the sum of £10—which will keep up the assumed right for another year; and at, or before, the expiry of the sixth year he must pay another £10; and in the same way each year up to the eighth, when the payment is raised to £15, which has to be repeated; and before the expiry of the tenth the payment is raised to £20, which has to be repeated before the expiry of each succeeding year it is desired to keep the patent in force until the thirteenth year is reached, when the last payment covers the fourteenth year; at the expiry of which the patent comes to an end, and then becomes the property of the public, unless an extension is obtained. If preferred, in place of the above, £50 may be paid before the expiry of the fourth year, and £100 before the expiry of the eighth, which payments keep the patent in force for the full term of fourteen years. We should never advise an inventor or intending patentee to trust to his own unaided exertions in preparing the title, documents, and claims required by the law to define his invention; nor would we advise him to trust himself in the hands of anybody but a really skilled, respectable, and capable adviser. At the present time we are swarmed out with a host of persons undertaking to "advise" inventors, and prepare their specifications, drawings, etc.; not a few of whom will be found to be foreigners—Jews as well as Gentiles—and whose thorough acquaintance with the English language, and the English patent law, must be obvious to any person of the least comprehension. Of what good is a useless and invalid patent to anyone, even if it is a gift? and if PATENT is an admirer of such things, he will be most successful in obtaining one by doing the work himself.—C. E.

**Negative Varnish.**—C. G. (*Putney*).—A very good negative varnish may be made by mixing one part of best white hard spirit varnish with two parts of methylated spirit and straining. If this is found to be too thick, add a little more spirit. It is rather long in hardening, but is, otherwise, a very good protection varnish. Another popular recipe is—to six ounces of best orange shellac, two ounces of sandarach, powdered coarsely, and mixed with as much roughly powdered glass (this is merely to expedite the solution by keeping the particles of gum separated), to a gallon of cold methylated spirit. Shake up daily for a week, let it stand to settle for a few days, then pour off the clearer portion and filter. This makes a rather dark-coloured varnish, but a very good and hard surface. Of course, with both kinds the negative requires warming *slightly* before and well after the application.—D.

**Illuminating Addresses.**—GUGLIELMUS.—All materials for illumination are to be bought from the larger artists' colourmen, such as Brodie & Middleton, 79, Long Acre; Lechertier, Barbe & Co., Regent Street; and Winsor & Newton, Oxford Street. The sizes and prices of vellum at the first-named shop are—10 in. by 8 in., 1s. 9d.; 14 in. by 10 in., 3s.; 16 in. by 12 in., 4s. 6d.; 18 in. by 14 in., 5s. 9d.; 25 in. by 19 in., 10s. 6d. I am not acquainted with any published designs for these things, the illuminator generally arranging his own design so as to be emblematical of the circumstances under which the address is presented; but if there are any such things in the market, they will be met with at such shops as those mentioned above. I believe that Martin Billing, Son & Co., Livery Street, Birmingham, print and sell vellum for the purpose with a border in *type* ornament, printed in two colours.—S. W.

**Pattern for Down Pipe over Plinth.**—J. G. (*Glasgow*).—If an order came to our foundry for a pipe to pass over the return plinth, such as you draw, having a 4 in. projection and a 4 in. rise, I should simply draw it and the pipe out to full size on a drawing-board, measure the angles A and B, and, setting a bevel to them, cut the pipe ends to suit. This is as simple a job as one can have. If I have misunderstood your query, please make it clearer.—J.



Rain Pipe.

**Carpenter's Rule.**—W. I. C. (*Tavistock*).—The eight square lines, or the lines marked E M (see diagram of rule), are for the purpose of converting a square into an octagon or eight-sided figure. For instance, if the square below is 8 in. square, and you want to turn it into an octagon, look down the line E on rule until you come to 8, then the distance from the outer edge of rule to 8 on the E line is the distance from each corner of the square to the points of the octagon, viz., $2\frac{5}{16}$. In exactly the same manner, if the side of the square measures 9 in., 10 in., 12 in., or any other size up to 36 in., the length from the corner or angle of square to the points of octagon is found on the front edge of the rule opposite the length of side of square on line E. The figures on the line M give exactly half the length of the side of the octagon required. If you now look at 8 on line M, you will find it is exactly $1\frac{1}{16}$ in. from the outer end of rule, which is the length of half the side of the octagon. This can easily be proved by a little attention. For instance, the side of our square is 8 in., the length from corner of square to point of octagon is $2\frac{5}{16}$ in.; therefore, if you add the two $2\frac{5}{16}$ in. together, this will give you $4\frac{5}{8}$, and the difference between $4\frac{5}{8}$ in. and 8 in. is the length of one side of the octagon, viz., $3\frac{3}{8}$ in., the half of which is $1\frac{11}{16}$ in. as above. Similarly as this line M gives the half of one side of an octagon, it also gives the means of determining at once the size of the piece of stuff required to get out an octagon on any given size. For example, divide the length of the given side by 2, find the result on edge of the rule and the size opposite on the line M, it will be the size of the piece of stuff required. For instance, an octagon is required with its faces each 12 in. $12 \div 2 = 6$, then find 6 in. on the edge of the rule (that, of course, is opposite 15 in.), and the size on the line M is the size required to get the octagon out of. There are sometimes three teeth on a carpenter's mortise gauge, two on one side for mortises, and one on the reverse side to enable the tool to be used either as a mortise gauge, or a single tooth or ordinary gauge. The majority of carving tools are sharpened in the way described in your letter.—E. D.

Carpenter's Rule.

**Polishing Rosewood and Inlays.**—S. S. (*Salford*).—As you can already polish plain surfaces, you ought to experience no difficulty in polishing the rosewood inlaid work. If you omit the "filling," which you seem to think is so necessary, especially if the work is well cleaned off and glass-papered quite smooth, it might be wiped over with a little clear linseed-oil, but this is a matter of choice. Instead of the usual brown polish, as made from orange shellac, use what is known as white or transparent polish. It will be necessary to give a few extra rubbers of polish in place of the "filling in," and it will be found an advantage if you give the work a few taps occasionally, as the "bodying in" proceeds, with a little powdered pumice tied up in a piece of rag or very fine muslin. It helps to fill up the grain and grind the polish to a level surface. The mahogany inlaid work will require a somewhat different procedure. As you wish to darken the mahogany, the light and coloured stringings must be protected by carefully coating them over once or twice with white polish, or equal parts white polish and white hard varnish, applied with a camel-hair brush, taking care not to put any on the part you wish darkened, as it will prevent the stain striking in. When this is dry, apply your stain, which, when dry, may be oiled and filled in if desired, but can with advantage be omitted. Unless you feel sure the inlays are well protected when polishing, give two or three good wet rubbers of polish to set the stain. When quite dry, glass-paper quite smooth; then body up, using pumice as advised. You will perceive that if the mahogany had been carefully selected as regards colour, or stained previous to using, the process of polishing would have been much simplified.—LIFEBOAT.

**Telescope.**—GANELON asks if articles have appeared on the construction of microscopes and astronomical telescopes, and, if not, for the necessary dimensions. If GANELON will procure Nos. 22 and 23, Vol. I., of WORK, he will find full instructions for a good microscope designed expressly for the readers of WORK. It has been a matter of gratification to the writer of the articles to know that the readers of WORK have in several instances worked from the design, and have expressed great satisfaction with the result. As far as I am aware, details for the construction of a telescope such as GANELON desires have not been given. I would just say that a 4 in. achromatic is rather an expensive O. G. to try one's skill upon as a first effort. However, I will give such brief information as is adapted to "Shop." The body tube may be about two-thirds or four-fifths of the focal length of the O. G., which we presume will be about 60 in. At a distance of half of the focal length of the O. G., a stop must be placed with an aperture of 2 in. The full length of the focus must be made up by a smaller tube to carry the focussing tube with the eye-piece. The Editor has in hand a short article on the construction of eye-pieces, giving the fundamental principles, which will enable anyone to construct one of any power. No doubt it will appear as soon as possible, when GANELON will find all the information he needs.—O. B.

**Xylonite.**—R. W. (*Blaina*).—The address of the Company is—The British Xylonite Company, Limited, 124, High Street, Homerton, E.

**Picture-Frame Clay.**—J. T. H. (*Bacup*).—The clay mentioned in Picture-Frame Gilding, Vol. III., No. 121, page 262, is prepared clay ground fine by machinery, and sold at any reliable artists' colourman's as "gilders' clay." There is no difficulty in getting this, as any of G. Rowney's agents will sell it at 9d. per lb.—H. E. M.

**Sensitised Paper.**—J. D. (*Hull*).—Albumenised paper is sensitised by floating it for three or four minutes on a solution of silver nitrate of about fifty grains to the ounce of distilled water, then drying in the dark, in a warm current of air free from gas or other noxious vapour or dust. When dry, the paper should be either rolled tightly or laid flat under pressure until required for use. The custom is in sensitising, after the paper has laid a sufficient time on the silver solution, to carefully raise it by two corners and draw it over a glass rod fastened to the end of the dish in order to remove the surface moisture as much as possible; the remaining moisture is blotted off with pure blotting paper. The sensitised paper is then hung up to dry. As to the preparation on dry plates that J. D. alludes to, it is an emulsion of bromide and iodide of silver in a strong solution of gelatine, for which there are many formulæ. The best plan would be to procure a hand-book on the subject. Abney's "On the Preparation of Gelatine Emulsions" is about the best; and make yourself thoroughly acquainted with the process.—D.

**Patentees.**—R. E. (*Bolton*).—Indexes to WORK, Vols. I. and II., can be procured of any bookseller, or of Cassell & Co., London, E.C. Price one penny —with postage, three-halfpence.

**Copying a Medal.**—H. H. (*No Address*).—We much doubt whether H. H. will succeed in making a satisfactory copy of the medal in question by *casting* in metal; he will find electrotyping a far superior method. Let him oil one side of the medal, but very slightly, so as not to fill up any of the depressions, tie a slip of stiff paper round the edge to form a rim, and having mixed *fine* plaster as thick as cream, pour it on to form the mould. The second side will be treated in the same manner. These moulds, when dry, should be rendered non-porous by laying them face downwards in melted wax. Their faces then need to be brushed over with black-lead, and they are ready for the bath of dissolved copper. If the copyist has no electrotyping apparatus, his better plan will be to hand his moulds to a professed electrotyper, and let him place them in his bath. This he will do for the merest trifle, as they will give him no trouble beyond simply hanging them in the solution of copper. But for small matters, such as medals, and for the use of copper only, all the needful apparatus may be set up for a few pence. The electrotyping process reproduces the minutest touches on the object copied with absolute fidelity. The shells of copper which will be deposited when removed from the moulds may be backed up with soft metal—lead with a little tin and antimony in it—either together or separately; and the faces can be bronzed in various ways, or, if desired, coated in the bath with a film of gold or silver.—S. W.

**Small Organ.**—G. W. O. (*Durham*).—The dimensions of the parts for the organ referred to in the answer to GOOD TIPS (see page 108, column 3, No. 111) are as follow:—Sound-boards, 3 ft. 9 in. long. Total width when joined together, about 16 in. Wind chest, same size, and 4 in. deep. Bellows, 3 ft. 4 in. long, 14 in. wide; middle board of bellows 3 in. longer, so as to rest on supports on building frame. Building frame, 3 ft. 9 in. long; same width as the two sound-boards, and about 3 ft. 6 in. higher, or a few inches higher if couples or pedals are required. As regards general construction, I should advise you to obtain one of the books on organ building which have frequently been mentioned in these columns. —M. W.

**Organ Building.**—C. W. T. (*Old Trafford*).—It would require too much space to give you all the information you require as to scales, thickness of wood, lengths, voicing, etc. Your best plan would be to purchase one of the books mentioned frequently in these columns, which would give you all the information you require on these points, and on other matters connected with organ building. Any reply which I could give in these columns would be too meagre to be of much service to you. —M. W.

**Wind Trunk for Organ.**—J. E. B. (*Smallheath*). —The wind trunk for your organ should not be less than 10 in. wide by 2 in. deep; if you have space to spare so as to make it 2 in. or 3 in. wider, so much the better. The pedal wind trunk may be about 10 in. wide and 2 in. deep if single; but if two are used, make them each 5 in. by 2 in. The length of these trunks depends entirely on the height of your building frame; they must be long enough to reach from the trunk band to the wind chest in each case. The manual wind trunk will be about 3 ft. 6 in. long, and pedal one about 16 in., but it is impossible to give the exact lengths. You can easily find them for yourself when you have constructed your building frame, etc.—M. W.

**Organ Pipes.**—F. B. (*Oldham*).—You are quite right; there is a slip in the reply to F. W. (*Sheffield*), at the top of page 220 (No. 118). It should read that the 16 ft. tone can be obtained from a stopped pipe 8 *feet* long, not 4 *feet*.—M. W.

**Watch Cylinder.**—SILVER WATCH.—When a horizontal escapement is at rest, the scape tooth may not always be in the same position, it may be inside or outside, or partly both; but in case, the distance the balance moves from the point of rest should be equal both ways. If it is not so, shift the collet (hairspring-collet) round until it is equal. Generally there is a dot mark on edge of balance and three on the plate; when at rest, the one on balance agrees with the centre one on the plate; the others coincide with the one on the balance when scape wheel drops off. The lever escapement is also the same, the balance moving equal distances from the point of rest, or may be made so by moving hairspring or roller.—A. B. C.

**Gilding on Glass.**—T. W. V. (*Leicester*). — Any communication you may make in the pages of "Shop" upon this subject shall have consideration; or you may send in an article, on approval, on the terms of payment usual with the journal.

**Brass Savings Bank.**—D. S. (*Glasgow*).— You must please state more definitely what kind of savings bank you require a design of, or if the pattern is left for the choice of the replier to your question. You seem to write as if you require a sketch of an existing article.—J. S.

**Electric Current from a Battery.**—P. R. (*Birmingham*).—The total volume of electric current obtainable from a battery is equal to its total electro-motive force divided by its total resistance. The total volume of current obtainable from it through work being done by the current will be equal to its total electro-motive force divided by *all the resistances* in the circuit. Hence, although the current volume of one cell may be the same as that obtainable from ten cells connected in series when taken by themselves, a far different result is shown when the resistance of instruments and of work placed in the circuit is added to the internal resistance of the battery cells. Suppose, for instance, we connect one cell to an ammeter having a resistance of ·005 ohm, we shall have to add this to the resistance of the cell, and the result will then be $\frac{1{\cdot}86}{{\cdot}08 + {\cdot}005} = 21{\cdot}88$ ampères, instead of 23·25 ampères. If, now, we connect ten cells in series with the ammeter, the reading should be $\frac{1{\cdot}86 \times 10 = 18{\cdot}60}{{\cdot}08 \times 10 + {\cdot}005 = {\cdot}805} = 23{\cdot}10$ ampères, because the ·005 resistance of the ammeter is divided among ten cells. Now, if you connect some accumulators in circuit with the ammeter and your 10-cell Bunsen battery, you must add the resistance of the accumulator cells to that of the Bunsen cells and ammeter, and also the resistance of the connecting wires. Now, supposing the resistance of the accumulator cells to be 8 ohms, that of the connecting wires, screws, and ammeter to be ·2 ohm, and the internal resistance of the battery cells to be ·8 ohm, then the current will be $\frac{1{\cdot}86 \times 10 = 18{\cdot}60}{{\cdot}08 \times 10 + {\cdot}2 + 8 = 9} = 2{\cdot}06$ ampères, and this agrees with the reading of your ammeter when charging is commenced. As the internal resistance of the accumulators increases whilst being charged, owing to the back electro-motive force of the charged plates, the current volume is lowered, hence, your ammeter then gives a reading of 1·5 ampères. I hope you will now clearly understand why the volume of current from your battery is reduced whilst connected to work being done by the current. —G. E. B.

**Rat Cage.**—J. H. (*Cork*).—Figs. 1 and 2 show a small cage open and closed for white rats or mice. It is really a wire cage made to slide in and out of a wooden box. To make such a cage, cut two strips of mahogany 3 ft. long by $\frac{5}{8}$ in. Cover one angle with tin; temporarily fasten the tin on; mark off half inches on the two sides covered with tin; then bore the holes for the wires with a strong bradawl through the tin into the wood. This will fasten the

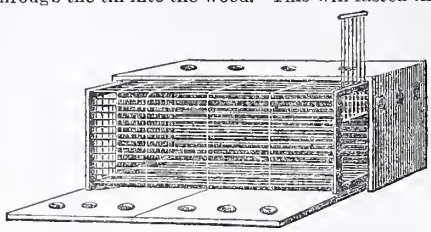


Fig. 1.—White Rat Cage (open).

tin on. Cut each strip into four, join them into two strong frames, and wire them as illustrated, leaving eight wires for the sliding door. Have four stout wires 18 in. long, and fix them into the corners of the frame. Make a box of $\frac{1}{2}$ in. deal an inch deeper than the wire cage, as per figures. The inch allowance will form a tray for the sawdust at the bottom of the cage. To clean the cage out, open the two doors in front, withdraw the wire cage, and knock

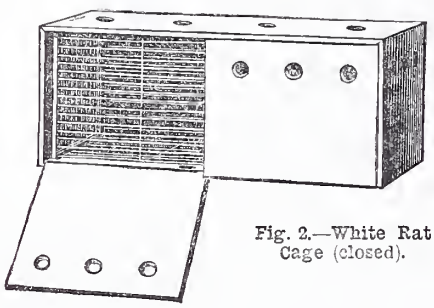
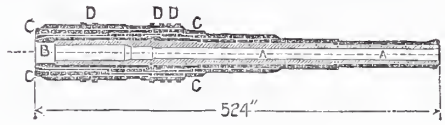


Fig. 2.—White Rat Cage (closed).

out the box. Sprinkle some fresh sawdust in the bottom, and replace the wire cage. To form a nest for the rats, a piece of wood is fastened inside the wires at one end; or, what is better, a little box can be made to fit the inside of the cage. This form of cage on a larger scale answers equally well for squirrels, and smaller, for white mice.—F. H.

**110-Ton Gun.**—LITTLE JIM.—The figure shows the 110-ton gun in section. It is constructed entirely of steel. Like all heavy guns made in this country, there are two essential portions, the inner tube and the outer section. In the figure, the inner tube is indicated with fine shading, and the outer portion with more open shading. The inner tube, A, is made of a single piece of Whitworth compressed steel. Over this is shrunk the breech-piece, B, and around this again are shrunk three layers of steel hoops, C. It will be noticed that all of the main hoops, as well as the breech-piece and the inner tube, are provided with shallow shoulders. The shrinkage of the hoops causes longitudinal




110-Ton Gun.

pulls against these shoulders, and their arrangement is such that there is a system of perfect and mutual resistance to longitudinal stress in each section of the gun. There are no trunnions. At D D a series of rings are formed on the outermost or "trunnion hoop." Three strong bands pass round between these rings and tie the gun to its carriage. The dimensions of the gun are as follows:—Total length, 524 in.; length of bore, 487 in.; length of rifling, 393 in.; diameter of bore, 16·25 in.; diameter of powder chamber, 21·125 in.; cubical capacity of chamber, 28,610 cubic in.; weight of gun, 247,795 lbs.; weight of powder charge, 960 lbs.; weight of shot, 1,800 lbs.; muzzle velocity, 2,128 ft. per second; total energy, 56,520 foot-tons.—J.

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. P. (*Leeds*); G. F. J. (*London, W.*); A. H. J. (*Norwich*); A. C. (*Leicester*); E. W. (*Halifax*); A. J. (*London, N.*); P. T. (*Birmingham*); W. P. (*Southport*); WATER; SOUTHPORT; H. F. (*Gateshead-on-Tyne*); J. M. (*Sutton-on-Hull*); J. H. (*Ballina*); C. (*Lewisham*); G. T. (*Sunderland*); NORTH JACK; POTASH; GALVANOMETER; A NOVICE; S. AFRICA; H. D. (*West Norland*); D. S. R. (*Glasgow*); AIRDIE; A. S. (*Addiscombe*); W. R., JR. (*Carlisle*); IRISH DISTRESSED LADIES' FUND; F. B. (*Aldershot*); J. R. (*Liverpool*); J. M. F. (*Notting Hill*); HODGE; E. S. (*Birmingham*); S. P. A. (*Walthamstow*); M. & C. (*Grimsby*).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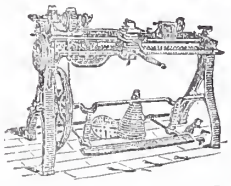

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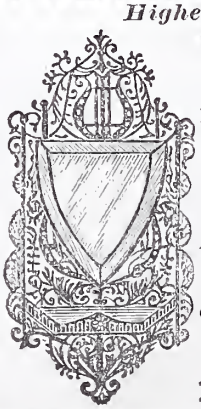

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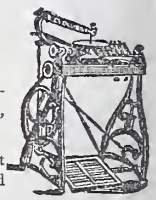

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 129.] SATURDAY, SEPTEMBER 5, 1891. [PRICE ONE PENNY.

### CARVED CASE FOR AMERICAN STRIKING CLOCK.

DESIGNED BY F. FAULDING.

THE ordinary case of a large American striking clock is by no means "a thing of beauty," as a glance at Fig. 6 (see page 387), in which a clock of this kind is shown, drawn on a scale of 1½ in. to 1 foot, will serve to show. Still, such a clock is a good timekeeper, and the sound of the hours, struck in succession on a wire gong in the form of a coil, is so soft and full and deep that it is worth while to withdraw the clock and its appurtenances in the shape of works, pendulum, pulleys, cords, weights, and dial-plate from the old case, and enshrine it in a carved case, for which a pretty and easily-worked design is afforded in Fig. 1. That there may be no mistake as to the kind of striking clock that is meant, it may be said that the wooden case, taking outside measurements, is 2 ft. 1½ in. high, its breadth, 15¼ in., the width of the casing in front, including the plain external frame and the intermediate moulding, is 3 in. Further, the width of the external frame and of the framing of the door is ⅞ in. From these, too, it is easy enough to reduce the other measurements, which it is unnecessary to give in detail. It will suffice to say that the object of the frame and moulding is to afford room for the weights, which work up and down behind them one on each side. The framing of the door, which is hinged to the intermediate moulding, as shown in Fig 6, is divided into two parts by a cross-bar, and there is a piece of clear glass in the upper part, through which the dial is seen, and a piece of painted glass in the lower part, consisting, in the clock from which the sketch shown in Fig. 6 has been made, of a small bunch of flowers—a tulip, a rose, some nondescript bloom, and two or three leaves, on a red ground. The case itself may be spoken of as being plain even to ugliness, and the art work on the door as meagre and unattractive in the extreme. Notwithstanding this, the clock itself, which has been doing good service for more than twenty years, is much liked, and its appearance is condoned for by its utility, the familiar sound of its gong, and "auld lang syne" combined. Perhaps many readers of WORK are possessed of such a clock, and may wish to transfer the works to a new and better-looking case; if so, a design for the new case is now placed at their disposal.

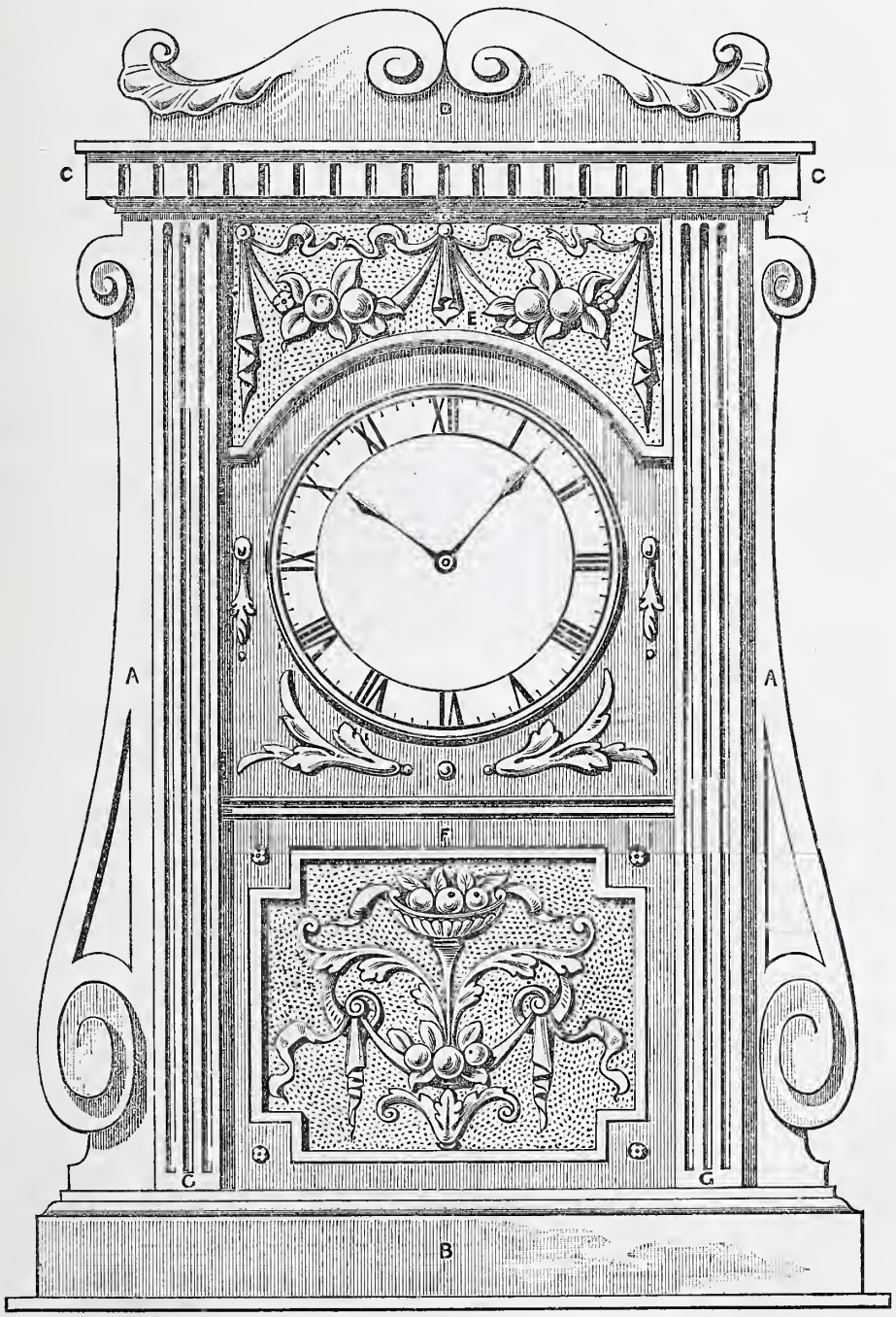



Fig. 1.—Design for Carved Case for American Striking Clock.

It must be understood, however, that the use of the design need in no way be confined to the large American striking clocks, of which one has been described in the above remarks. It may be modified by reduction to suit smaller clocks, and be made available for the small drum clocks which have to a great extent superseded the clocks with pendulums, etc.

With reference to the carved case represented in Fig. 1, it may be made in walnut or any similar hard wood. The size of the case must be determined by the size of the clock, and the first thing to be done will be either to make a new case, which will involve but little trouble and labour, or to get one made by a joiner or cabinet-maker, to whom the necessary instructions would have to be given respecting size. The case thus made would afford a basis or substructure on

which to fix the ornamental carving. The wood of which the case or cupboard is made should not be too thin—not less certainly than ½ in. stuff planed down; and possibly ⅝ in. stuff which would plane down to ½ in., or thereabouts, would be better. The brackets, A, A, shown at the sides in Fig. 1, should be dowelled or pinned to the sides of the casing, and the plinth, B, which must cover the entire bottom of the case, be screwed on from underneath. The cornice, C C, at the top should be treated in precisely the same way, and the pediment, D, blocked and glued to top side of cornice. The carving above the dial, shown on a larger scale in Fig. 2, will be best cut in a solid arch-shaped piece of wood ¼ in. thick, and then fixed on the upper part of the door, as shown in Fig. 1 at E. The carving below the dial, shown on a larger scale in the same manner in Fig. 3, should be attached to the door in the position indicated at F. Fig. 4 shows a section of the grooved or fluted pilasters, and Fig. 5 a section of the cornice. The pilasters, which are shown at G, G, are attached to the front edge of the case, and to a strip of wood fastened to the inside of the case, to afford a firm bearing for the pilasters. They form, with the cornice and the plinth, a framework for the door, which is hinged to the pilaster on the right-hand side. It is behind these pilasters that the weights will work up and down, as behind the broad moulding in Fig. 6. When the carving is completed it may have a finish imparted to it with wax or French polish, but the carved work should be left dull, and the mouldings only brightened in the manner described, as by so doing a superior appearance will be imparted to the whole of the work. Do not use any glass-paper in finishing the carving. Amateurs will sometimes do this, with the idea that their work will be improved thereby; nothing, however, tends to destroy the sharp and vigorous appearance of wood carving more than the employment of glass-paper in finishing.

Figs. 2 to 6 inclusive have been placed in the opposite page, as this arrangement is more convenient for readers.

I have omitted to mention that the dotted grounds shown in the carved parts at E and F are finished so as to present the roughened appearance indicated by means of any of the small punches that are used for this purpose. The end used for surfacing is generally fashioned into some form such as a trefoil, etc.

So much for the more ornamental and elaborate portions of the carved work of the clock-case—I mean those shown at E and F in Fig. 1—of which, after all, there is not so very much that involves what I may call carving proper, for the ornamental work in the pediment D, and at the head and foot of each of the brackets, A, A, is such as may be done by any woodworker of ordinary capacity; while the cornice, C C, and the fluted pilasters, C, C, present no difficulty whatever, or, at all events, ought not to do so, for the work in both of them is plain and straightforward, and in the latter case may be readily done by means of a scratch or router, which has frequently been mentioned and its construction described in Vol. I., page 101, of Work. Thus even to a workman of no great skill the only portions that should present any decided difficulty are the parts at E and F, and possibly the small carved pieces on each side of the dial and just below it.

Now the question is, how may this difficulty be surmounted by anyone who cannot, or will not, attempt the carving. By fret-workers it may be easily done, for a thin overlay of the forms indicated at E and F might be placed in the positions now occupied by the carved work, and pierced, or cut with a fine fret-saw in such a manner as to imitate very closely the patterns that are given in Figs. 2 and 3. In this case the edge of the overlay will represent the outer lines of the projecting parts that form the borders of the panels, the borders themselves being omitted. The pattern being cut out will appear as if sunk in the overlay, and the wood below will appear through it. Thus, an effect similar in some measure to inlaid work will be produced, and, if the door of the clock-case were ebonised, and the overlay were of thin white holly, or, better still, of xylonite, the semblance of inlaid work in ebony and ivory would be obtained. Another and perhaps a better way would be to cut out the carved work in outline in the flat, and the borders of the panels and other ornamental parts, at the sides of and below the dial, in xylonite or white holly, and attach them with glue to the woodwork below. Indeed, a very close resemblance to the actual carved work itself might be produced, if, instead of cutting or carving it out from the solid, the framing of the sunken parts and the carved pattern were cut out in wood of ⅛ in. in thickness by the fret-saw, and the edges sufficiently reduced and rounded, and the markings of the foliage and drapery sufficiently taken out by aid of a V-tool to remove all impression of the flatness that is inevitable if the cut-out pattern were put on in the solid; or, in other words, of uniform thickness throughout without any attempt at relief by the means of the V-tool and the simple tools used in chip-carving. It will be understood that when xylonite or any other material is used to gain the effect of inlaid work, the material should be as thin as possible, not thicker, in fact, than cardboard or Bristol board of tolerable substance. So much has already appeared in Work upon the subjects of inlaying and marquetry that these matters need not be gone over again here. Nor is it necessary to do more than refer the reader to the "Shop" pages of Work for all information as to materials, etc., for carrying out the present bit of woodwork.

## AN EASILY MADE FIXING TANK.

BY W. E. D., JUNR.

HYPO. BATH—ITS NECESSITY—BEST FORM—MAKING TANK—MATERIAL TO USE—SIZE—HOW MADE—CASE FOR TANK—DIPPER—COVER.

EVERYONE who has taken up photography knows that before the negative can be brought into the daylight and used, it must be placed in a hypo.-sulphite of soda solution; this solution must (or ought, if good work is to be done) be kept in a separate dish or tank; the question then arises, "What is the best form to use?"

In my opinion it is one in which the negative is placed in an upright position, as in the old wet-plate process the glass was let down into the silver bath, because in this position the silver, as it is fixed out, settles to the bottom of the tank, as well as other impurities, and this is not disturbed when other negatives follow, as in a flat dish; it is also easier to take out, and much less fear of breaking the film.

For a long time I used an old silver bath to hold the hypo., and found it answer fairly well, the chief fault being that I could only fix one negative at a time; so I resolved to make a larger one, and looking round for a material to use, I fixed upon gutta-percha, and have found it answer exceedingly well.

Suppose the reader wishes to make one to take half-plates as the largest size. I would recommend that the bath be just about the size for half-plates one way and quarter-plates the other—say, an inside measurement of 6⅝ in. × 3⅝ in. × 6 in. deep; it is as well to decide upon the exact size. Cut out paper patterns and take these to the shop, so that the gutta-percha can be cut from the piece to the proper size and shape, thus preventing any waste.

When you have the five pieces ready for making the tank, heat an iron red-hot, draw along the edge of one piece and the side of another, bring the two pieces quickly together, and by holding a little time until set they will be firmly fixed; if not, and they betray any tendency to spring apart, you may use small brads or screws, as you would in making a box. Proceed in the same way with the other side and end, then put the bottom on; when done, take the red-hot iron and draw along the edges of the join both inside and out: this will cause the gutta-percha to run and fill up any holes, thus making it perfectly water-tight; do the same round the heads of the screws or nails; you can then put grooves along the sides and ends to hold the different plates, fastening them on in the same way; then put on one side for a little time so that it may set.

Now make a wooden box to fit tightly round the tank: thin wood, such as ¼ in., will answer every purpose, but unless the gutta-percha is thick it will be better for some support, and by using thin it comes cheaper. Make the bottom of the wood box an inch larger all round: this gives greater stability.

A dipper, to put the plates in the tank and take them out again, will be found very useful. If you have one belonging to an old silver bath, this will answer perfectly; if not, take a strip about 7 in. × 2 in., either of gutta-percha, thin wood well covered with shellac varnish, or glass; a ledge to hold the negative should be cemented on at the bottom.

A cover to keep out the dust and partly prevent evaporation completes the tank.

Should any further information be required it will gladly be given through "Shop."

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

### More about Chalk Work.

CHALK AND PEN ON STONE—CORRECTIONS AFTER ETCHING—HOW TO HOLD CHALK—MODE OF WORK ALWAYS PERCEPTIBLE IN COLOURED DRAWING—GROUP OF LEAVES—MIXED STYLE IN COLOURED WORK—INTELLIGENCE AND FEELING IN WORK—LETTERPRESS, WITH DRAWINGS—UNIFORMITY DESIRABLE IN SERIES OF DRAWINGS—WORKING WITH MAGNIFYING-GLASS.

THE student should feel that he grasps the stone with the chalk—that is to say, that he works into the grain of the stone.

In holding the pen, he may use it as lightly as he likes, as the ink flowing from it will do its own work on the stone; but with the chalk it is different, for he must use a certain amount of pressure, however light the tint may be: therefore the necessity of using light crayon-holders. (*Vide* paragraph on "Chalk," page 66, No. 109, Vol. III. of Work.)

There are times when corrections can be made after the stone has been etched by darkening tints with the chalk, but the artist should advise the printer that he intends doing so, that the stone may be most carefully prepared for him. He must remember in making alterations by stippling over chalk work not to do so too strongly, or to make the dots too large, as the tint already on the stone is most deceiving to the eye, and an otherwise good tint may be completely spoilt by the dots showing up when printed about three times the strength of the rest of the tint.

There are as many modes of working with the chalk as there are with the pen; in fact, more, as there is so much more scope for the student's artistic taste to have its bent. In drawing a sky, a flat point would be preferable to a fine round one, and by holding the chalk at the end of the holder make the lines as broad as possible; or don't show any lines at all, but put a tint on the stone with the broad chalk evenly and smoothly; in fact, almost rub it on, making it stronger at the top and gradually fade into the distance. Should there be clouds in the picture, these may be drawn in comparatively short, broad, *curved* lines fading at either end, which may be joined by and slightly crossed by others at a slightly different angle. When this is filled in a good effect is produced by the different treatment in working; but I really can only repeat myself, and say, in lithography, the same as in drawing or painting, the student must use his own artistic knowledge and taste, and know what style of work is necessary in drawing different objects; and if he persistently follows the elementary and necessary rules, the knowledge and experience will be gained by every succeeding piece of drawing he produces.

On looking at a coloured drawing which has been drawn with the brush and pen, the *mode* of work is invariably seen, whether the tint be broken, flat, or shaded, etc. For instance, anyone who understands lithography can immediately, on looking at a Christmas card, tell whether it has been worked in little lines or dots, etc. But in

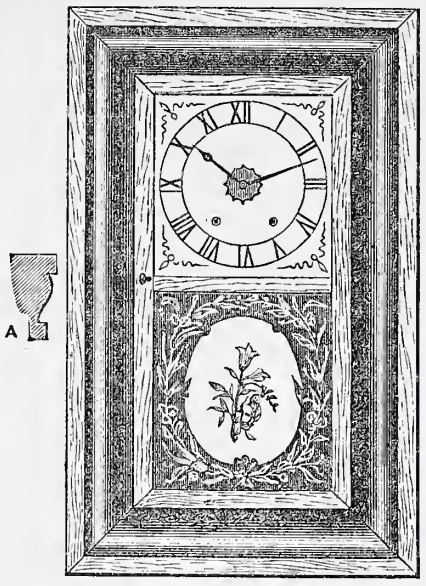



Fig. 6.—Ordinary Case of Large American Striking Clock—A, Section of Moulded Frame.

chalk drawings the style of work is not quite so easily detected, especially in colour printing. You can only see the effect, which certainly gives the drawing a much more natural and artistic appearance, although, from a commercial point of view, perhaps not so profitable, because of the necessity of printing from the original stones, on account of the difficulty in transferring good fine chalk tinting.

Take a group of leaves. In pen work they would be either stippled or drawn in fine lines, which must inevitably show when printed; but in chalk the tinting would be laid in in clear firm lines, with a broad point and the side of the chalk used; then, after crossing these at about an angle of 25° with lighter ones, still using the broad point, fill in any patches or spaces left with a fine pointed chalk. If this be printed in colour, a much more natural water-colour effect is produced. Of course, if a lot of colours are used, it considerably lightens the artist's work, besides the finer finish given to the drawing; but as everything nowadays has to give way to cheapness, we have to see how to obtain the best possible result with the fewest possible colours. By using a strong yellow, blue, or red, as the case may be, and shading it in such a manner that when the one colour is printed perhaps half a dozen different tones are produced, will naturally reduce the expense, instead of printing two or more shades of the one colour, which, in the above instance, is done away with by the artist's cleverness in execution.

Very often in coloured drawings the style of work may be mixed: that is, some of the colours worked with chalk, and others stipple, but it is simply an impossibility to say which means should be used for any special colour. I can only quote for example a good-sized landscape subject, with figures, etc., in the foreground. Now those stones on which the sky and distance are worked would be most effective done in chalk, whilst the figures, foreground, etc., would be best drawn in lines—stipple, splash, etc. But the student must not forget that should he be working a light blue stone, which would draw the sky, he must also draw the foreground in that colour in chalk, as the stone will be grained.

I trust I have not tired the student's patience in endeavouring to explain how to execute a good piece of artistic drawing, but I am sure he will understand how much I want to impress upon him the necessity of putting intelligence and feeling into his work, so that he may not fall into that fatal error of being a mere mechanical machine, which, unfortunately, is too often the result of any art requiring technical manipulation, and which in lithography consists in reproducing drawings and sketches by means of dots and lines.

After a drawing is completed, letterpress is sometimes required to be added at the foot of it; so to save an extra printing this is done by the draughtsman, and transferred to any one of the stones, whichever colour is most suitable: generally a dark grey or brown; but the artist must know where this is coming, and, if possible, not etch that part.

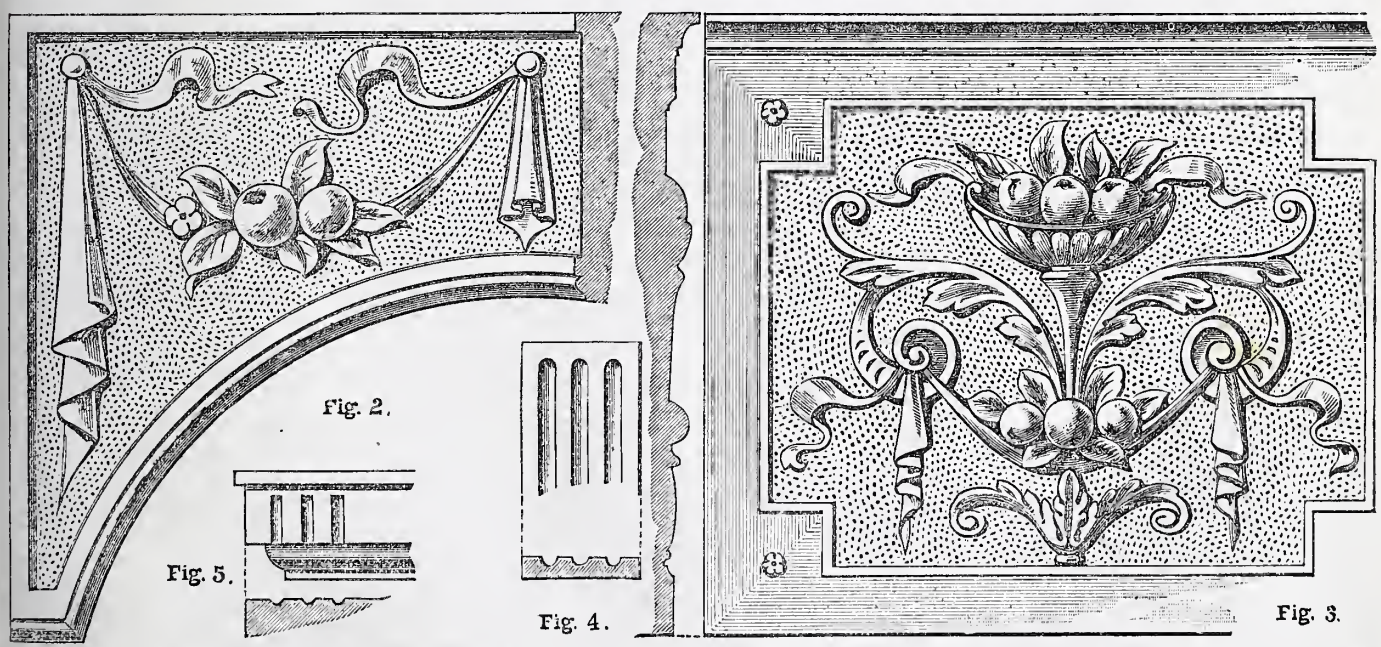



Fig. 2.—Half of Carved Arch at Top of Door as shown at E, Fig. 1. Fig. 3.—Carved Work on Panel at Bottom of Door, below Dial, as shown at F, Fig. 1. Fig. 4.—Top and Section of Pilaster at Side of Door. Fig. 5.—Section of Cornice above Door.

In arranging a series of small drawings on one stone, the student should try and get those of the same tone together, for he will see presently in practical work that it is not well to draw, say, half a stone with very heavy work, such as solids and strong tinting, and the other half with very fine line and stipple work. The drawings should, if possible, be uniform, or two different stones should be used. I do not mean those subjects requiring the gradations in shading from strong tinting or solid to the finer shades, such as the above diagrams; but where *one* drawing may require great depth, strength, and force in working, *another* may require to be very delicately and finely drawn; and as the etching for two such dissimilar pieces of work requires different treatment, which will be spoken of later, it would not be advisable to have them on the same stone, more especially as in the printing the former would require double the quantity of ink to the latter.

I must warn the novice against the bad habit of accustoming himself to work with a magnifying-glass, for if he does this he will get so used to it that he will only with great difficulty and force of will be able to do a fine tint without it, especially in stipple work; and it is unnecessary, I am sure, for me to point out the strain it would be on the eyes to continually look through glass.

In some fine work it is absolutely impossible to do it clearly and distinctly without: but as this is an exception, there is no reason why it should be made a practice, and after any such work is finished the glass should be entirely put away, and not brought out again unless the occasion requires it.

## BOILER EXPLOSIONS.

BY FRANCIS CAMPIN, C.E.

Classes of Boiler Explosion—Boiler Insurance—Phenomena arising from the Boiling of Water—Sudden Conversion of Airless Water into Steam—Fowler's Experiment—Explanation of Causes leading to Boiler Explosions—Defective Plates.

The failures of boilers by explosion or collapse may be divided into two classes: those in which the causes lie on the surface, and are, therefore, easily ascertained; and those in which the accident occurs under circumstances that do not admit of a clear explanation.

The former class of disasters may be prevented by care and intelligent supervision, such as is now rendered available to all steam boiler users by the Boiler Insurance Companies. They are due principally to two sets of causes: one is wear and deterioration by corrosion, and the other over-heating of flues, commonly arising from the deposit of scale.

To the unscientific observer the boiling and evaporation of water seems a very simple process, and one not at all likely to give rise to any surprises. This, however, is not the correct view, and it has long been known to physicists that under certain conditions the heating of water may lead to phenomena of an explosive character. It is well known that water has the property of absorbing and retaining considerable quantities of gases: hence water found in nature will be saturated with atmospheric air, and this air exerts a notable influence on the behaviour of water when heated, as it seems to aid its evaporation. Many years back M. Donny, of Ghent, found that water deprived of its dissolved air might be heated to a temperature of 360 degrees Fahr. before it entered into ebullition; it would then burst into steam with explosive violence, scattering the contents of the vessel containing it. For a reason which will subsequently appear, we call particular attention to the fact of the suddenly developed steam carrying the surrounding water with it. Of course, the whole mass of highly heated water is not vaporised, as a great quantity of the heat is immediately rendered latent by vaporisation of a part of it. The excess of heat over the boiling point is 148 degrees; and, as the latent heat of steam at atmospheric pressure is 967 degrees, only between one-sixth and one-seventh of the bulk of water could be evaporated at that pressure, though, of course, a smaller quantity might be generated at a higher pressure. The reason a smaller quantity of steam would be evolved at the higher pressure is because the water, keeping the same temperature as the steam, would not yield enough sensible heat to become latent. This explosive action has been pointed out as a possible cause of boiler accidents by some scientific authorities, especially in cases where fires have been banked up and the water unrenewed for some time; but on this point we shall have more to say.

A short time since Mr. F. G. Fowler, of Connecticut, U.S.A., made an experiment which tends to show that it is dangerous to use water containing air. According to this scientist, if water containing air is heated in a boiler until steam of low pressure—say, about 40 lbs. per square inch—fills it, and it is then inverted or shaken, the pressure will suddenly rise to about 80 lbs., and this, he thinks, indicates the cause of many boiler explosions. He accordingly advises us to discharge all the air from the water before feeding it to the boiler.

Taking these two statements as they stand, we appear to be in a dilemma, for whichever way we turn we are met by danger. One experiment shows that airless water is most dangerous to use, while another leads to the conclusion that the presence of air may lead to a catastrophe. Let us, however, look a little closer into these matters, and see if we cannot find some means of escape. We will go back to the case of the water from which the air has been discharged.

In the first place, it is to be noticed that the experiment is made under atmospheric pressure, 15 lbs. per square inch, so that when a part of the heated water bursts into steam there is no sufficient resistance to prevent it acting suddenly and carrying the remaining water with it; and, as water strikes a somewhat solid blow, a startling effect is produced. If, however, this water were in a boiler containing steam at 150 lbs. (absolute) pressure per square inch, the evaporation would proceed quietly, because there would be a resistance equal to the force of the fresh steam generated, or on the point of being generated; for while the temperature of the water and superincumbent steam are the same, evaporation will be suspended. Now, if we suppose the boiler pressure be allowed to run down to atmospheric pressure or thereabouts, and then rapid evaporation to commence, the steam thus evaporated, being confined, would rapidly rise in pressure and, of course, in temperature; and as soon as its temperature exceeded that of the water it would be condensed again, so that the pressure in the boiler could never reach 150 lbs.—that is, 135 lbs. above the atmosphere—so that actual bursting from over-pressure is hardly to be feared on this account.

There is, however, another view of the case. Water deprived of its air by mechanical means is in a different position from that deprived of air by heat in this respect, that when the air is removed in the former way the molecules of water come closer together, and, their mutual attraction becoming proportionately stronger, they require a higher degree of heat for their dispersion into vapour, and this dispersion will take place in a more vigorous manner. When, however, air is driven out of water by heat, it would seem reasonable to conclude that it is displaced by aqueous vapour, in which case no closer approximation of molecules will occur, and the water will evaporate at its normal temperature. If the case were otherwise, we might expect an explosion every time a boiler fire is lighted, as the air is driven off before the temperature of ebullition is reached. It is very obvious that water does dissolve or absorb steam in proportion to the pressure under which it is in contact with it; for if we draw water from a steam boiler into an open vessel a large quantity of steam will escape, and this steam is certainly not *generated* after the water leaves the boiler. If the water, after having been boiled, is allowed to cool so that air cannot reach it, it will, when cold, assume the condition of water from which air has been removed mechanically; but if air has access it will be absorbed, and the water will resume its normal condition.

Mr. Fowler's experiment of inverting or shaking up a boiler represents a state of affairs which can hardly occur except in a railway accident or a collision between steam vessels; but yet it has an interesting aspect, and further researches to determine the cause of the results reported would seem worth undertaking. A hypothesis might be hazarded that the air first expelled from the water carries up with it the vapour with which it is saturated at a temperature of 212 degrees, and remains in that condition in a stratum separate from the steam subsequently generated, and at a lower temperature. When agitation or inversion occurs, the air and its contained aqueous vapour will be raised to a temperature of 287 degrees, which will necessarily cause their expansion, and therefore the increase of pressure in the boiler. If this is the explanation, the trouble would cease as soon as the boiler gets to work, as the air entering with fresh feed water would all be heated up to the full temperature in passing through the water already in the boiler. If danger is anticipated, the first lot of air might be got rid of by blowing it off.

It has been suggested that boilers have been destroyed by sudden blows from the contained water due to its being carried up bodily by its contained steam on the occurrence of a sudden loss of pressure—such, for instance, as would happen if a plate gave way and released the steam instantaneously; but this is a case which is under control, as the primary cause is the defective plate. Taking the matter altogether, it seems that the causes of boiler explosions are getting to be pretty well understood by those whose speciality lies in that direction, and that before long what remains of mystery will be for ever cleared away.

Readers interested in this subject should read the papers on "Engine and Boiler Management," by Mr. M. Powis Bale, which are now appearing in Work, and which afford much useful information not to be found in a collected form elsewhere.

# DOVETAIL JOINTS.

BY FRED CROCKER.

TOOLS—COMMON DOVETAIL—SPACING—POSITION OF PINS—LAP DOVETAIL—SECRET DOVETAIL, LAPPED—SECRET DOVETAIL, MITRED—DOVETAIL HALVING—HALVING DOVETAILED BOTH WAYS—BLOCK APPARENTLY DOVETAILED ON FOUR SIDES.

DOVETAILED joints are used in a great variety of trades and materials, but the present paper will only apply to those used by the wood-worker. These consist of a taper mortise or socket on one piece (B, Fig. 1), and a pin or tenon on the other (A, Fig. 1).

*Tools.*—A detailed description of these will be scarcely required, as they are in general use for other purposes, but a small-backed saw, known as a dovetail saw, and a few bevel-edged chisels will almost be absolutely necessary.

*Common Dovetail.*—The most common form is used at the angle of two boards (Fig. 1). In making this joint, both edges are shot true and square; a gauge-line is run round one board at a distance from the end equal to the thickness of the other one, and the other board is treated similarly. Now, two methods are followed. Some mark and cut the pins first; others the sockets. In the first method (B, Fig. 1) you would have the pins carefully spaced, and the angles marked with the bevel; the saw would be run in down to the gauge-line, and the spaces between cleaned out with chisel and mallet. Then B would be put on the top of A, and the mortise marked with a sharp-pointed scriber. These would then be squared over, cut down to the gauge-line, cleaned out, and tried together. The second method is to first mark the sockets on A (sometimes on common work the marking is dispensed with, the workman using his eye as a guide); then run the saw in down to the gauge-line; put A on B, and mark the pins with the front tooth of the saw; cut the pins, keeping outside of the saw-mark sufficiently to allow of the pins fitting fairly tight; then both pieces may be cleaned out and tried together. In cleaning out the mortises and the spaces between the pins, the worker must first chop half-way through, then turn the board over, and finish from the other side, care being taken to hold the chisel upright, and not so as to cut under, as shown in Fig. 2, which is sometimes done to ensure the joint fitting on the

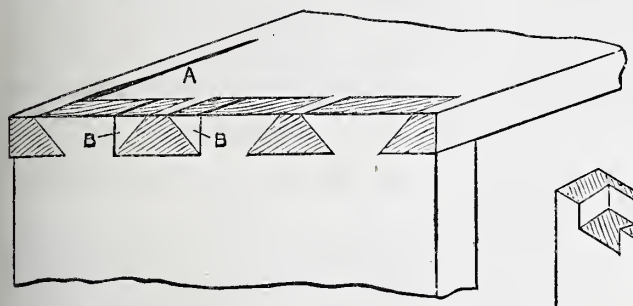



Fig. 3.—Dovetail bevelled too much.

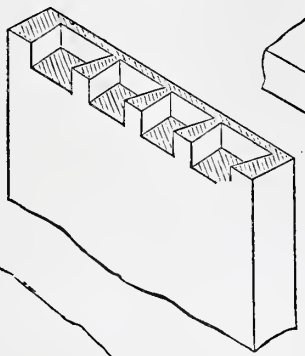


Fig. 4.—Lap Dovetail.

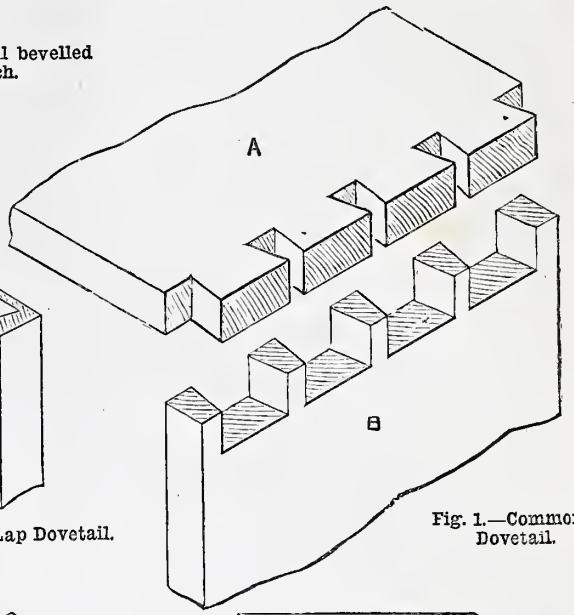



Fig. 1.—Common Dovetail.

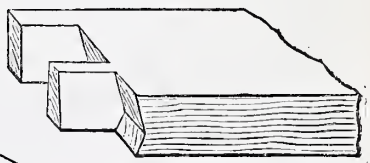


Fig. 2.—Dovetail Joint badly cleaned out.

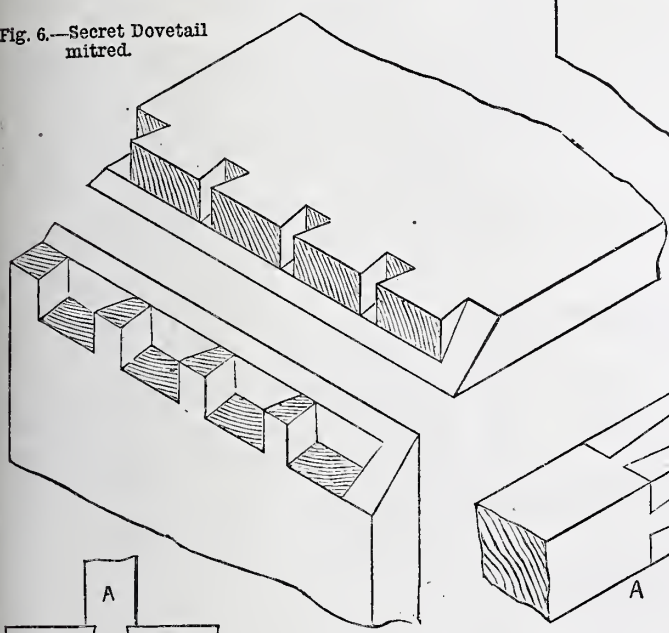


Fig. 6.—Secret Dovetail mitred.

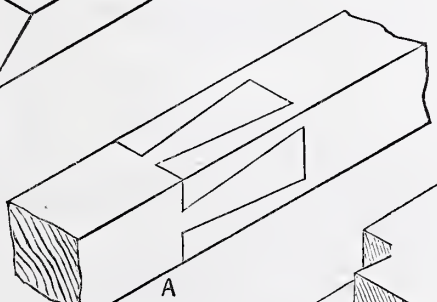



Fig. 9.—Block with Dovetail on Four Sides.

Fig. 7.—Dovetail Halving.

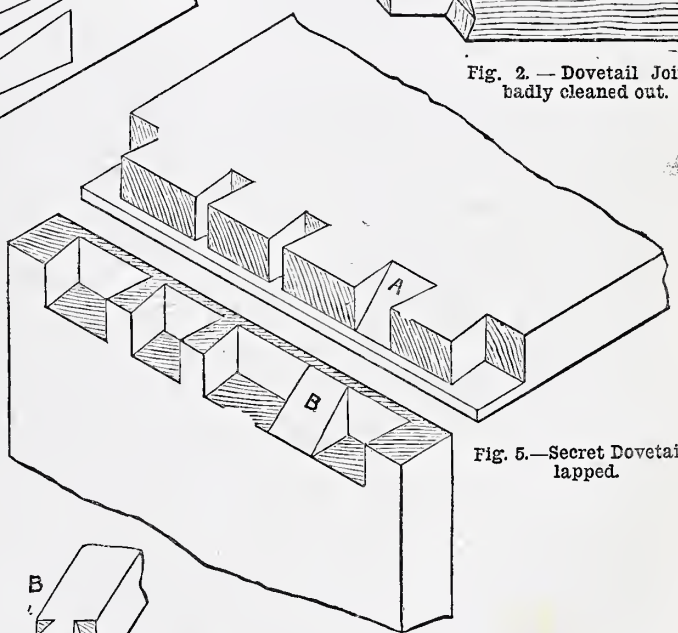
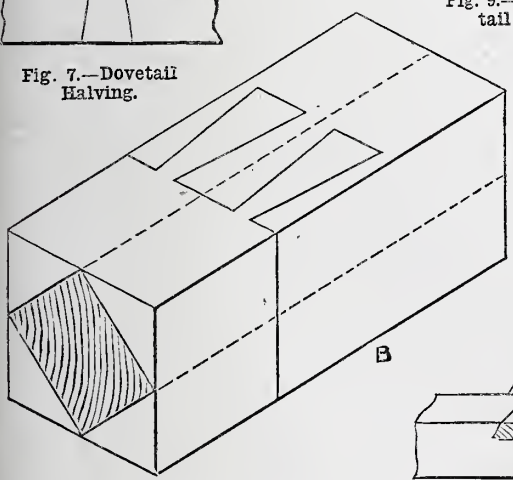



Fig. 5.—Secret Dovetail, lapped.



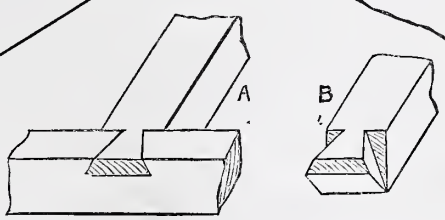




Fig. 8.—Halving Dovetailed both ways.

outside. Another bad practice is to leave the pins long, and rivet them over with the hammer when the joint is glued up.

*Spacing.*—The maximum strength would be gained by having the pins and sockets equal; but this is scarcely ever done in practice, the mortise being made so that the saw will just clear at the narrow side, the space being from eight to ten times the width of the widest side. Small pins are used for the sake of appearance, but fairly large ones are preferable. The outside pin should be larger than the others, and should not be too tight, or there is danger of its being split off, as shown at A, Fig. 3. In all dovetailed joints the angle should be slight, and not acute (as shown in Fig. 3). This looks strong, but is not so, as there is danger of the pieces, B, B, being split off in putting together.

*Position of Pins.*—When boxes are made the pins are generally cut on the ends, the sockets being on the sides. Drawers have the pins on front and back, the rule being to have the bevelled parts so that they are in opposition to the greatest stress that comes upon the piece of work to which the joint is applied.

*Lap Dovetail.*—Fig. 4 shows this joint, which is used for drawer fronts, the end grain being concealed on one side.

*Secret Dovetail, Lapped.*—Fig. 5 shows this joint, the end grain being almost concealed. The pin B is mitred, A being cut to correspond. This joint would be suitable for a work-box, the joint of the lid coming through B, so that when open it has the appearance of a mitred joint. This is a good form of joint, is more easily made than Fig. 6, and if, after gluing up, the edge be rounded, it equals it in appearance. In making this joint, first cut the pins, then the lap, and mark the sockets with the scriber.

*Secret Dovetail, Mitred.*—This joint (Fig. 6) is the most difficult to put together. The top pin is mitred right across, for the sake of appearance. In making this joint, both parts must have a lap or rebate cut on them, similar to the socket part of Fig. 5. Then the construction will be nearly the same, with the addition of mitreing.

*Dovetail Halving.*—This joint (Fig. 7) is objected to by some writers, because when A shrinks it will depend for its support on the screw, nail, or bolt, as the case may be. Then the dovetail form will be of no assistance in strengthening it, but will be a source of weakness at the shoulder, and the more the joint is bevelled the weaker it will be.

*Halving Dovetailed both Ways.*—Fig. 8 shows this. A gives the appearance, and the method of putting together may be gathered from B.

*Block apparently Dovetailed on Four Sides.*—This is shown at Fig. 9. A shows the block, and B the method of dovetailing. The pieces are dovetailed together with two pins, and then faced up to the smaller section shown on the end of B, which gives the appearance shown at A.

The two last-mentioned joints are of no practical value, but are rather curious. Many other applications of the dovetail are used, but cannot be described for want of space; but the columns of "Shop" are always open to the reader who requires advice. Amateur wood-workers are more disposed to nail ends of a box, for example, to sides instead of connecting them by dovetail joints. This may be all very well for rough work, but in joinery and cabinet-making the dovetail joint is much to be preferred.

## ANOTHER HINT ABOUT RAZOR STROPS.

BY OPIFEX.

In page 7, No. 105, of the present volume of Work, P. B. H. gave some very useful hints on the subject of stropping a razor which should prove acceptable to many, as we may safely say there is no mechanical process—except the use of a knife and fork—in which so great a number of men are daily engaged all the world over. And yet, as far as my observation goes, comparatively few know how to perform this simple operation to the razor's advantage.

The wonder is that so many razors shave at all, and the credit of their doing so is certainly due to the makers of the instrument rather than to the users in the great majority of instances. With regard to the use of the strop described by P. B. H., little can be added to his remarks; the only exception I take to them being that he recommends "flour of emery" to be applied to the strop, for if the ordinary flour emery of commerce be thus used, the result will be disastrous to the razor. The fact is that nothing but the most perfectly levigated flour of emery should ever be used upon a strop.

My object in writing, however, is to suggest that neither P. B. H.'s strop, nor the common strop of leather, etc.—used by

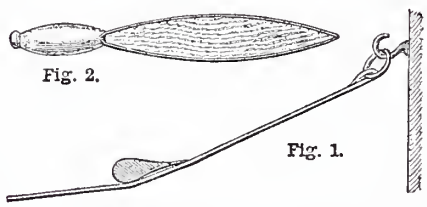



Fig. 1.—Diagram showing Section of Razor as applied to Barber's Strop. Fig. 2.—Convex Surfaced Razor Strop.

barbers—is suited for the purpose of sharpening or keeping a razor sharp, as both, but especially the latter, tend to thicken the edge of the instrument, and thus to detract from its cutting power.

The edge of a razor being formed by grinding both sides of the blade upon a wheel until the portions of the sides which form the edge are the nearest thing possible to being parallel without being actually so, it follows that, in order to preserve the shape of the blade as finished by the maker, it will be necessary to apply it to an abrading and smoothing surface, which shall correspond in some measure to the shape of the surface which originally formed it—*i.e.*, a wheel.

Now, this is exactly what the ordinary strop, whether rigid or flexible, does *not* do. In the former case the concave surface of the blade is applied to a flat surface; in the latter the edge bears upon a surface which forms an obtuse angle with it, as shown in Fig. 1.

Anyone who inspects the edge of a razor through a strong magnifying-glass will see that it consists of irregular teeth, like a very jagged saw, and will be able to appreciate the effect produced by either of the methods alluded to.

By frequent stropping these teeth are bent from side to side, until they are eventually broken off, and the edge becomes smoother, but considerably thicker, and, therefore, comparatively blunter.

To obviate this result, I suggest the use of a strop (about sixteen inches long, including the handle) shaped as represented at Fig. 2. The "body" of the strop is of mahogany, and is covered with finest buff leather or buckskin—in my case made from one of an old pair of braces; it is coated on one side with finest jeweller's rouge and blacklead, made into a paste with suet; the other side is the plain leather. Use it as directed by P. B. H. in the article already quoted; I have done so every day, with very rare exceptions, for ten years, and have never had my razor ground or "set" in all that time, because the original edge has been *preserved.*

## THE ZITHER: HOW TO MAKE IT.

BY R. F.

Introduction—Wood—Patterns—Construction of Instrument—Various Parts—Fitting of Parts—Gluing Parts Together—Bridges—Finger-Board—Marking Frets—Cleaning up and Feet—Pins and Wrest-Pins.

How well I remember the first time hearing a zither played! I was staying at a London hotel during the Exhibition of 1871, and in the small hours of the morning was awakened by the strains of "She wore a wreath of roses!" most exquisitely played. What manner of instrument was being used I had no idea, and thought at first it was one of those delicate musical-boxes with reeds; but, from the expression used and the subdued accompaniment so unattainable by mere mechanism, I was soon led to alter my opinion, and the introduction of an addition to the melody decided me that someone of the *genus homo* was concerned in its production. Inquiry in the morning disclosed the fact that "Julius," the night attendant, was wont thus to beguile the weary hours, and soon I had the satisfaction of examining the instrument, whose strains had so captivated my fancy a few hours before. A desire to possess one was soon followed by its acquisition, and an idea of improving upon it led me first to try and construct one. Since then I have made several, which have turned out very good instruments; and I therefore feel quite justified in giving my experience for the benefit of those readers of Work who care to "go in" for one, promising them that if they follow my instructions, they will be able to produce an article alike creditable to themselves and satisfactory as a musical instrument, and, bearing in mind always the maxim, that "Whatever is worth doing, is worth doing well," not being satisfied with anything short of perfection. That the attainment of such a standard is highly problematical I am prepared to admit, but that need not deter the worker from doing his very best. In this paper I do not pretend to give the orthodox methods of construction, but the easiest and most suitable for amateurs, and which I trust will prove as successful in the hands of any who may take it up, as they have done in my own case.

First, for the requisite wood, you will require 2 ft. of the best Swiss pine for the back, $\frac{3}{16}$ in. by 12 in.; a piece of mahogany, rosewood, or another piece of pine of the same thickness for the belly; a strip of maple or sycamore, $\frac{3}{16}$ in. by $\frac{7}{8}$ in., and 24 in. long, for the ribs on the curved side; another piece of the same for the straight side, 19 in. long; a piece of pine for the stays, 15 in. long by $\frac{3}{4}$ in., and about 3 in. wide; a piece of beech for the blocks, 10 in. long, $\frac{3}{4}$ in. thick, and 5 in. wide; a piece of ebony, 13 in. long, $\frac{3}{16}$ in. thick, and $2\frac{1}{4}$ in. wide, for the finger-board; another piece of the same,

7 in. long and 1 in. wide, from which to get out the upper bridge; a piece of ebony or rosewood, $\frac{3}{8}$ in. thick, 1 in. wide, and $8\frac{1}{2}$ in. long, for the lower bridge; and a small piece, from which to make three knobs for feet. Rather a formidable-looking list for such a small instrument, but nothing so very alarming after all, when the quantities of each are considered. Note particularly that all the *thicknesses* here given, with the exception of the stuff for the stays, are for finished material, as it will be required; but lengths and widths are given a little more than wanted, to allow for working. In addition to the stuff necessary for the instrument itself, you will require a piece on which to build, unless you prefer to use your bench-top for the purpose. This piece must be 24 in. in length and 18 in. wide; any thickness not less than $\frac{3}{4}$ in., and must be planed true on one side; and, lastly, a piece of $\frac{3}{4}$ in. by 6 in. wide, and 24 in. long, for a mould for the curved side; and a few more odd pieces of $\frac{1}{2}$ in. stuff, which will be mentioned as we go along.

Commence by getting out a stiff paper pattern from Fig. 1, and cut this out. Cut off $\frac{1}{4}$ in. from the bottom edge; then turn it over, and on the reverse side mark the position of all blocks, stays, and the sound-hole, as shown at Fig. 2; cut the sound-hole out, and your pattern is ready. Now take the pieces intended for the back and belly, which have been reduced to the thickness previously given, and mark on them all round the pattern; cut these out, and shape them up exactly alike, leaving the edges perfectly square. Lay the back on one side, and, taking the belly, lay it face downward on the slab or bench, and fasten it there by two screws, through the place where the sound-hole will be. Put these screws through another piece of wood, about $\frac{1}{2}$ in. thick and 2 in. wide, first, as the belly itself is not strong enough. Now take your piece of beech, 5 in. by 10 in. by $\frac{3}{4}$ in., and lay your pattern on, and mark along the top; then shift it $2\frac{1}{2}$ in. lower, and mark again; then mark off $\frac{3}{16}$ in. from each end, and this will give the pattern for the wrest-pin block, A, Fig. 7; and from the remaining piece can be got the lower block, $1\frac{1}{2}$ in. by 8 in., B, Fig. 7. Square the edges of these, and lay the upper block in its place at the top of the belly, flush with the top edge, and leaving $\frac{3}{16}$ in. at each end for the ribs to come on. Now lay the lower block in its place, and mark where the end of the curved rib will come; then cut a piece $\frac{1}{2}$ in. deep and $\frac{3}{16}$ in. wide out of the end of the block, for the end of the rib to fit into, as shown at Fig. 2. This block is now ready, and both it and the top one may be glued into their places, and weighted down till dry. When doing this, take care that the $\frac{3}{16}$ in. of the belly are left at *each* end of the upper block, but at the straight end of the lower block only. Before these blocks are glued on, you must be careful to have them well warmed, and also take care that your glue is perfectly hot, clean, and strong, but not thick. While they are drying you may get out your two diagonal stays, the shape of which is shown at Fig. 4, and a section in its centre at A′. These, you will observe, taper off to nothing at each end, and go quite across the belly, the lower one starting from a point $5\frac{1}{2}$ in., and the upper one $10\frac{1}{2}$ in., from the bottom on the straight side, and being carried across to points, $2\frac{1}{2}$ in. lower, on the opposite side. They should be $\frac{1}{2}$ in. deep in the centre, and $\frac{1}{2}$ in. wide throughout. They may be glued on, and cramped down by a button at each end, and by the piece that is already holding the belly down to the board being taken off, and its position altered, of course, using longer screws for this purpose. Fig. 8 shows this arrangement at A. The next parts to get on are the ribs, and for this a mould is required. The piece of wood, 6 in. wide, 24 in. long, and $\frac{3}{4}$ in. thick, will be required for this. On it lay the curved side of your pattern, and mark along its edge; then cut it out, and clean up the *hollow* side, and, taking up the buttons from the ends of the stays, screw this down side by side with, and exactly fitting, the curved side of the belly. The remaining piece can be screwed down at the straight side, and you will then have the belly in a mould. On the top of these pieces screw buttons of wood, about 2 in. long and 1 in. wide, at intervals of 3 in., and the arrangement is complete.

Before gluing in the ribs, it is as well to see that everything fits properly. Take, therefore, the slip you have prepared for the ribs, and reduce it to $\frac{3}{4}$ in. wide; then insert one end in the groove in the lower block, and gently bend it round the curved side, screwing the buttons down on to it as you proceed. If the wood is harsh or brittle, it will be as well to damp it before doing this. Mark the places where the ends of the diagonal stays come; take the slip out again, and cut out the little pieces that may be necessary; then replace it, and fit accurately. The straight side must be fitted in the same manner; and when this is done, the ribs may be glued in and cramped down, and the whole be left to dry (Fig. 8). The interior construction is now nearly complete, requiring only the addition of the long stay or inner bridge, C, Fig. 2. This is $13\frac{1}{2}$ in. long, $\frac{3}{4}$ in. deep, and $\frac{5}{8}$ in. thick, and must fit tightly between the top and bottom blocks. Two curved pieces are cut out of the under edge to give lightness to it, and two square pieces out of the upper edge to receive the diagonal stays; and if the blocks are thoroughly dry, this long stay may be glued into its place. Another interval for drying, and the cramps may all be taken off, the shell taken out of the mould, and the sound-hole cut. This is $3\frac{1}{2}$ in. in diameter, and must have its edges neatly rounded. A straight-edge must now be passed over the blocks, ribs, and stay, to see that all are exactly level, and any inequality must be rectified. When all is ready, the back may be prepared for fixing. Glue a small block, 1 in. square and $\frac{1}{4}$ in. thick at the widest part of the inside of the back, $\frac{3}{16}$ in. from the edge; this is to take the stem of a foot that will afterwards be fastened in. Mark on the outside of the back where the centre of this block comes. Now replace the shell in the mould, and refix the buttons in their places, turning them to one side to leave the top edges of the ribs bare. All being ready and your glue quite hot, pass a warm flat-iron several times over the blocks to get them warm; then glue quickly all the points of contact with the back—*viz.*, the blocks, the edges of the ribs, and the feet of the long stay; and, as soon as this is done, clap the back on, and weight down at top and bottom; turn the buttons into their places, and screw down. As this operation of getting on the back is a very important one, it being absolutely necessary that the contact with all the points should be perfect, it is better not to attempt it by one's self, but to get a little assistance. When all is quite dry, the instrument may be taken out of the mould, the edges cleaned up, and, with the back and belly, thoroughly smoothed with glass-paper. When this is done, prepare the bridges and finger-board. First cut out your upper bridge from the piece of ebony, 1 in. wide and 7 in. long. This bridge, when finished, is $\frac{3}{8}$ in. wide and $\frac{5}{16}$ in. thick, and has a small groove cut in at a distance of $\frac{1}{8}$ in. from the front edge, to take a piece of No. 18 brass wire, over which the strings are to pass. This is the pressure-bar, A, Fig. 5. Glue this bridge on with its bottom edge $2\frac{1}{8}$ in. from the top edge of the wrest-pin block, and its left end $2\frac{1}{8}$ in. from the straight side; the remaining distance to the edge will be occupied by the finger-board. The lower bridge may now be got out of the piece of ebony or rosewood, 1 in. by $\frac{3}{8}$ in. by $8\frac{1}{2}$ in.; and this, when finished, should be of the exact size and pattern as shown in the drawing D, Fig. 6, and the exact length of the straight part at bottom of instrument. The strings do not pass *over* this bridge, but partly over and partly through it—over it as far as the pressure-bar, and then through channels to where the bridge joins the top edge of the belly. The first five channels are cut at intervals of $\frac{3}{8}$ in. from each other, leaving $\frac{5}{16}$ in. of the finger-board on the outside of the first and fifth strings respectively; then a further interval of $\frac{1}{8}$ in., and divide the remainder of the bridge, leaving $\frac{1}{4}$ in. at the bass end, into twenty-six equal parts. These marks, which will be about $\frac{7}{32}$ in. apart, must be sawn through diagonally (as shown in Fig. 6) from the pressure-bar to the belly, and the lower of the channels thus made must be wider than the others, as the strings going through them will be thicker. It is better, perhaps, to glue the bridge on (leaving $\frac{1}{4}$ in. projecting over the end), and let it dry before cutting through it, as it is less liable to fracture then. The finger- or fret-board may now be taken in hand. This, when finished, should be 13 in. long, $2\frac{1}{8}$ in. wide, and $\frac{3}{16}$ in. thick. At a distance of $\frac{1}{4}$ in. from the top draw a line across, and on this line cut a groove $\frac{5}{32}$ in. deep. That is exactly half-way through the board. In this groove insert a piece of sheet brass or German silver, which must project $\frac{1}{8}$ in. above the top surface. This forms the nut, and from the *front* edge of this all the distances for the other frets are measured. Directly at the back of this nut five holes are drilled, sloping to the left, in which to insert the nut pins. These holes correspond to the five channels in the lower bridge, in being $\frac{3}{8}$ of an inch from each other. Now you may proceed to mark off the finger-board for the frets, the distances here given being from the *front* edge of the nut to the *centre* of each fret, so that the mark must in each case be cut out:—

| | |
|---|---|
| 1st.—$\frac{7}{8}$ in. | 16th.—$9\frac{3}{16}$ in. |
| 2nd.—$1\frac{1}{16}$ in. | 17th.—$9\frac{5}{16}$ in. |
| 3rd.—$2\frac{7}{16}$ in. | 18th.—$9\frac{7}{8}$ in. |
| 4th.—$3\frac{3}{16}$ in. | 19th.—$10\frac{3}{16}$ in. |
| 5th.—$3\frac{1}{2}$ in. | 20th.—$10\frac{3}{8}$ in. |
| 6th.—$4\frac{7}{16}$ in. | 21st.—$10\frac{3}{4}$ in. |
| 7th.—$5\frac{1}{16}$ in. | 22nd.—11 in. |
| 8th.—$5\frac{5}{8}$ in. | 23rd.—$11\frac{1}{4}$ in. |
| 9th.—$6\frac{3}{16}$ in. | 24th.—$11\frac{1}{2}$ in. |
| 10th.—$6\frac{11}{16}$ in. | 25th.—$11\frac{11}{16}$ in. |
| 11th.—$7\frac{3}{16}$ in. | 26th.—$11\frac{7}{8}$ in. |
| 12th.—$7\frac{5}{8}$ in. | 27th.—$12\frac{1}{16}$ in. |
| 13th.—$8\frac{1}{16}$ in. | 28th.—$12\frac{1}{4}$ in. |
| 14th.—$8\frac{1}{2}$ in. | 29th.—$12\frac{7}{16}$ in. |
| 15th.—$8\frac{7}{8}$ in. | |

When all are marked, proceed to cut carefully each one to $\frac{3}{32}$ in. deep, except Nos. 23 and 25, which are short frets, and only go half-way across the board. For this purpose a very fine dovetail saw must be used. Having cut all the grooves, fill in each one with a piece of the same metal, as

previously used for the nut, allowing $\frac{1}{16}$ in. only to remain above the surface. To fasten these frets in their places securely, take a small quantity of shellac, crush it to powder, and place a little in each groove, then heat the fret by holding it in a flame, and place it quickly in position. Note, do not make it red-hot, or it will burn the shellac instead of melting it. The rough edges and the ends of these must be rounded off, and the dots or stops may be inserted. These are for a few hours to dry. The whole may now be thoroughly cleaned up; the holes bored in the back for the insertion of the feet, one at top and one at bottom of straight side, and one at the widest part of the curved side, where you have a block ready for it. These feet are small round knobs, $\frac{1}{2}$ in. in diameter, with a stem $\frac{1}{4}$ in., and when in position have a sharp little spike of iron projecting from the bottom, to prevent the instrument slipping about on the table when with those of the other, and the whole sloping slightly to the top of the block. After boring they should be slightly countersunk. The bridge-pins of the accompaniment strings are $\frac{7}{32}$ in. apart, and slope to the right. All these bridge-pins should be made of No. 20 brass wire, and be $\frac{5}{8}$ in. in length, with $\frac{1}{8}$ in. left above the bridge. The holes for them should be drilled, not bored. The wrest-pins are of a special kind, and can be bought for a small sum. They can be had either

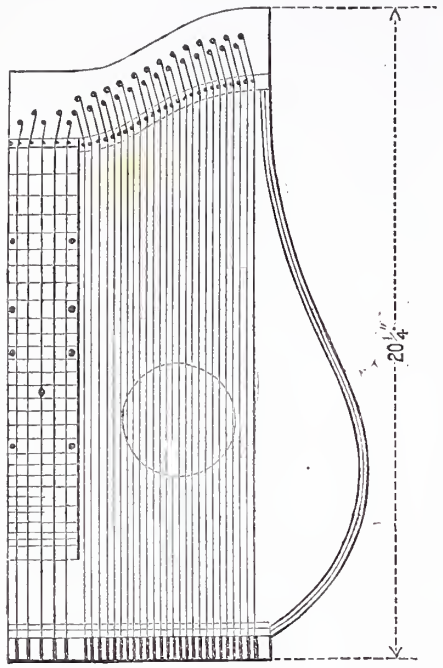


Fig. 1.

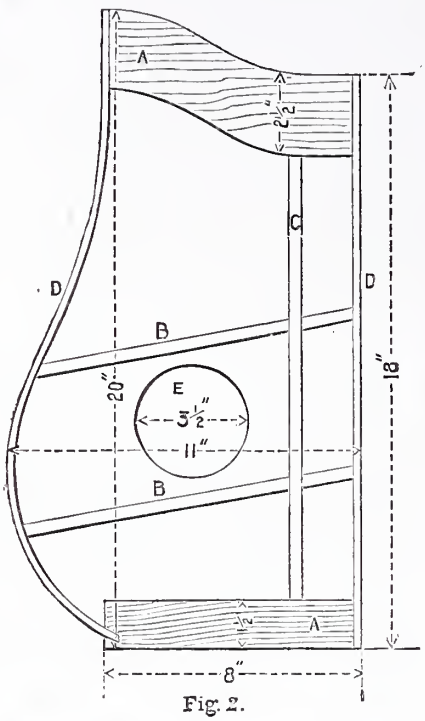


Fig. 2.

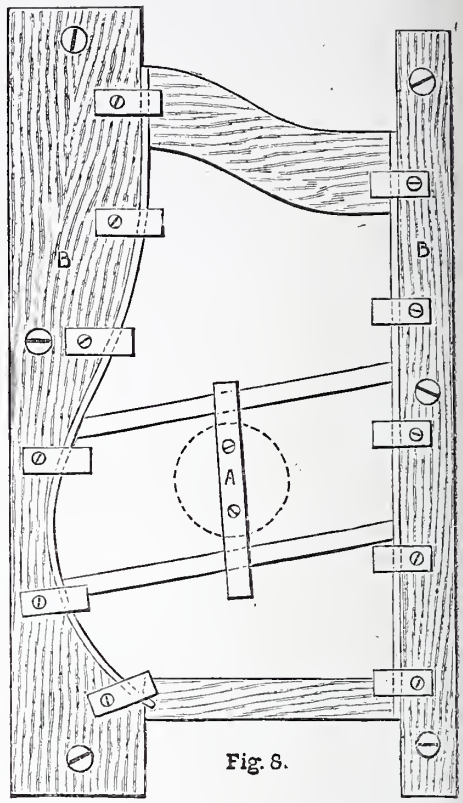


Fig. 8.

Fig. 3.

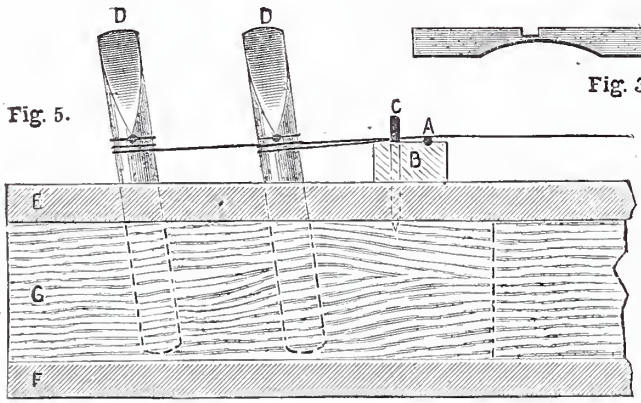


Fig. 5.

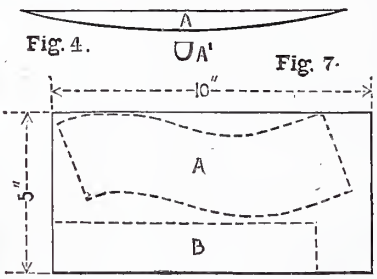


Fig. 4. Fig. 7.

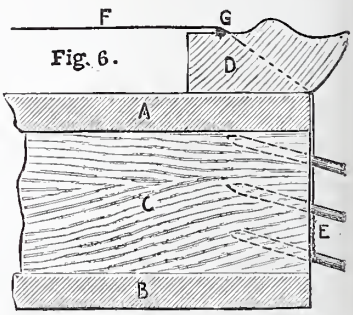


Fig. 6.

**Fig. 1.—General Plan of Zither, on Scale of 2 in. to 1 ft. Fig. 2.—Plan of Underside of Belly, showing Arrangement of Blocks (A, A), Diagonal Stays (B, B), Long Stay (C), Ribs (D, D), and Position and Form of Sound-Hole (E), on Scale of 2 in. to 1 ft. Fig. 3.—Elevation of Long Stay on Scale of 2 in. to 1 ft. Fig. 4.—Elevation of Diagonal Stays—A', Section at A, on Scale of 2 in. to 1 ft. Fig. 5.—Full-Size Section of Upper Block and Bridge (B), with Pressure-Bar (A), Bridge-Pin (C), Wrest-Pins (D, D), Belly (E), Back (F), and Block (G). Fig. 6.—Full-Size Section of Lower End of Zither, showing Direction taken by Strings (F) through Lower Bridge (D); Other Parts shown being Belly (A), Back (B), Block (C), Hitch-Pins (E), and Pressure-Bar (G). Fig. 7.—Method of cutting out Top Block (A) and Bottom Block (B), on Scale of 2 in. to 1 ft. Fig. 8.—Method of cramping down Ribs and Stays—A, Stay Cramp, also holding down Belly to Board; B, Mould with Buttons.**

of ivory or pearl, $\frac{3}{16}$ in. diameter. Two are inserted half-way between the fourth and fifth, the eighth and ninth, the eleventh and twelfth, and the eighteenth and nineteenth frets; one on each side of the board; and one between the fourteenth and fifteenth, in the centre. These dots are guides to fingering (Fig. 1). The board may now be placed in position. First, warm it well; then glue it over, and quickly lay it in its place, giving it a rub up and down to set the glue, and taking care that the nut is level with the groove in the upper bridge, and the outer edge flush with the straight side. Clean off the glue that has squeezed out, and set aside being played. The back and ribs may now be stained and the instrument polished, unless you wish to try your hand at purfling. In this case you will require a purfling chisel and about 4 ft. of purfling, to go round the curved side and the sound-hole. When polished, the wrest-pin block may be bored. First, bore the holes for the melody strings. A reference to Fig. 1 will show where these are to be, and care must be taken that they are a little to the right of the holes for the nut pins. The pins for the accompaniment strings occupy the centre portion of the block, are $\frac{7}{16}$ in. apart, and are placed in two rows, $\frac{3}{4}$ in. apart, the pins of one row alternating in blue steel, polished steel, or nickelled. Messrs. W. J. Chilvers & Co., St. Stephen's, Norwich, supply them, as well as all other fittings, strings, etc. The work now remaining is the insertion of the hitch-pins, which are shown at E, Fig. 6. The lower row consists of the first five strings only, and are put in in a straight line, the other two rows alternate with each other, and the whole corresponds to the thirty-one channels through the lower bridge. These pins are made of No. 17 wire, are $\frac{5}{8}$ in. long, and are driven into the block for $\frac{1}{2}$ in. Now fit a piece of the No. 17 wire into the groove in each bridge, and the instrument is ready for

stringing. In stringing, take care to turn the pins to the left, as all the tuning is done with the left hand, when the instrument is in use. To learn to tune the zither it is necessary to have a scale, and these are always to be found in good instruction books. Procure one of these, and study it attentively.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

THE WORM BLOCK—TYING—FRAMES—KNUCKLES.

SPIRAL springs are extensively used for various purposes, such as for salad or vegetable ladles, etc. They are usually made by the aid of an article called a "worm block." In Fig. 70 I have shown the appearance presented by such an adjunct, which is, in this diagram, supposed to be rigged up with the intention of being secured in a convenient position on the bench, although frequently it will be observed that the block is fitted to a very plain framework, with no view of being secured to the bench, but in order that it may be fixed to the vice when required for use, and always be regarded as a loose tool. Of course, the reason for this being the case in some shops is obvious enough: where a bench has several machines or tools upon it as fixtures, there is likely to be far less clear space for the workman than would be considered by him to be necessary; and, further, such tools, etc., as fixtures, would always be exposed to sundry knocks from the wire-work under manipulation, and, perhaps, in this manner receive more damage than would be the case were they made so that they might be placed underneath the bench during the non-requirement of them.

The worm block which I inspected was composed of a hard wood. It was about 7 in. or 8 in. long, 3 in. or 4 in. thick at one end, tapering to a point, as shown in Fig. 70, at the other end. Beginning at the point, a groove was worked around it completely to the other end, thus making a worm or spiral line upon it. Wires of various gauges can be used, provided the groove is, of course, made deep and wide enough for the purpose.

If to be fastened to the bench, it should be mounted upon standards, as shown. For these there will first be a H iron foot, with screw-holes in it. At each side there will be a support in the shape of a perpendicular iron rod, the bottom end of which will be welded into the foot, while the top end will receive an end of the handle-bar. Of the handle-bar I have not previously spoken. It will be an iron rod, bent as in Fig. 71, and driven through the middle of the worm block in such a way that there will not exist the remotest possibility of the latter working at all loose. That this should be the case is a very essential matter.

For the better utilisation of the machine, it will be advisable to firmly fix a wooden handle over the proper part of the handle-bar.

The ends of the uprights which are to receive the handle-bar will be bent as in Fig. 72. At each side, in addition, will be a half-circular iron rod, the top of which will be as in Fig. 73: so made in order that it may receive the perpendicular supports, and thus tend to strengthen the machine without creating inconvenience by arousing any possibility of the wire being worked getting entangled in any way.

If it is desired that this machine shall be a loose article, nothing more than a simple frame, after the pattern shown in Fig. 74, is required; for, attached to such a frame, when use were being made of it, it could be screwed up tightly in the vice by one corner.

At the pointed end of this block, at about the spot indicated in Fig. 70, will be a small hole, across the opening of which will be a little staple or piece of wire, as in Fig. 75. When the wire is about to be bent to the form of a spiral, the swift upon which the coil is placed must be fixed in a handy position for working from. One end of the wire is then hooked to the catch described in the point of the worm block, and guided in the groove. It will require little intelligence to perceive now how, when the handle is turned—the wire, of course, being properly

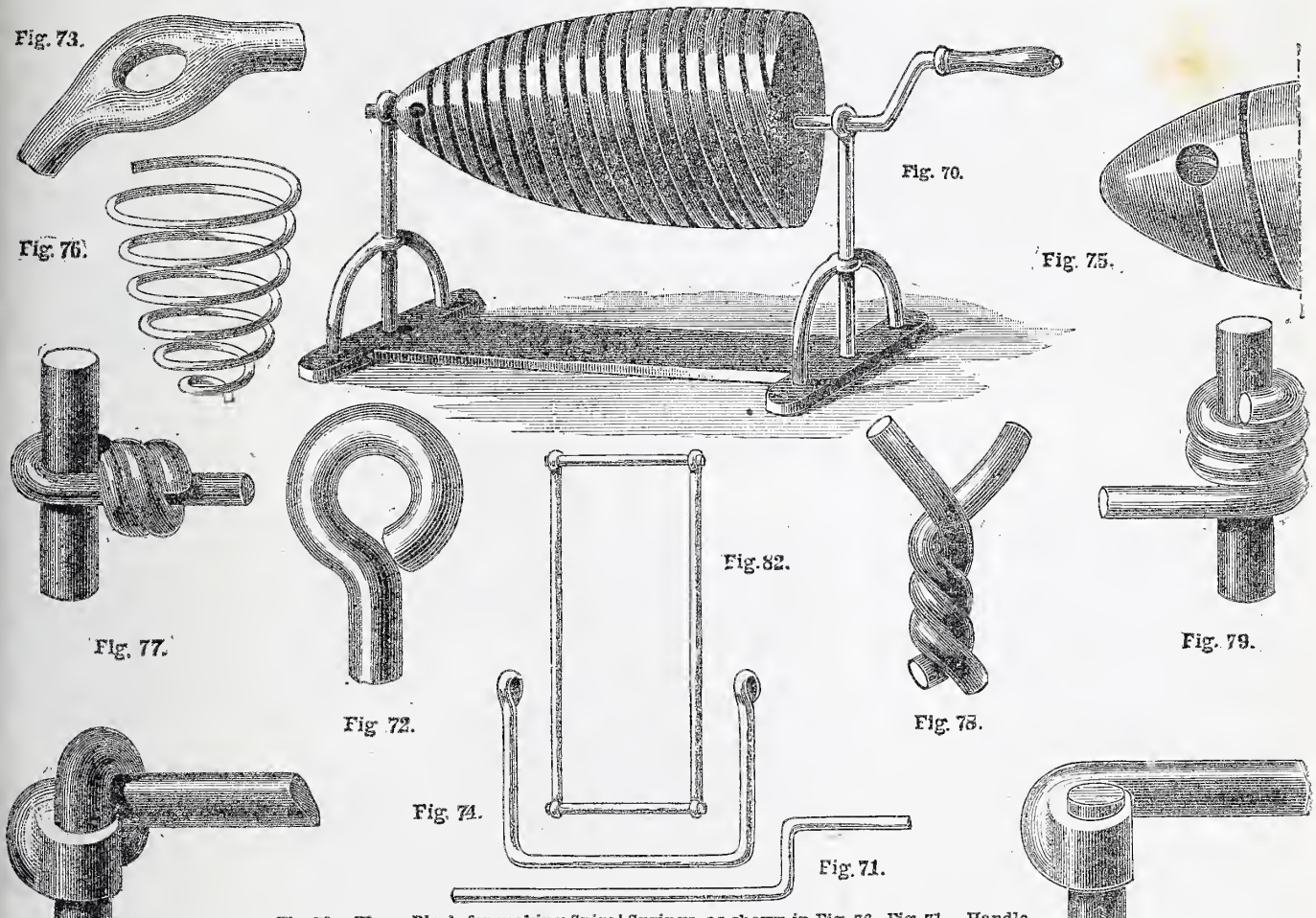



Fig. 70.—Worm Block for making Spiral Springs, as shown in Fig. 76. Fig. 71.—Handle-Bar for Worm Block. Fig. 72.—Top of Perpendicular Rods which support Worm Block. Fig. 73.—Top of Curved Irons which help to support Worm Block. Fig. 74.—Alternative Form of Block Support for use in connection with Vice. Fig. 75.—Enlarged View of Nozzle of Worm Block, showing Catch or Eye. Fig. 76.—Spiral Spring as result of bending Wire round Block. Figs. 77, 78, 79.—Various Methods of Tying. Figs. 80, 81.—Corners of Frames formed by Stout Rods. Fig. 82.—Frame complete as formed by Stout Rods, as shown in Figs. 80, 81.

guided—is entwined around the worm block, and when cut off at the required length and released, a spiral spring is formed.

Supposing that the wire is worked round the block for a third of the latter's length, when cut and released it would be found that it will spring out considerably, thus increasing in width and shortening in length, although it can be turned with the fingers to the proper size again. If it were not for this "springy" conduct on the part of the turned wire, it would be a very troublesome experience for a workman to release it from the block. In Fig. 76 is proportionately represented a spiral spring, similar to what would result with our worm block.

This expression of "tying" can hardly be said to be correct, for what is generally understood to be tying, in connection with such material as string, is the fastening over and under of the parts to be secured. With wire it is different. If a single end of a wire is to be tied, it is turned round and twisted to itself, as in Fig. 77; and when the two ends of a wire, or a pair of separate ones, are to be united, they are twisted around each other, as in Fig. 78. Sometimes, when a thin gauge wire is used, the operation of tying can be accomplished by the aid of the fingers only; but if wire of any stoutness at all is used, it will be found that the pliers will have to be called into requisition. Another method of single-wire tying is that shown in Fig. 81, but, in my belief, it is not nearly so useful as that described in Fig. 77.

Hereafter, when I refer to "frames," I shall suppose that the reader will have acquainted himself with my notes upon them. Fig. 82 shows a frame. The term can be said to mean the skeleton of a job of any description, as, for instance, fire-guards or garden arches. According to the size of the article, so will be regulated the gauge of the rods composing the frame. The corners are made either as in Fig. 80 or Fig. 81. Sometimes the joint (Fig. 81) only is necessary. This is for small work, as the wires, when once turned over within the frame, hold all parts together, and with the additional strength afforded by stay-bars (of which more is said elsewhere) is all that is required; but for large work it is desirable to use the joint shown in Fig. 80.

The term "knuckles" is used in connection with turning over. That part of a wire which encircles a rod of a frame is a knuckle. When it is said that knuckles are inward, the meaning is that the wire is so bent towards the middle of the work as the article will appear when completed; and the same applies, in a reverse manner, when knuckles are said to be outward.

## OUR GUIDE TO GOOD THINGS.

**** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 59.—JACOB'S IMPROVED WINDOW-BOX.

NATURALLY enough, if one does not exactly like any article or appliance in every-day use, and further happens to be of a constructive and, may I say, alterative condition of mind, one tries to improve on existing circumstances, and to make life in that particular direction more worth living. That this was the case with Mr. Thomas Jacob, Cabinet and Joinery Works, 31, Cleveland Mews, Fitzroy Square, his "Improved Window-Box" clearly shows; and a little reflection will show any reader who understands, and is fond of, gardening, that Mr. Jacob has made life moro worth living for plants that are destined to pass their time, or the greater part of it, in a window-box, and for persons who have perhaps no opportunity of growing plants in any other way, by having made better provision than heretofore for keeping plants in a healthy state. When Mr. Jacob sent me his model for inspection, he wrote: "I took this matter in hand because I always regarded the ordinary window flower-box as an examplo of the most primitive and thoughtless construction to be met with, and although much expense has frequently been lavished upon it by the addition of artistic tiles, it cannot be said that the result is satisfactory. I therefore set myself the problem of producing a flower-box that should he efficient, as regards drainage and ventilation, artistic in form, of greater durability, and at the same time cheap. Ventilation and drainago, tho most important objects,

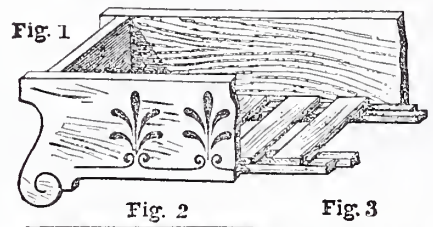



**Fig. 1.—Diagram showing Construction of Box, and open and movable Bottom formed of broad Laths. Fig. 2.—Plan of Box seen from above—A, A, Ledges. Fig. 3.—Plan of Bottom.**

are provided by a trellis bottom, which is raised about 1½ in. This, as a convenience of manufacture, and that it may be renewed if desirable, is loose. Improved form is ohtained by allowing the front of the box to project beyond the ends of box, and shaping it. Inexpensive artistic effect is produced hy a painted decoration, although tiles may be applied, if desired. With regard to the strength of this hox, the improved method of construction ensures that, unless it is really broken to pieces, it will not give way. Such a box, 3 ft. 6 in. long and decorated as model, can now be sold for 10s. 6d." I agree with Mr. Jacob in all he has advanced with regard to his box. The open bottom, which is movable, certainly provides ample means of drainage and means also of aëration or, as he terms it, ventilation. Tho construction of the window-box, as described by Mr. Jacob, is shown in Fig. 1, from which it will be seen that the front and back are nailed to the ends, and that the front, which projects beyond and over the edge of the brick-work forming the side of the window, is shaped. Fig. 2 shows a plan of the box as seen from above, and from this it will be noted that two slips, A, A, about 1 in. square, are nailed to the inner surfaces of the front and back, at a little distance above the lower edge. These ledges receive and sustain the ends of the broad laths of wood which form the bottom, and which are nailed on to two laths running transversely from end to end. The way in which the bottom is made is shown in Fig. 3. The laths need not be so far apart as shown in Fig. 3; it will be sufficient if they are about ½ in. apart and 2 in. in breadth. If the plants are grown in mould placed in the box, a layer of moss or coarse cocoa-nut fibre should be strewn over the laths.

THE EDITOR.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

PAPER MOUSETRAPS.—An American journal, under this heading, tells an amusing story, which may serve as a useful hint to those whose premisos are overrun with mice. It is to the effect that in a house where fly-papers were extensively used on account of a plaguo of flies some were accidentally left on the kitchen floor one night when the family retired to bed. Next morning the mistress was delighted to find that several young mice had been caught by the fly-paper—tho sticky qualities of which happened to be superior—and that, taking the hint, she set a fresh series of papers coated with birdlime, which very shortly caught all tho obnoxious little rodents on the premises. The idea is not a bad one, whether the story be truo or merely invented.

A REAL "BACHELOR'S BUTTON."—Several attempts have been made to provide a button capable of quick and secure attachment to clothes when needle and thread, or someone who knows how to use them, are not at hand. These qualities have been secured by devices in the market; but the button invariably fails in ono important essential. The shank, being of metal, is unyielding, and the consequence is that it is most unpleasant to deal with, there being a difficulty in passing the button through the button-hole. What is wanted is a soft (preferably string) shank which can, at the samo time, be securely fastened to the garment. The inventor of some simple device in this direction would earn the blessings of male humanity and, we venture to think, a substantial return for his trouble.

## SHOP:

### A CORNER FOR THOSE WHO WANT TO TALK IT

**** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTER FROM A CORRESPONDENT.

**Wire-work Errata.**—J. S. (*London, N.*) writes:—"I am sorry that upon page 293, No. 123, Vol. III., are two errors, one palpably my own. From line 21 it should read . . . . . 'wires A, B, C, D, E, F would be parallel with the free portions. M, N, O, P, Q, R; and those of G, H, I, J, K, L parallel with S, T, U, V, W, X.' On line 36, Fig. 53 should read Fig. 58."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Current for 5 c.-p. Lamp.**—ELECTRO.—A 5 c.-p. Edison-Swan lamp with a voltage of 5 volts will take 3 ampères of current to light it; whilst the same candle power may be obtained from a lamp of higher resistance requiring a voltage of 65 volts, by employing a current of ·35 ampères. If accumulators are to be used, we shall require one cell for each 2 volts of lamp voltage, and one square foot of positive plate surface for each six ampères of current required. Thus, a 5 volt 5 c.-p. lamp to burn ten hours would require an accumulator battery of three cells, each cell having at least five square feet of positive plate surface. It will be better to exceed this by 20 per cent., to prevent undue exhaustion. The plates should be totally immersed in the solution, and the distance between them may be reduced to a minimum ascertainable by practice—care being taken not to short-circuit the plates. The waste will be variable, and can only be ascertained by actual measurement in each instance.—G. E. B.

**Copper-Plating Solution.**—X. E. A. (*Sheffield*).—Your zinc plates may be smoothly coated with copper in an alkaline copper solution worked with a three cell half-gallon Bunsen battery, and an anode of pure sheet copper equal in area to the surface of the sheets to be coated. The alkaline copper solution is made as follows: Dissolve 2 lbs. of copper sulphate in 1 gallon of hot water. When this is cold, stir in enough liquid ammonia to first throw down a precipitate, and then dissolve this to form a beautiful blue solution. Dilute this with

1 gallon of cold rain-water. Next, dissolve 6 lbs. of 85 per cent. cyanide of potassium in 2 gallons of rain-water, and add this to the blue solution. The blue colour will all disappear, and the resulting solution will be of the colour of old ale. Pass this through a calico filter, and allow it to rest for some twelve hours before using.—G. E. B.

**Carpentry.**—R. K. (*Brockley, S.E.*).—Could you teach, or have you a shop you could hold classes in? Could you write effectively on any subject? I am truly sorry to know you are afflicted, though you are not specific on the subject. With the present taste for enamelling, you might make suitable articles in wood, and sell them to fancy shops; or if you can make model ships well, there is a sale for them, or fittings, which, judging by your occupation, you would be likely to understand.—B. A. B.

**Arm Chair.**—ERMIUS.—I must ask you to give me fuller details of the chair you allude to, as I am inclined to think that it is a patented article. You should try to ascertain whether it is patented, and send a rough sketch.—J. S.

**Workshop in Garden.**—PUZZLED.—You cannot erect any permanent structure in your garden, and remove it on giving up the house, without previously coming to an understanding with your landlord, and obtaining his permission to do so, which you should have in writing. See papers entitled "A Tenant's Greenhouse," in Vol. I., pp. 177, 211, and 227 of WORK, otherwise Nos. 12, 14, and 15. This will answer your queries with regard to construction, concrete floor, etc. If you are building a greenhouse you may sink the floor, if you like; but on no account sink the floor of a workshop. Let this be rather above the surface of the ground than below it.

**Whitewashing.**—W. A. (*Shildon*).—Sorry we could not help you in time, for we are well-disposed toward the co-operative movement and its workers, who are strong supporters of WORK, we know. There is no reason why you should not make "good whitewash," and use it properly—providing you allow for practice and experience. First put the water in the pail, then break up the whiting as you put the same into it. After standing, pour off the superfluous water; then add a little lime blue, as a faint grey dries a purer white than whiting alone. It should be quite stiff, not at all sloppy; now add about 4 lbs. of patent size, already melted but not too hot, to the pail two-thirds full with whiting, and thoroughly mix it together with your hand and arm. When cold, it will be set or jellied, and if necessary, may be thinned with a little water for use. Distemper of any kind should never be put over old, dirty stuff, but the latter washed off. A good tradesman will *not* "flap" his brush in working proper distemper; he will make very little noise, using the tip of his brush only. Whitewash or any distemper can be laid off in any direction *from* the outer or working edge. Splashes are the result of "watery" wash, not *jellied* stuff, and want of experience in working. Read the paper on "Distemper" in Vol. I.—F. P.

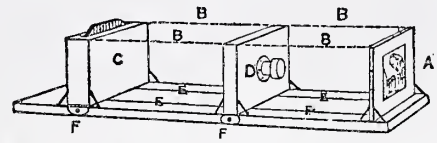
**Die Sinking.**—R. W. (*Bradford*).—There are good practical articles on the subject in the "Encyclopædia Britannica" and other cyclopædias. There are, as far as I know, no books published on the subject.—H. S. G.

**Gassner Dry Battery.**—D. O. W. (*Ipswich*).—Make the ingredients into a paste to the consistency of mortar by adding the concentrated chloride of zinc solution. A capped carbon plate with binding screw embedded in the cap, as employed in the construction of the Leclanché cell, is employed as the negative element. Put a layer of the paste to the thickness of one inch in the zinc cylinder or cell, set the carbon plate in this, and fill all the cylinder around the carbon plate with the paste to within half an inch of the top. Seal with pitch or marine glue.—G. E. B.

**Index to Vol. I.**—D. O. W. (*Ipswich*).—On page 328, Vol. I., you will find the following announcement. "An Index to the First Yearly Volume of WORK has been prepared, and can be obtained by order from all booksellers, price one penny. It is included in the last monthly part of the volume (Part 12)."—G. E. B.

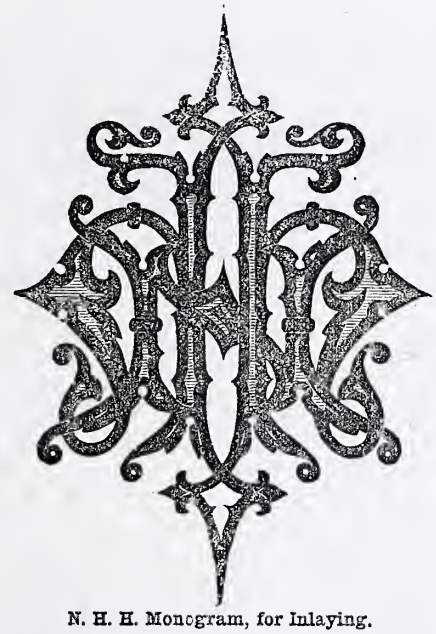
**Bunsen Cell for Silver-Plating.**—AN AMATEUR.—The Bunsen cell may be used for this purpose, but the Daniell is superior, because its electro-motive force is lower. You do not say what kind of soft metal you wish to plate, but it is, presumably, some alloy of lead such as pewter or Britannia metal. The books are right in enforcing absolute cleanliness, especially in plating on such alloys. It is best to clean the article thoroughly, rinse in a potash solution, and transfer direct from this to the plating solution without loss of time or rinsing in water. The battery must be on ready to supply current at once, and so "strike" the silver on the article before the solution has time to act on the metal. If you will follow these directions, and avoid heavy pressure with the burnisher, the silver coat should not strip whilst being burnished. You will not find a better hook than that by A. Watts, so frequently mentioned in Vol. I.—G. E. B.

**Enlarging Camera.**—J. D. (*Hull*).—The space at our disposal in these columns is too limited to permit more than a rough outline of how to make an enlarging camera. It consists mainly of three frames, two of which are movable and slide along in grooves on the surface of a board or table about 5 ft. long. These frames are connected by a light, tight body made of black twill, which is kept extended by means of cords or elastic attached to the corners of the frames. The frame in the front—that intended to hold the transparency or negative to be copied and enlarged—is firmly attached to the base-board. The centre frame is designed to carry a small lens, as a quarter-plate portrait, or 5×4 rapid rectilinear lens. The remaining frame is made to hold the dark slide in which the sensitive plate or paper is placed. The distance between these frames regulates the size of the enlargement; the nearer the lens is to the object to be copied and




**Enlarging Camera—A, Transparency; B, Elastic Cords; C, Dark Slide; D, Lens; E, Guiding Cords; F, Binding Screw.**

enlarged, the larger the enlargement will be, and *vice versâ*. Provision is made for a piece of ground glass to be inserted in the exact position that will be held by the sensitive plate, and on this the image is thrown, the size adjusted, and the definition of the image properly secured. The transparency or negative to be enlarged must be equally illuminated over its whole surface, which is most easily done by aid of a reflecting screen adjusted outside, and at a proper angle. In case of artificial light a condenser is generally made use of, and the photograph to be copied placed close to it. A proper exposure being given, the dark slide is removed, and the plate or paper taken out and developed, *secundum artem*; the mode of development being dependent on the sensitive surface employed, and in no way differs from other photographic development. The means of doing this is described fully in many elementary handbooks on photography. The best way is undoubtedly to see some experienced worker do it. The principal points to be remembered in enlarging are—to let no light fall on the sensitive surface except that passing through the lens; to ascertain that the definition of the image is good; and to give the proper exposure. Above is a diagram of the whole arrangement.—D.



**N. H. H. Monogram, for Inlaying.**

**Monogram for Inlaying.**—FRETWORK.—In reply to FRETWORK, I submit design herewith of the letters "N. H. H." monogramically arranged. When cleanly pierced and carefully inlaid it should prove an elegant yet effective piece of work.—A. C.

**Photographic Studio.**—NEW SUBSCRIBER.—A portable studio is a somewhat indefinite description, as it may be anything from folding canvas and poles to a four-wheel van. *Any* building put together with screws unattached to any fixed foundation is termed portable. There has been no description at present given in WORK of a portable studio. The term indicates a somewhat small arrangement in comparison with the usual brick and glass building, although size has really very little to do with it. A room, say, 25 ft. long, 12 ft. high to ridge, and 10 ft. wide, will make a useful size of a ridge roof pattern. Glazed on one side of the pitch of the roof and one side to within about 4 ft. of each end—which may be opaque—it will afford sufficient facility for taking single portraits or small groups. The frame may be of wood, and the opaque portion constructed of match-boards, covered on the inside with canvas and papered. A door may be made at one end or on the unglazed side for ingress and egress. The floor should be a little above the surface of the ground for dryness' sake, and may be supported on brick or stone piers. Any builder would be able to construct one given these dimensions. If the framing is put together with nuts and screws, the studio will be portable for all intents and purposes. The height of the sides should be about 8 ft.—D.

**Glass-Sign Gilding.**—GILDER.—There is no electrotyping process used for glass-sign gilding and embossing. Continued *practice and experience* with the isinglass method and its accessories will alone, I believe, obtain the perfect results we see on the best glass writing and gilding, such as is turned out by the London firms, brewers' writers, etc. I cannot go here into the detail of the gilding and washing, but, assuming from your letter that these processes are familiar to you, I may help you in the subjoined. What gold do you use? Foreign heat stuff is of no earthly use for glass work, and even with the best English heat, you may not do much better if you use it from the ordinary rouged hooks. The rouge placed between the leaves has much to do with it, and you must get the gold put in books without it, and direct from a genuine heater or trustworthy source. There is a lot of misrepresentation going on with gold-leaf in the trade, especially, I believe, with the quality of foreign heat stuff. English E. D. (ordinary) is worth 1s. 3d. of anybody's money, so don't begrudge a few pence each book for the above kind.—F. P.

**House Painting.**—G. P. (*Elgin*).—In deciding how and in what style a drawing-room should be painted and papered, the matter must be looked at from many different standpoints. First, the cost: how much, roughly, we are desirous to spend on labour and material; secondly, what *aspect* the room has, whether warm or cold—a fact which materially affects, if it does not always govern, the general tone of the colour and scheme; and, thirdly, whether the decorations to be introduced are to be used with the same furniture, hangings, etc., as previously found in the room, or whether the room is to be refurnished, draped and arranged to harmonise with the new decorative treatment. When these matters of expediency are determined, then the purely decorative *ensemble* can be considered. So far as you have given me particulars, I will try to aid you. For S. or S.W. aspects, the prevailing colour—always given by the walls—may be cool tints of any silver-grey, French grey, green-grey, or even so decided as a soft "electric" blue. If the outlook from windows is all green vegetation, don't get too close to decided blue tints; if only "bricks and mortar" in front, decided but "soft" colouring in the room makes it cheerful to sit in. Rooms facing N. or N.E. and thereabouts require warm tints to compensate for the small amount of sunshine and warmth they get. For such, old gold tones, and verging to cinnamon and rich brown, may be best, and from these on to the endless varieties of terra-cotta tints as far as deep crimson. The latter in plain flock paper is excellent for engraving background; whilst in silks it is very popular for walls of State and aristocratic drawing-rooms. With *grey and blue walls*, cream or "ivory white" paint, and panels of door in grey tone with walls is best, ornament on panels "old gold" or grey monochrome, and gilding to mouldings; ceiling cream, grey band of about 9 in. on same next to cornice, ornamental corners and lines of old gold separating the cream and blue. Cornice with cove, or recessed parts, grey, remainder cream, same as the ceiling, with a little "lakey" pink in shadowed parts. For the cornice, painting and flatting is best, but distemper quicker and cheapest. A little gilding on the beads of cornice makes a wonderful improvement; this cannot be done on distemper without other preparation. In your case, have a border about 5 in. deep to match colour of walls, but more enriched, fixed under the cornice, and use a set dado-pattern beneath existing rail, fixing the dado border over the latter. Walnut will suit with blue or golden-brown tones if not too bright. The cover won't hurt, but the modern style is quite opposed to large centre table and set *suites* of chairs, etc. Paint the mantelpiece with the woodwork, and if it is hard and ugly, structurally, you must decorate it a little or drape it, the former if the fireplace is used much. "Workshop Receipts" are published by Messrs. Spon, Charing Cross, London, in four series, at 5s., treating different crafts and sciences. Make sure of the one you want before ordering the volume. Thanks for your letter; most of it has been now answered in other ways. I have, in reply to you, given more than I ought, in order to show any future inquirers that decorative advice cannot be given unless *all* details of the work are sent by the querist, as pointed out.—F. P.

**Loose Pulleys for Circular Saw.**—S. B. (*Nottingham*).—You cannot do better than follow the advice of Mr. Powis Bale on loose pulleys. Certainly he is right in saying that they "should in all cases be bored and rhymered perfectly true." He clearly means that when the pulley rides upon a bush or sleeve, that the bush is to be *fixed* upon the shaft, and the pulley is to revolve on the sleeve (or bush, as you term it). Probably the term *bush* implies a lining to the hole in the pulley, which, I think, would not improve it. Mr. Powis Bale means a covering to the spindle, for he says, in explaining the action of the oil, that motion "causes the oil to

fly immediately to the largest diameter, which is the working or rubbing face of the sleeve." He does not say how the sleeve is to be fixed to the shaft, but no doubt a screw countersunk would do, or perhaps two might be needed. The best plan would be to turn the outside of the sleeve *after* it is fixed on the shaft, and see that the ends are also turned true, and the pulley boss true also on the face, so that when the flanges are fixed they retain the oil, as Mr. Bale says, and keep the pulley in place as well. If any difference in size is made for the purpose of relieving the strain of the belt, I should, by all means, "make the loose pulley with an inclined flange leading up to the fast pulley," and let the difference be small.—B. A. B.

**Polishing Bullocks' Horns.** — ANXIOUS. — ANXIOUS writes to know what acid is used with whiting to finish these with. I expect the acid be saw used was sulphuric acid very much diluted, —say, 1 part acid to 40 parts water; but vinegar answers almost as well. To use whiting and weak acid in polishing horn is of no use unless the horn has been prepared for this final polish by being got smooth by glass or glass-paper or steel scrapers, followed by powdered pumice or powdered Bath brick, this being followed by a still finer polishing powder—viz., rottenstone, which can be mixed with oil. These powders are applied to the work by means of a piece of cloth or felt. The work should be well washed after each stage, so as to remove the coarser polishing powder before applying a finer one. The whiting and acid is used after rottenstone; finally, a portion of dry whiting gives a finishing polish to it, and is best applied by the palm of the hand. One man tells me that a mixture of soapsuds and whiting produces a good surface when it is applied after rottenstone. Plenty of rubbing is necessary in all of the stages.—H. S. G.

**Stopper Bottles for Drugs.**—J. M. R. (*Stratford*).—I believe that chemists usually get their stopper bottles with their drugs from the manufacturing or wholesale druggist. J. M. R. could, doubtless, get his, ready filled with the chemicals he wants, from such a firm as Baron, Harvey & Co., Giltspur Street, London, E.C. Yet, as he asks for the address of a manufacturer, I may mention the York Glass Co., York, who make a special feature of these bottles.—S. W.

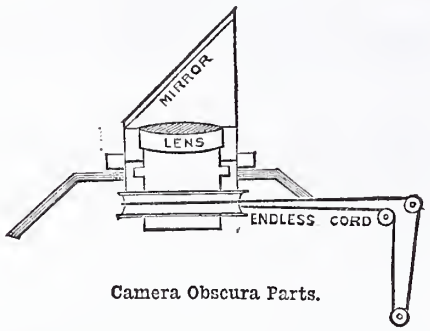
**Tricycle Mechanics.**—R. S. (*Airdrie*).—I have not heard of a tricycle to draw by electricity or air being lately brought out in America. Both steam and electric tricycles have been tried in this country with some measure of success. For common use, no power other than the feet has yet been successfully introduced; steam, I believe, will never be a success. Compound air requires strong heavy vessels to contain it, and the machine would be necessarily heavy. Electric motorology, so to speak, is yet in its infancy, and no one can imagine what it is capable of accomplishing, if men only knew how to construct an apparatus to utilise it to its full extent. As to its application to tricycles, I have no doubt it will yet be largely employed. Meantime, I would advise your correspondent to provide himself with a good tricycle, and have for a motive power his own pedal extremities.—A. S. P.

**Simplex Dynamo.**—F. D. (*Liswalt, N.B.*).—I cannot quite understand how you have wound the armature of your dynamo. You say you have "wound the wire *all on the outside* of the ring.' I suppose, therefore, that you have treated the ring as a drum, and wound the wire over it. Have you divided the ninety yards of wire into three sections and provided a six-part commutator for the ends? If so, are you sure you have made the connections right? If you have not done so the machine will not give any current. Supposing you have wound the wire on all right and connected the coils properly, I do not think you have gained anything by winding such a thin ring as a drum with the wire all on the outside. You have now only thirty-five yards of active and fifty-five yards of dead wire on the armature. I cannot say what you may expect from your machine—probably a current of 3 ampères at a pressure of thirty-five volts when driven at a speed of 1,300 revolutions per minute. Possibly you may get enough to light three 8 c.-p. lamps.—G. E. B.

**Discs for Electric Belt.**—L. W. (*Islington*).—I should advise you to get some thin sheet copper and thin sheet zinc, and cut out some discs the size of half-crown pieces. Coat these with thin flannel and sew them to the belt. I cannot tell you where they may be purchased. If you find any difficulty in getting them, write to my brother at 19, Avenue Road, Lewisham, S.E., and ask him to make some for you. He offers to get any electrical appliances for amateurs.—G. E. B.

**Nickel-Plating.**—FEODO.—You will find the job of nickel-plating a tricycle a most expensive one, as the necessary vats for such large work will cost a lot of money to purchase. Far better get it done by a professional plater. I hope to describe the whole process of nickel-plating in an article on the subject, but have not space at my command for this in "Shop," and a short paragraph on this art will be useless to you. In reply to your questions, I may say that nickel may be deposited from a double sulphate of nickel and ammonia solution direct on to the iron or steel without having to first copper the parts. But they must be first freed from organic impurities contracted in polishing, by boiling them in a solution of caustic potash, then rinsed in a solution of caustic potash, then rinsed in a solution of cyanide of potassium, and transferred at once to the nickel-plating solution before they have time to get rusted. A Bunsen battery of large cells will be needed for large articles.—G. E. B.

**Camera Obscura.** — NEW FANCY. — Make a sufficient number of frames. Cover them with Willesden canvas on the outside, and black lining on the inside; they might be hinged together in pairs. The height should be about 8 ft., and when set up, bolted firmly together. One side should be left open, and overlap thick curtains hung across as a means of ingress and egress. It need not be said the place must be perfectly darkened when in use. The roof must be made, and frames covered in the same manner as the sides, with an aperture left in the top for the lens. The mirror should be about a foot square, placed at an angle of 45° with regard to the lens, and made to revolve by a cord and pulley, after the manner of an ordinary blind. The kind of lens best adapted is a good single achromatic landscape lens, of the proper length of focus




Camera Obscura Parts.

to cast the image on a whitened table placed at a comfortable height for inspection. There is no necessity to have the table concave; a flat surface will answer every purpose if the lens is a good one. An excellent surface is made by pouring a mixture of plaster of Paris in water just thin enough to pour on to a flat table to about three-quarters of an inch, and let it set properly levelled. A rub with fine glass-paper will at any time renew the surface, and keep it in good condition for inspection. The accompanying diagram will show how the mirror is revolved. The mirror is mounted in a box which revolves, carrying the mirror with it. The sides are filled in with wood blackened, only the front facing the mirror left open, which may be closed when not in use by a shutter. It is as well to arrange it so that the lens can be removed for polishing when required. The whole thing is exceedingly simple. The size of the room is immaterial, so long as there is sufficient space to move comfortably round the table. The whole may be secured with guy-ropes like an ordinary tent, as the positions generally chosen for setting them up are elevated and exposed, and ropes offer the best security. If the building is of hoards, the uprights will, of course, be sunk in the ground, and require no further precautions.—D.

**Electric Time Alarum.**—N. H. Y. (*Battersea*).—Thanks for your letter describing your electric alarum. It does not present any new features of improvement on those already described. A short time since I saw a much more simple method of using an ordinary alarum. The workman connected one wire to a piece of thick brass, and laid it down on the bottom of his clock. He then connected the other wire to another thick piece of sheet brass, and set this with one end resting against the hammer of the bell alarum. When the alarum went off, this piece of brass fell down to the bottom of the clock, and closed the circuit of an electric bell placed near the head of his bed. Thus he had the benefit of two alarums, and did not remove the bell as you have done. Placing the battery in a cupboard by the fireplace is bad for the battery. It should be kept in a cool and slightly damp place.—G. E. B.

**Winding Dynamo.**—H. E. A. (*Hackney*).—The field magnets of your dynamo are of the Siemens type. On such a small machine, having an armature 3 in. long by 1¼ in. in diameter, you will only be able to get 4 oz. of wire, even if it is silk-covered. The utmost current you will get from such a small quantity of wire, without injuriously heating the coils, will be 1 ampère. The smallest wire that will safely carry this current will be No. 22 B.W.G. Four ounces of No. 22 wire will measure 30 yards, and we shall have to reckon one-third of this as dead and useless, because it will work out of the magnetic field on the armature ends. This will give 20 yards of active wire on the armature, and will develop an E.M.F. of 20 volts when driven at a speed of 1,200 feet per minute. To balance this, you will require 1½ lbs. of cotton-covered No. 22 wire in the fields, connected in shunt with the armature coil. Use single cotton-covered wire, well soaked in hot paraffin wax. As an insulating covering for the iron, employ tough brown paper soaked in hot paraffin. Cut strips from this, and soak in hot water to soften them. Dress the iron with hot, thin glue, then mould the softened and prepared paper to the shape of the iron. Allow this to dry and get firm before winding on the wire. You will only need one layer of this if you are careful, in winding the wire, not to cut through the layer. The finished machine will look well if painted with Aspinall's enamel. You may make up a paint for the purpose by mixing Venetian red with methylated spirits, and then stirring in enough white hard varnish to bring the paint to the required consistency. If you get Bottone's book on "The Dynamo: How Made and Used" (latest edition), you will find a whole chapter devoted to winding dynamo machines.—G. E. B.

**To make Cotton Waterproof.**—G. D. (*Woolwich*).—To do this without making it sticky, it must be dried at about 150° Fahr. by artificial heat. The sun on a hot day will do. Get as much boiled oil as is necessary, and mix enough lamp-black to blacken it, if for black work; if for yellow, use ground yellow ochre instead. Then lay the fabric on a smooth surface, and put the oil on with a brush—a shoe brush is best. Let the first coat get quite dry before putting on another. A little patent driers will make it dry quicker—say, ½ lb. to a gallon of oil. If the last coat remains sticky after it is dry, take 1 lb. of shellac to 2 quarts of water, simmer it gently, and when near boiling add a little liquid ammonia to dissolve the shellac: when this is cold mix a little lamp-black for black; if yellow, use it as it is. If the fabric is coated over with this, it will make it hard: put it on with a sponge. Lay the oil on as thin as possible, or it will not dry. Of course, this paint will, in a measure, obstruct the light.—L. Y.

**Tarpaulin.**—CARDIFF NO. 1.—The reply to the query sent is given in WORK, No. 118, p. 222, Vol. III., in answer to the inquiry of an earlier correspondent.

**Bookcase.**—J. P. (*Blackburn*).—The Editor has a paper in hand on the construction of a bookcase. It will appear as soon as practicable, and will, no doubt, help you, though it is intended to be made to stand on the floor, and not on a shelf. By the way, your inquiry about a bookcase of *ordinary* size is very vague, and conveys little or no meaning. Do you not think it would have been nearly as easy for you to have given an idea in feet and inches?—D. D.

**Elastic Mould.**—CICERO.—The following recipe has been recommended:—Gelatine 1 lb., beeswax ½ oz., to which add three-quarters of a pint of water. Boil in a glue-pot to a thick syrup, and pour it over the work to be moulded whilst warm, but not boiling. None but the best and purest sheet gelatine ought to be used.—M. M.

**Removal of Hair by Electrolysis.**—J. S. (*Preston*).—For the removal of hair by electrolysis you will require a bichromate or chromic acid battery of several small cells, and a switch to throw a variable number of cells in the circuit at will. You will also require a pair of platinum or gold needles with suitable handles, costing about 6s. per pair. The needles are inserted in the skin at the roots of the hair, and a current of electricity is passed until the root-glands are destroyed by electrolysis. It may be necessary to employ a large number of cells, some ten or more in series. I do not advise you to perform this operation yourself, as it would be more costly and uncertain in results than when performed by a qualified practitioner. The battery and needles may be obtained from Mr. K. Schall, 55, Wigmore Street, London, W., or Messrs. T. Gent & Co., Braunstone Gate, Leicester.—G. E. B.

**Electric Bells.** — NEW READER. — The book, "Electric Bells: and All about Them," was written by Mr. S. Bottone, Wallington, Surrey, and is published by Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C. The price is 3s., and it can be obtained direct from the author or publishers at this price by post. Questions cannot be answered in "the next issue" of WORK.—G. E. B.

**Angle Cog Wheels.** — C. H. (*Finsbury*). — I should advise you to write to Messrs. Ormerod, Grierson & Co. (Limited), St. George's Ironworks, Manchester.—F. C.

**Distemper Colours.** — B. A. (*No Address*).—"Recipes for mixing the most fashionable distemper colours for walls for a public institution." This request, simple and plain although it may appear, is really very indefinite. A chapel, a theatre, and a free library would each and all, I presume, come under such a category; but how different are the sentiments associated with each! I, therefore, cannot help you with instructions particular to your special apartment or hall. A few considerations, however, of the subject generally will probably aid you and many other readers of WORK, with whom the handling of mass colours and tints is a most obtuse and difficult problem. The relationship of fashion to colours, rational as it *may* be in connection with bonnets and dresses—*irrational* it most often is—when looked at from any commonsense standpoint, can be but of a suppositionary nature in the practical colour-decoration of apartments. Therefore, we will substitute "useful" for "fashionable," and come to some conclusions. Distemper, or any absorbent *tempera* paint, is certainly preferable to oil paint for public buildings. The former holds the condensed moisture, and then dries out again; whilst with the latter, the moisture gathers on its surface and trickles down the walls. The range of colour suitable for such places is rather limited, unless the scheme of decoration is elaborate, and the colours properly balanced and juxtaposed. In dealing with *masses* of plain tints, mixtures of *pure* pigments, such as red, blue, or green, with *white alone*, are seldom successful. The larger the mass presented to the eye, the less must be the strength of *colour*. Now, every positive

colour effect conveys a definite sensation; whether we can analyse it or not, such is the case, unless the beholder is colour blind to more or less extent. The sensation of red is chiefly warmth; of blue, coolness; of yellow, brilliancy and excitement; and, lastly, of green, a cool and soothing effect upon the mind, usually, as well as in scientific reality to the colour-nerves of the human vision. Without going further into theory here, you can now apply the above to your own purpose. Turn to the new tint circular of the Alabastine Company. Do you want a warm-looking room, use No. 6 or No. 18; or if extreme warm richness is wanted, dull tones of No. 24. For cool, well-lighted halls, etc., No. 16 is very soft and suitable, and lights up admirably. Nos. 9 or 23 are also good, but rather too bright if the light is strong. No. 1 is a good serviceable tint, cool and clean, and would not clash with any accidental colour (dresses, etc.) that might be introduced, as in a ballroom. Amber and cinnamon colours are very popular for theatres, contrasted by a little of such as No. 9, but they require clever handling, and are best only used for places lighted by yellow gaslight. Recipes, used in the sense of exact written parts and proportions, cannot be given for *colour* mixing. Experience for ordinary purposes, and added thereto a natural and cultivated faculty for extraordinary instances, can alone be the guide to success. If you haven't got the colour card alluded to, write to the Company at 127, Pomeroy Street, London, S.E. A bed-sitting room would look well in No. 6, with a soft terra-cotta brown (*not purple*-brown, please!) dado for a northern aspect. For a sunny room, either No. 1, 8, 9, or 16, with a dado of 10, 19, 18, or such like, of dull, yellow-brown tones. A stencil border, and, perhaps, frieze stencil of a *darker* tone of dado colour used upon the filling colour, would make a very pleasing finish.—LONDON DECORATOR.

**Medical Coil.**—W. A. S. H. E. (*Sheffield*).—The ordinary Leclanchè cells as used for bells will serve very well indeed for a medical battery, or to form a battery for working a medical coil. They are quite equal in power and efficiency to the special forms of this battery. A special price is charged for the special forms, because special attention is paid to sealing the cells, adapting their form to the box in which the battery is held, and making it portable. Where special portability is desired, I should recommend a battery of dry cells, such as the Gassner, Gent's "Perfect Dry Cell," or the "W. & R" cells, obtainable from Messrs. Gent & Co. Faraday Works, Leicester; or Mr. K. Schall, 55, Wigmore Street, London, W. I do not know the "Harness" cells, so cannot say whether they will work a medical coil successfully or not.—G. E. B.

**Colourless Varnish.**—A. M. (*Liverpool*).—I have a practical acquaintance with both gilding and photography, and yet know nothing of "a colourless varnish used after gilding picture-frames, and which same varnish photographers use for finishing." *Finishing* what? Gilders use, or should use, a final coating of clear parchment size—made from parchment trimmings and water simmered for many hours in a clean saucepan—upon all gold-leaf gilding. Photographers use—or should use; the amateur doesn't always—a coating of a spirit *negative varnish* for finishing his negatives. Cheap frames are "gilded" with white metal, and then coated with a yellow spirit lacquer. For cleaning oil paintings of value and without risk, get Brodie & Middleton's (Long Acre, London) "Anadeiktine," sample bottle, 1s., with instructions. Several good recipes for gold lacquers for brasswork are given in Vol. II. (see Index). I cannot help you more without the exact particulars of your work and wants. A colourless varnish, useful for gold, bronzes, etc., is a solution of white stick lac in methylated spirit.—F. P.

**Whole-Plate Camera.**—F. W. B. (*Leicester*).—If you will refer back to the first volume of WORK, you will see a full and explicit description of how to make a camera whole-plate size. It is very easy to alter the dimensions to 6½ in. by 4¾ in.—the size you require. Of course, rather lighter woodwork may be used, and when panelling is directed, merely clamping will give sufficient strength. Keeping to the general design, many little alterations will suggest themselves to the maker to reduce the labour, and yet afford sufficient rigidity. As to cost, much depends as to the market you go for the raw material; ten or fifteen shillings would probably procure it.—D.

**Self-Acting Fountain.**—W. C. (*No Address*).—An article describing the construction of a self-acting fountain appeared in No. 69 of WORK. From the diagram therein, illustrating the working of the apparatus, you should be able to make such alteration as would suit your purpose in fitting it to an aquarium. The latter is a somewhat difficult job, and I do not recommend a self-acting fountain for the purpose; the oxide from the zinc kills the gold fish, and the dirt, etc., inseparable from a flourishing aquarium, is continually stopping up the jet-hole. It is far better to connect to a water supply and run off to waste.—C. M. W.

**Tray for Coins.**—R. E. D. (*Holborn Circus*).—Your most ready way will be to cut a piece of millboard to fit your wooden tray, and to pierce the holes through this; no levelling of the bottoms of holes will then be required. The millboard can be fixed down to the wood with four, six, or more brass tacks, as size may require. A great advantage of this plan is that, when the acquisition of more coins renders (as it is sure to do) a rearrangement of the collection imperative, the millboard can easily be detached, and a new one cut and fitted in. The holes are most readily cut with gouges of suitable sizes, but in the absence of such tools a sharp penknife will answer the purpose.—M. M.

**Sign Writing—the Lemon Tree.**—GUGLIELMUS.—As I remember (I have lived in a lemon growing country), there is no appreciable difference in foliage between this and the orange tree, but the lemon is less bushy in growth; the fruit, of course, is widely different in form and colour. The annexed sketches, though drawn from memory, will, I trust, be sufficiently accurate for any but scientific purposes. Fig. 2 shows the growth, Fig. 1 is the tree conventionalised to fill the required space. For the purpose in view, GUGLIELMUS is advised to make his fruit big enough, and to give to trunk, fruit, and leaf, a bold black outline. The fruit, to make an effective

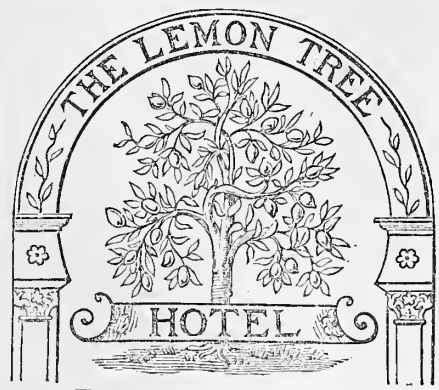
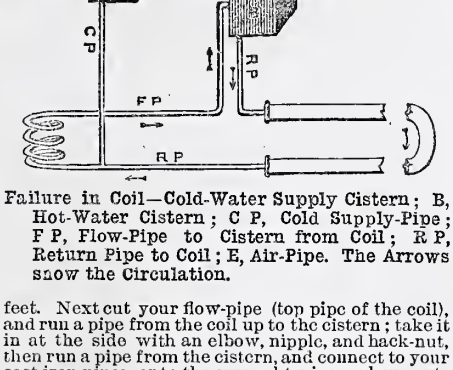



Fig. 1.—Sign of the Lemon Tree.

Fig. 2.—Lemon Tree Bough.

sign, should be gilded, and can be shaded up with wash-black mixed with just a dash of verdigris and Prussian blue. The leaves should be of a dark green, something like that of the laurel. GUGLIELMUS will see that the Moorish arch, as sketched, will compare better—will be better filled by the tree—than the Roman one which he suggests. It will also be more appropriate, as being the arch of the countries where lemon trees grow.—S. W.

**Failure in Coil.**—J. L. (*Upton*).—The cause of your coil not circulating properly is because the coil is not low enough. You should have arranged it so that your *lowest* pipe—technically known as the "return"—was slightly above the top of the coil or boiler. As you have got it all fixed, it would be, no doubt, awkward to lower the coil, but you will have to do it or adopt the following plan, which you will find will make it work satisfactorily. Procure a small cistern, which must have a man-hole cover, and also an air-pipe out of the top; fix the cistern a foot or two above your pipes (see sketch), and let the air-pipe run above the supply cistern three or four




Failure in Coil—Cold-Water Supply Cistern; B, Hot-Water Cistern; C P, Cold Supply-Pipe; F P, Flow-Pipe to Cistern from Coil; R P, Return Pipe to Coil; E, Air-Pipe. The Arrows show the Circulation.

feet. Next cut your flow-pipe (top pipe of the coil), and run a pipe from the coil up to the cistern; take it in at the side with an elbow, nipple, and back-nut, then run a pipe from the cistern, and connect to your cast-iron pipes, or to the wrought pipes where cut; this you will see is making the cast pipes wholly a return to the boiler or coil, and you will find it act perfectly. Of course, you have your cold supply taken into the lowest pipe of the coil. I shall be glad to hear how you get on with it, and to help you further if you find any difficulty, but do not think you will.—R. A.

**Preserving Skins of Moles, etc.**—W. F. (*Salisbury Square*).—The dampness of the skins in wet weather of which you complain is probably owing to the use of salt in preserving. The dressings recommended in curing skins are legion, and common salt, bay salt, and saltpetre enter into the composition of many of them. Alum alone will, however, suffice, though the addition of a little corrosive sublimate will render the skin safer from insects. One way is to dissolve the alum, etc., in water, and rub the solution into the skin (on the flesh side) daily for a week or two. Of course, all flesh, fat, etc., should first be scraped off, and it is well to stretch and tack the skin, fur downwards, on a board. Some, however, prefer to use the dressing dry, and instead of stretching to lay two skins flesh sides together after dressing, to roll them tightly up, and tie them. Skins may afterwards be made soft by rubbing over a metal edge.—S. W.

**Dulcimer.**—H. B. (*Wakefield*).—The stringing of the dulcimer is a very simple matter. The lowest note is composed of four brass strings, the next of four steel, the next of four brass, and so on, alternately, to the top of the instrument. If you have been trying to pull the brass strings up to the same pitch as the steel ones it would account for the breakages; but if the instrument has been properly strung, then the fault lies in the wire, as good wire ought to and will go up two or three notes above the pitch at which it will be required to stand. Are you sure you have obtained the right sizes? The dimensions you give of your instrument are out of proportion; one of twenty inches in length on the sound-board would require to be at least fourteen inches deep.—R. F.

**Polishing Ebony Walking Stick.**—E. W. (*Islington, N.*).—Being made of ebony, which is of a very close grain, no "filling" need be used. To polish it, you will require a little white or transparent polish, which is applied with a polish rubber. For particulars of how to make, see No. 108 of WORK, issue of April 11th; and "How to French Polish" in No. 105, March 21st. If the ebony is not perfectly black, you will require a little gas-black or Frankfort black on the face of the rubber; at least, this is the way most polishers would do it. But as you appear to have no knowledge of French polishing, and may have to buy your polish ready made—which I strongly advise—you might do worse than send to Mr. Flack, Steam Works, 75, Blackman Street, London, S.E., for a small quantity of "Ebonite" French polish and spirit varnish; or to Thos. Jackson & Son, 199, Borough High Street, London, S.E., for their "Improved Ebony Polish." No previous staining is required for these, and I believe full particulars of how to apply are given with each bottle. The handle can be fixed on with a little of Prout's bicycle cement, or a little ordinary shellac will do, applied with a hot iron in the same way as the cement.—LIFEBOAT.

**Window-Sash Making.**—I. H. (*Holloway*).—I know of no book specially devoted to sash making. You will find a great deal of information has been given from time to time in WORK, in pp. 177, 211, 364, of Vol. I., and in pp. 192 and 405 of Vol. II. If after reading these you are still in a fix, I shall be pleased to give you any information you may require on receipt of detailed descriptions of what you find any way puzzling, which descriptions you will be very much more able to give after thoroughly digesting the various tips contained in the above numbers of WORK.—E. D.

**Supply of WORK.**—R. H. (*Notting Hill, W.*).—If you or any other reader should experience a difficulty in getting WORK, whether in current or back numbers, you should apply to the publishers, Messrs. Cassell & Co., Limited, Ludgate Hill, London, E.C., and it might be well to quote the name and address of your bookseller.

**Lettering.**—W. P. (*Southampton*).—The letters are done with gold-leaf on an ordinary black ground, and then varnished.—T. W.

**Polish Reviver.**—J. P. (*St. Helens*).—Read carefully replies already given in "Shop" during the last few weeks—"Polish Reviver," p. 238; "Cracked and Dull Polish" and "Polish Reviver," p. 315. These fully answer your question.—LIFEBOAT.

**Bent Shafts.**—T. S. (*Pendleton*).—I cannot advise you to try and bend your shafts for your proposed mail cart, as the process would be too tedious. We have several times bent shafts for light traps: but the cost in time and trouble, to say nothing of the expense of a shaft occasionally snapping in two pieces, far exceeded the price of what we could have bought new bent shafts for. I should advise you to get two shafts sawn out of straight-grained ash free from knots, 1½ in. square when planed up, and 53 in. long. I see from your address that you live near Manchester; therefore I advise you to take your straight shafts to be bent at Thurman's, bent timber merchant, Hulme Street, off Oxford Street, Manchester, where they will soon bend according to any shape you like—indeed, I am not sure but what you can buy them ready bent. However, I would, if I were you, pay them a visit to ascertain before going on any further. When you have got the shafts bent, you just simply round the handles off, and take the average off the sharp edge of the shafts.—W. P.

**Tram-Line Curves.**—J. G. B. (*Oldham*).—The gauge or width between the rails is 4 ft. 8½ in. on most lines, though there are some narrow gauges in use. To get the curve for any particular turning, you must have a plan of the streets, and mark down the largest radius you can get in. This, however, will not affect your invention I take to refer to operating the points. There is no difficulty in the matter. If you send a sketch, I shall be happy to give you an opinion and advice upon it.—F. C.

**Shock Coils and Time Alarum.**—J. K. (*Manchester*).—I share in your pleasure, because you have been good enough to give me an account of your success in making the electric time alarum. It gives me pleasure to know that you—only a youth of fifteen years—have succeeded in making an excellent time alarum at a cost of 5s. The delay in answering your former question was unavoidable, owing to the crowded condition of our "Shop." If we devoted the whole of our little penny worth to the publication of contributions to "Shop," it would take several weeks to catch up with arrears of replies to correspondents. I cannot promise a date for the publication of the articles on shocking coils. You will find Dyer's work on coils a fairly good one for a beginner. Coil making is quite within the province of an amateur.—G. E. B.

**Silvering Carriage Fittings.**—COACH TRIMMER (*Edinburgh*).—Carriage fittings are coated with silver by the electro process. This will be described in due time, when room can be found for the articles. There are no addresses of coach-makers' furnishers in the London Directory; but coach furniture is made and supplied by Mr. C. Bunn, Herbert Street, West Bromwich, and Messrs. J. H. Hawkins & Co., 16, Station Road, Walsall. Of coach platers there are twenty mentioned in the directory, amongst which may be noticed Messrs. J. H. Radcliffe & Co., 8, Barrett Street, Manchester Square, London, W., and Messrs. Smith Brothers, 53, Paul Street, Finsbury, E.C.—G. E. B.

**Imitation Marble.**—E. M. H. (*Glasgow*).—The reply on p. 112, No. 59, to similar query will suit your frecstone stand equally well, taken in conjunction with the following: As the surface of stone will not be so smooth and regular as wood, I would advise you to rub up a stiff paste from warm patent size and finest whiting. After the first coat of paint is thoroughly hard, scrape on or brush on, according to convenience of surface, a good coating of this "filling up." When same is quite dry, rub it down to a smooth and level surface with fine glass-paper. A coat of linseed oil, with a little patent driers only added, is next given; this hardens the surface. When dry, proceed with the painting as described on p. 112.—F. P.

**Picture-Frame Gilding.**—S. S. S. (*New Kent Road*).—The writer, who humbly but firmly claims to be a "real practical man," might have practically helped you had you stated the *nature* and *condition* of the frames to be gilded. I must refer you to pp. 603 and 795, Vol. I., as answers thereto appear worth your careful perusal. If you mean how frames *water-gilded*—viz., in mat and burnish size—are properly re-gilded *same* way, it is a matter beyond "Shop" entirely. The labour necessary to thoroughly "re-get-up" a water-gilt frame is so excessive as to make it seldom done, and they are usually re-gilded with *oil-gold* size. Although the process may eventually be thoroughly explored in WORK, few would benefit therefrom. If you want to learn it thoroughly from a professed "carver and gilder," advertise for lessons.—F. P.

**Varnish.**—G. H. (*Wakefield*).—Oil varnish, if at all exposed to the air, will thicken and become "fat," owing to the mixture taking up oxygen; the cheap qualities, by reason of the copal gum being substituted by common resins, become so affected much quicker than good "copal." They can never regain their original qualities by any dilution or addition, but may sometimes be so thinned with turpentine as to be useful on common work. The "turps" re-dissolves the oil and resin, but, of course, reduces the bulk and gloss. Mathieson Brothers, of Ardrossan, N.B., make an "enamel oil" which can be advantageously mixed with varnish. To add ordinary linseed oil means that the varnish will never properly dry.—F. P.

**Paper-Hanging.**—C. H. (*London, S.E.*).—It seems somewhat difficult to describe any method of "folding a pasted length of paper in order to convey it from the board to the wall" as being "the *correct* one," since individual experience and expertness is the only standard of judgment we have. One of the best that a professional worker will use for lengths of about 8 ft. I will endeavour to explain. The lengths being cut to about the right size and properly arranged for clean pasting upon the pasteboard, the lower half is first pasted, and then folded over for about 18 in. or more of doubled length. The paper is moved along and pasted complete; the upper half is then folded over for a distance, and then the top edge turned right back. In conveying and fixing it, the top edge is taken hold of firmly but carefully by finger and thumb of each hand, and the fold is held by the other fingers. Assuming a practised and smart man is working, he will then mount the steps in a convenient position without holding with his hands, but using them both for the paper. The worker being in position, he drops the top fold, which has been held by his fingers, and fixes the upper half in place. If correct in plumb, this is rolled or brushed; and then, descending to the ground, the bottom end is unfolded, and the length brushed down, trimmed, and completed. If the man is working from a plank and scaffold, he must, of course, use one hand to get up to his work, in which case the top is folded as the bottom, and the length thrown over one arm. The difference between having the top edge in the fingers ready for matching and that of having to unfold the same, makes a great difference in the speed of paper-hanging. I hope this is the answer you wish for, and that I have made myself clear. If you use this method I don't think you can better it.—F. P.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Opal Glass-Letter Cutting.**—OUVRIER writes:—"I should be glad to have the address of makers of the appliances for cutting out glass letters, and any information respecting the method of making same."

**Heliograph.**—R. N. (*Grays*) writes:—"Can any of your readers describe how to make a heliograph, and also the mode of signalling with it?"

**White Letters on Glass.**—GLAZIER writes:—"Can anyone tell me how to remove the same without breaking?"

**Pumps.**—J. H. (*No Address*) writes:—"Will any reader kindly inform me where I can get a hook about pumps, engines, and such like matters? I want something with drawings, so that I can see the inside steam passages."

**Refrigerator.**—J. H. (*Liverpool*) writes:—"I have a refrigerator to make. Would any reader give me a plan of one fit for a butcher's shop?"

**Bones.**—E. F. P. (*Warrington*) wishes to know if any reader can tell him of any hook or hooks on "Bones," or the uses, etc., to which bones are put.

**Rubber Arrow Shooter.**—ARROW SHOOTER will be obliged to any reader who will tell him how to make a rubber arrow shooter.

**Hat Making.**—J. S. G. (*Portsea*) writes:—"Can any correspondent give me a little assistance in hatting? Being a hatter's salesman, I should like to know the process of half-blocking a silk hat; also, whether there is any way of taking grease or other marks out of hats other than washing the hat, for I find it takes such a long time to dry a hat when washed; and I often have a customer that wants his hat cleaned and ironed whilst waiting."

**Terra-Cotta Plaques.**—PLAQUE ARTIST writes: "Where can I purchase, good and reasonably, terra-cotta plaques of various sizes—not a large quantity, but a few dozen or so at a time."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Root's Blower or Blast Fan.**—M. (*Bishop Auckland*) writes, in reply to F. W. B. (*Huddersfield*) (see page 286, No. 122):—"Try A. Walton, 9, Queen Anne Street, Stoke-on-Trent, for castiugs of small blast fan."

**Saw.**—CHOPSTICK writes, in reply to CONSTANT READER (see No. 120, page 251):—"The sketch and information you ask for would take up too much space in 'Shop' columns. I will, therefore, send a brief article on the subject shortly, which will give you full information; but I can tell you this now: you must not expect to cut 3 in. stuff without some hard work with only one man on the wheel—it is best to have two when there is any quantity to do."

**Upholstery.**—E. W. C. (*Leicester*) writes, in reply to T. C. (*Belfast*) (see page 286, No. 122):—"Your question is unintelligible. Do you mean an outside cover to cover the whole of the article of furniture, or do you mean hair seating, otherwise known as hair cloth? Also, what do you intend to cover, either scroll, back, or seat, and is it a sofa or couch? The former has a scroll at both ends, and the back extends between the two; the latter has only one scroll, and the back only extends about three-quarters of the seat. If you will state definitely what you intend to cover, also with what material, I will try to help you."

**Worm and Wheel.**—E. G. PLATT, Birbeck Works, Birbeck Road, Ridley Road, Kingsland, N.E., writes:—"I see by one of your answers in 'Shop' (see page 269, No. 121) that you cannot give your correspondent an address of rack and wheel, or worm and wheel maker. I beg to offer myself as same."

**Battery.**—THE ELECTRICAL COMPANY (*Crewkerne*) write, in answer to T. R. (*Ashton-le-Willows*) (see page 270, Vol. III.):—"Our new central zinc batteries would answer the purpose required. The prices are—No. 1, 1s. 9d.; No. 2, 2s.; No. 3, 3s."

**Air Cushion.**—H. H. P. writes, in reply to H. R. (*Clapham*) (see page 222, No. 118):—"If H. R. will fill the cushion with air, then put it in a tub of water and press it, he will find where the leak is by the bubbles that arise."

**Bread Machines.**—W. A. (*Faversham*) writes, in reply to JEAN (see page 286, No. 122):—"You could not do better than apply to Mr. W. F. Mason, engineer and patentee, Longsight, Manchester, for prices and particulars. His machines are simple in construction, and make a good, even, and smooth dough. They are also fitted with friction gear for throwing dough out, which I must say saves a lot of winding tank up and down, as in most machines. The bakehouse where I am has been fitted up by Mr. W. F. Mason, and I cannot speak too highly of the way I find things to hand, which is a great pleasure in the trade."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. H. (*St. Helens*); C. S. (*Leigh*); E. G. (*No Address*); T. B. D. (*Glasgow*); W. H. C. (*Leicester*); F. W. (*Kentish Town*); F. H. (*Battersea*); P. McN. (*Shettleston*); R. A. B. & Co. (*London, W.*); B. A. C. (*Glasgow*); L. & Co; F. M. (*Portsea*); W. C. S. (*Edmonton*); W. J. (*London, N.E.*); W. T. (*London, N.*); W. K. (*No Address*); M. A. P. (*No Address*); INCUBATOR; E. A. P. (*Beckenham*); C. S. (*Leominster*); H. J. C. (*London, S.E.*); J. W. (*Wellington, Salop*); W. H. F. (*Kingston*); J. O. H. (*Wandsworth Common*); B. A. B. (*Hampstead*); G. E. L. (*Battersea*); W. J. A. (*St. Helens*); DEVON; T. L. (*Peckham*); F. W. B. (*Sunderland*); W. J. D. (*Manchester*); J. E. B. (*Chesterton*); W. S. (*Pontefract*); M. P. D. (*Brighton*); W. W. (*Bristol*); F. H. (*Hull*).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| Half Page | 6 | 10 | 0 |
| Quarter Page | 3 | 12 | 6 |
| Eighth of a Page | 1 | 17 | 6 |
| One-Sixteenth of a Page | 1 | 0 | 0 |
| In Column, per inch | 0 | 10 | 0 |

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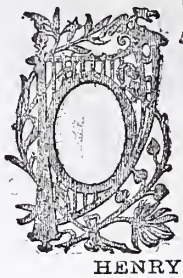

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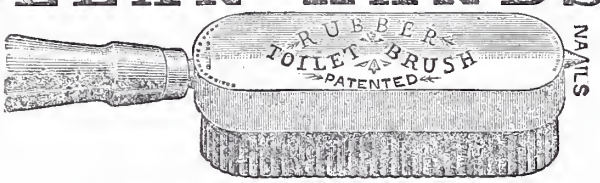


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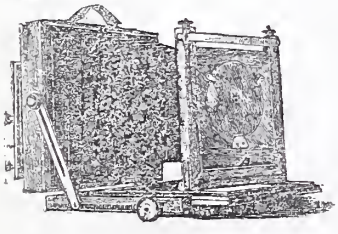

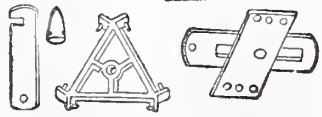

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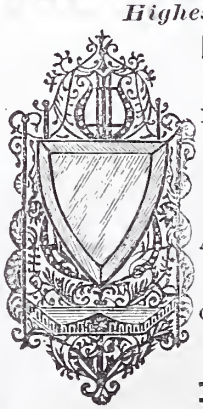

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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VOL. III.—No. 130.] SATURDAY, SEPTEMBER 12, 1891. [PRICE ONE PENNY.

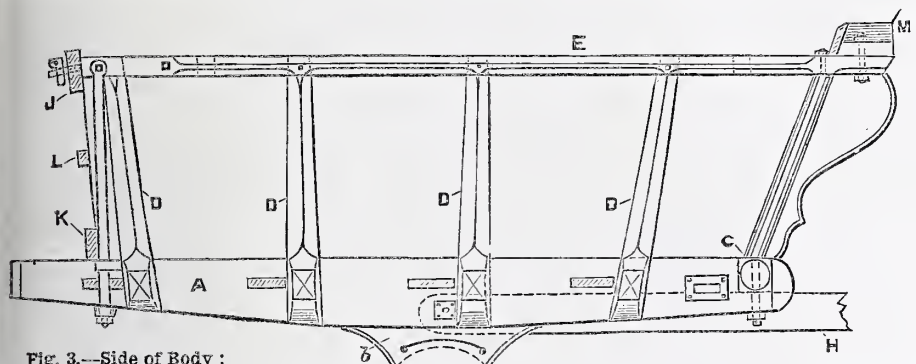



Fig. 3.—Side of Body: Elevation.

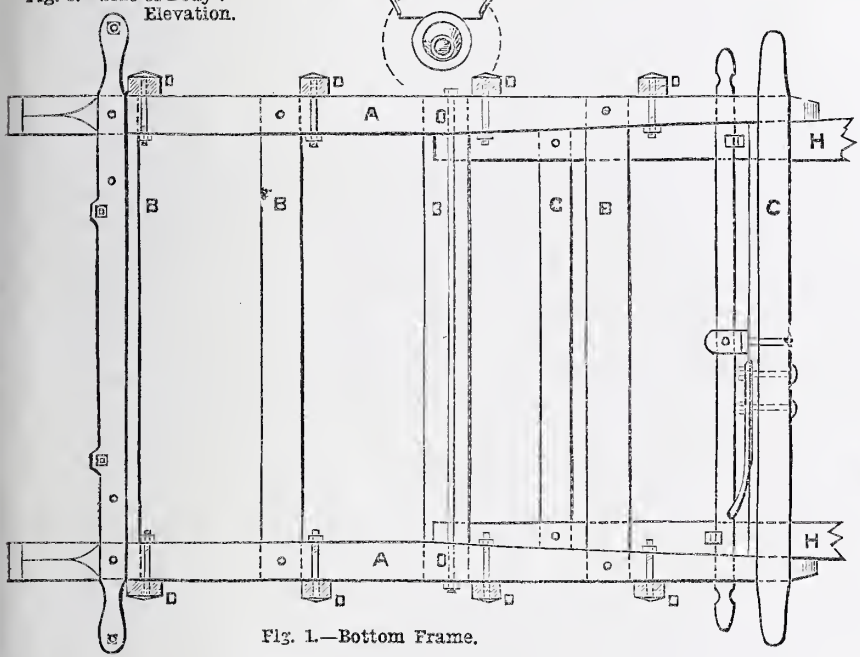



Fig. 1.—Bottom Frame.

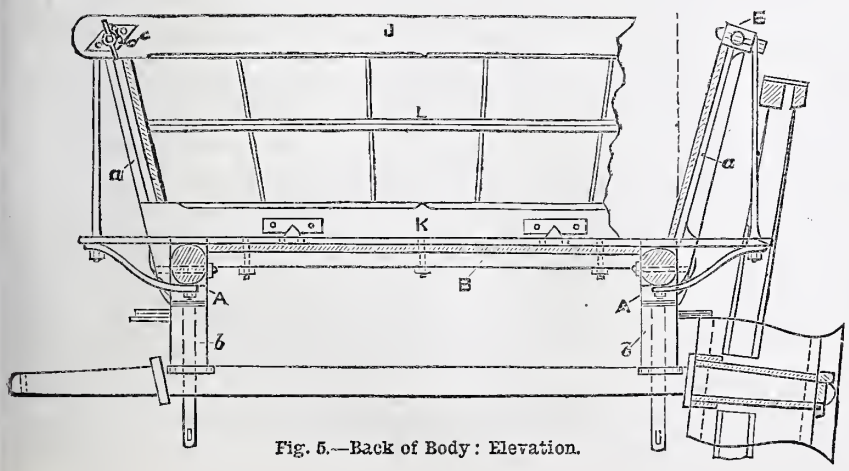



Fig. 5.—Back of Body: Elevation.

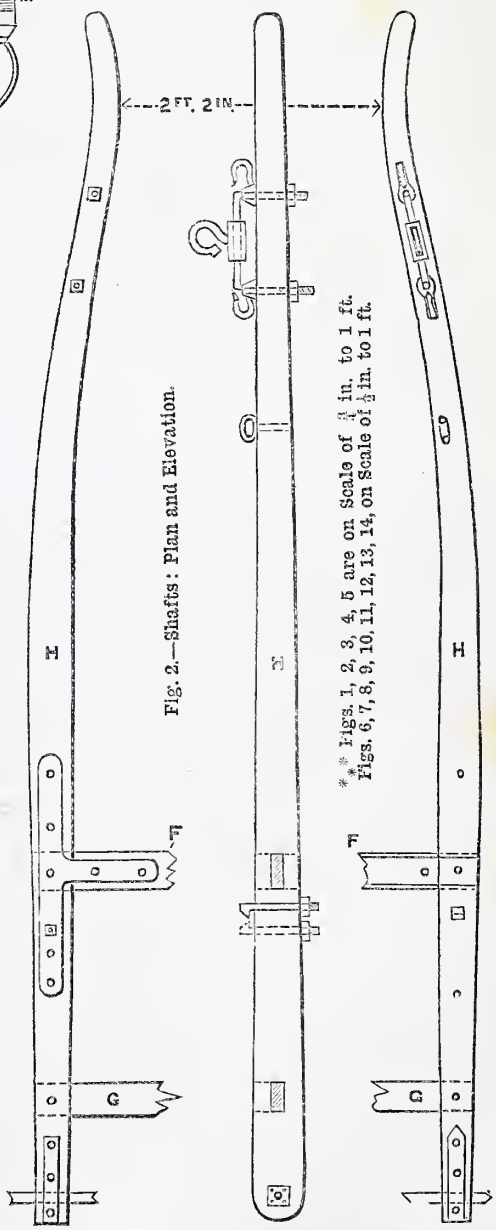



Fig. 2.—Shafts: Plan and Elevation.

*** Figs. 1, 2, 3, 4, 5 are on Scale of $\frac{3}{4}$ in. to 1 ft.
Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14, on Scale of $\frac{1}{2}$ in. to 1 ft.

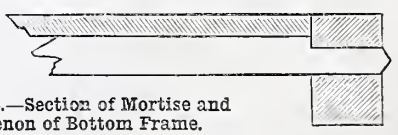


Fig. 6.—Section of Mortise and Tenon of Bottom Frame.

HOW TO MAKE A "TIP" CART.

## HOW TO MAKE A "TIP" CART.

BY J. P. S.

VARIOUS NAMES FOR THE "TIP" CART—MATERIALS—QUALITY—BOTTOM FRAME—FRONT BAR — IRONWORK — SHAFTS — BODY — BOTTOM — FRONT — TAILBOARD — BLOCKS — GENERAL HINTS—PAINT.

I CAN well understand many readers of WORK asking, "Who cares to know about that?" My reply to such must be, "A canny Scot." The readers of this journal are a host, and their wants are very varied; not a few of them are anxious to be instructed in making carts and vehicles of many descriptions, and amongst the number is this Scotchman; and as our Editor turns no one empty away, and the space allowable in "Shop" would be inadequate to treat such a subject fully, I am granted leave to put it in a special article as now set before you.

I have given what is known in my neighbourhood, where Scotchmen are fairly numerous, as a "Glasgow" pattern cart. It is fitted so as to empty its load very expeditiously. In "the land o' cakes" it is called a "coupe" cart; in East Anglia similar carts are designated as "tumbrils," but the more general name in trade circulars is "tip" cart.

*Materials.*—Our first thoughts must be given to materials, and while we are about it we may as well get the whole of the hard wood at one investment; consequently, we will prepare a list to take to the timber merchant. We shall require:—

| | *Marked.* | *Length.* | *Depth.* | *Thickness.* |
|---|---|---|---|---|
| | | ft. in. | in. | in. |
| For sides, 2 pieces of oak | A | 6 0 | 5½ | 3 (tapered) |
| For bars, 4 pieces of oak | B | 3 8 | 1½ | 3¾ |
| For front bar, 1 piece of oak | C | 4 8 | 2¼ | 3½ |
| For standards, 8 pieces of oak . . . . | D | 2 0 | 1¾ | 2¾ |
| For raves, 2 pieces of ash | E | 6 2 | 1¾ | 2½ |
| For front shaft bar, 1 piece of ash . . . | F | 3 3 | 3¼ | 3¾ |
| For hind shaft bar, 1 piece of ash . . . | G | 3 3 | 2 | 3½ |
| For shafts, 2 pieces of ash | H | 9 0 | 3¾ | (tapered) |
| For tailboard (top), 1 piece of ash . . . | J | 5 0 | 3¾ | 1½ |
| For tailboard (bottom), 1 piece of ash . | K | 4 9 | 3¾ | 1½ |
| For tailboard (centre), 1 piece of ash . | L | 4 9 | 1½ | 1½ |
| For front top rave, 1 piece of ash . . | M | 5 0 | 1½ | 5 |
| For cant piece, 1 piece of ash | N | 3 8 | 3½ | 2 |

Also 2 blocks, and a quantity of boarding 1 in. and also ¾ in. thick. The shafts and top rave of the front of body being crooked, templates will be required to saw them out by. These templates should be made of wood at least ⅜ in. in thickness. All the sizes given are "finished" sizes, and the lengths are longer than shown in the drawings, for reasons that will explain themselves as we proceed.

*Quality.*—The oak must be straight-grained, and free from *large* knots, at all events, and by no means use a piece that contains a bunch of "pin" knots. Timber so embellished looks ornamental while growing, and may answer for building or cabinet-making purposes, where it is not liable to varying loads and sudden strains, but it is wholly unsuitable for cart-building. Nor should the trees be too large or old, as oak loses much of its toughness with age, although—especially when well seasoned—it is often very hard and rigid. For cart-building purposes I prefer oak trees not exceeding 14 or 15 inches in diameter. The remarks as to straightness of grain and freedom from knots refer with equal force to the ash we may require; the shafts especially must be very tough. Much ash is spoilt by being felled after the sap has commenced to rise; it is invariably more or less soft if felled after February 1st, or if steam-dried instead of by the old and slow, but superior, methods used by our grandfathers.

*Bottom Frame.*—We must commence to erect by planing up the two largest pieces of oak, marked A, and the four pieces for bottom bars, marked B in Fig. 1. The hind edge of the hind bar must be perfectly straight; the other edges of all the others may be planed off to make the bars taper slightly in their width. This will allow our framing to drive together tighter, as well as increasing the strength of the bars in the centre. When the six pieces are true, straight and square, we will proceed to lay them out. We first lay our two pieces of oak side by side on a pair of stools, and proceed to measure off the distances, first of the hind pommels and also of the four bars, putting a short pencil-mark to denote the place of each. Our next proceeding is to consider—Are we going to use an axle which is to be made to order? If so, we can work to the drawing. Or have we bought a new one already finished from the ironmonger? Because in that case we must frame our cart such a width so that the pin-holes for the axle will come in the centre of our oak side pieces. The same holds good if we are using a good second-hand axle. Having settled this important point, we proceed to lay out the frame, bearing in mind *not* to lay the two side pieces parallel, but to make it 1 in. wider behind than in front. This is important, as I once saw a load of wet sand refuse to leave when the cart was "tipped," and consequently a shovel had to be used to unload it. As our cart is narrower in front than behind and our bars are taper, and, moreover, our mortises and tenons must fit very tight, I need scarcely say it is impossible to mark them off with a square and pencil as a joiner would soft wood framing; but instead, the framework must be laid out on the stools, squared with a rod, and the mortises scratched with a pointed piece of steel (a disabled gimlet ground to a point is what we use) in lieu of a lead-pencil. The tenons of the four bottom bars are "fair-faced" from the bottom side, and the shoulder is on the top. This is so done for strength. A tenon and mortise is given in section at Fig. 6. We invariably smooth up such work and drive it together at one operation, but it will be safer for a novice to drive it together in the rough and see that it comes accurate, and knock it to pieces again. Smooth up the bottom bars, and take a chamfer off the bottom edges; round off the rear ends of the sides to form the pommels, and then proceed to drive it together again for the last time, and pin it with oak pins. The ends of the pommels are finished by an iron band being driven on each.

*The Front Bar.*—We must next take the front bar, C, in hand. It is allowed to project 5½ in. each end to form handles. You will observe the ends are only 2¾ in. square, yet between the two oak sides of the frame it is 3¾ in. wide; the extra width has to be rebated out 1 in. deep to form a support for the front ends of the bottom boards; if the bar was carried through its whole width, it would not only unduly weaken the front end of the sides, but would also look very clumsy. The front bar will require fitting down in its place very exact; and here comes in a reason for our two oak sides being longer than necessary, as, if they were of the exact length, we certainly should break off the two "knucks" were we to drive the front bar into its place as tight as it should be. Perhaps someone will inquire the limits of the tightness allowable. My old master used to carry a piece of broken watch-spring in his waistcoat pocket, and woe betide us if he could insert it into our joints or mortises!

*Ironwork.*—Having done so much, we can go but little further without the aid of the smith. We shall want eight standard bolts, as at Fig. 9, and two front corner standards, as at Fig. 10. The iron bar across the rear of the body, with its bolts and two mortise holes for the tailboard, may be fitted at this stage, and it will be highly convenient to get the "tipping" bar, the jaws (Fig. 11) that hold it and its spring, and mortise plates at the same time, as they can be fixed in position far more readily now than at a later stage. If we are waiting for the smith, we may get out our eight wood standards, D, which are shown at Fig. 7, but we must not cut the top tenons until the standards are bolted into position and the raves have been marked on. If we are still waiting, we may proceed with the shafts, H.

*The Shafts.*—The drawings will make these fairly simple, I think. One is given showing the top side and the other shows the bottom; and to prevent any chance of an error, as the materials are costly, I have given an elevation, cutting away the bars to economise room. The hind bar, G, is not so strong as the front, F. The mortises are clearly shown, as is also the ironwork. The front bar has a plate of coach hooping the whole length of its top side, fastened down with wood screws, except the two end holes, which are countersunk for rivets. The underside has two T-plates of iron fastened with four rivets each, as well as wood screws. Each shaft has a band of hooping on its rear end, and the holes for the long pin are protected by plates of iron, as shown. The drawing shows a draught-hook on the slide staple, and also an eye further back; both are not necessary, consequently you are free to choose which you may prefer. The eye gives a steadier draught, in the estimation of many. The shafts being finished, they may be hung, and the irons and bar fixed for "tipping." Both catches are shown in elevation on the same shaft (Fig. 2), but it will be understood that one goes in the near and the other in the off shaft; the drawing is to show their relative *positions*. Having hung the shafts and fixed the "tipping" irons, we may withdraw the long bolt and set the shafts away while we proceed with the body.

*The Body.*—If the two iron standards are ready, fix them first, and be certain that they are not only the right bevel, both forwards and outwards, but also that they are both fixed alike. The wood standards, D, must next be bevelled to stand at their correct angles, and it will be as well to fit and fix them all in pairs, commencing with the two hindermost, which you will observe are slightly wider than the others. The standards are set out at irregular distances to admit of the bolts escaping contact with the

bottom bars. Be careful not to batter the heads of the standard bolts, or you will disgust your smith, who usually takes pride in finishing them well. When the standards are bolted up tight, the raves may be marked on and mortised, and the tenons cut on the standards. Next fit on the front top bent rave, M (Figs. 3, 4); and when this is done, shave the raves and standards, fix the tailboard irons (Fig. 14) on the rear ends of the raves, and fasten all together very firmly, seeing all is accurate as you proceed step by step.

*Bottom.*—This had better be next boarded; use good yellow deal or tough elm boarding 1 in. thick. It will lay in the rebate in the front bar, and it will require rebating behind to allow the hind iron bar to lay flush with the top of the boarding. The thin end of the bottom boards is shown in section at Fig. 5. The bottom being securely fixed, and the hind bar also, the sides will be ready for boarding. These boards should also be of good yellow deal or pitch pine, although I have known good Scotch fir to be used with success. The front ends give an opportunity for ornamentation, and the rear ends are protected by a fillet, A, being nailed on the outsides behind the standards. This brings us to the fore ends.

*Front.*—The cant piece, N, must first be fitted, made the correct bevel, and fixed with strong spikes. Next fit in the outside boards, which must be treated very carefully, or the wood may be spoiled. When fitted, it may be ornamented by cutting out and chamfering as shown in Fig. 4. If preferred, the board may be allowed to remain solid and the effect produced in paint; but for myself, I prefer to cut it out. The inside boards are fixed with the grain running from the top to the bottom, and the lines indicate where the joints may come. All the boarding except the bottom is $\frac{3}{4}$ in. thick. To prevent any errors in this front I have given a drawing in section, at Fig. 8, of the cant piece, top rave, and boarding.

*Tailboard.*—This is not double-boarded, or it would be too heavy. The two nib-irons (Fig. 12) on the bottom rail, and the two diamond plates with the pin-holes, are fixed with rivets, or they would soon jar loose. The $1\frac{1}{2}$ in. square strip in the centre is to bind the boarding and make it more rigid.

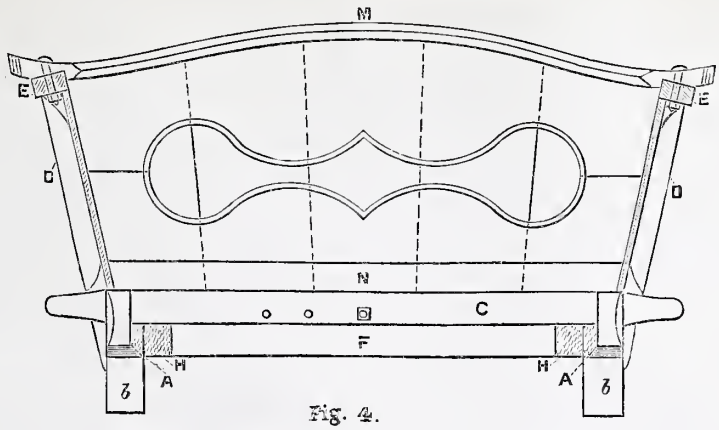



Fig. 4.

**Fig. 4.—Front of Body of "Tip" Cart: Elevation.**

The keys are fixed to the tailboard with small chains and staples, and in my drawing at Fig. 5 the tailboard is cut away to show the square line that gives the bevel of the cart.

*Blocks.*—These remain to be fixed, and the holes bored for the long axle-pins (Fig. 13). Two iron plates may be spiked to the blocks, *b*, to keep grit from working into the rear of the axle. The arms of the axle are $2\frac{1}{2}$ in. in diameter. The wheels are 4 ft. 4 in. high and the tires 4 in. wide. To a "Southerner" the front rave bands are very hideous, but they are the joy of the soul of a Scotch smith.

*General Hints.*—Much more instruction may often be given in the same space by drawings than by words; consequently, I fear I have given what may be considered an excess of drawings. I trust they may tell their own tale. I have endeavoured to help a young farmer, say, who has not had a training, and wishes to make a cart without spoiling his materials. Again, the strength of all vehicles largely depends on a judicious blending of wood and iron; bearing this in mind, I have given shore stays and bottom stays at the hind corners. I may remark loose top-boards are sometimes added, 7 in. deep, all round the body. If desirable, they may form the subject for a future paper. I may add another word which is highly important. It is this: all the mortises and tenons should be put together, and all the ironwork painted, where it comes in contact with wood, with white lead, made into a smooth soft paste by the addition of equal parts of raw oil and turps. The pins holding all the mortises down on the tenons should be made of tough oak, and driven in with the white-lead lubricant. In no case can wedges be allowed; they are certain to shake out.

*Paint.*—The wheels, bottom and inside of body, the shafts, and also the ornamental space in front, are all finished red. For the remainder green is the favourite colour. The ironwork is finished a deep *blue-black*, and so forms a relief and looks well.

If readers wish to know anything which may not be quite clear, inquire through "Shop"; it is always open, and I am yours to command.

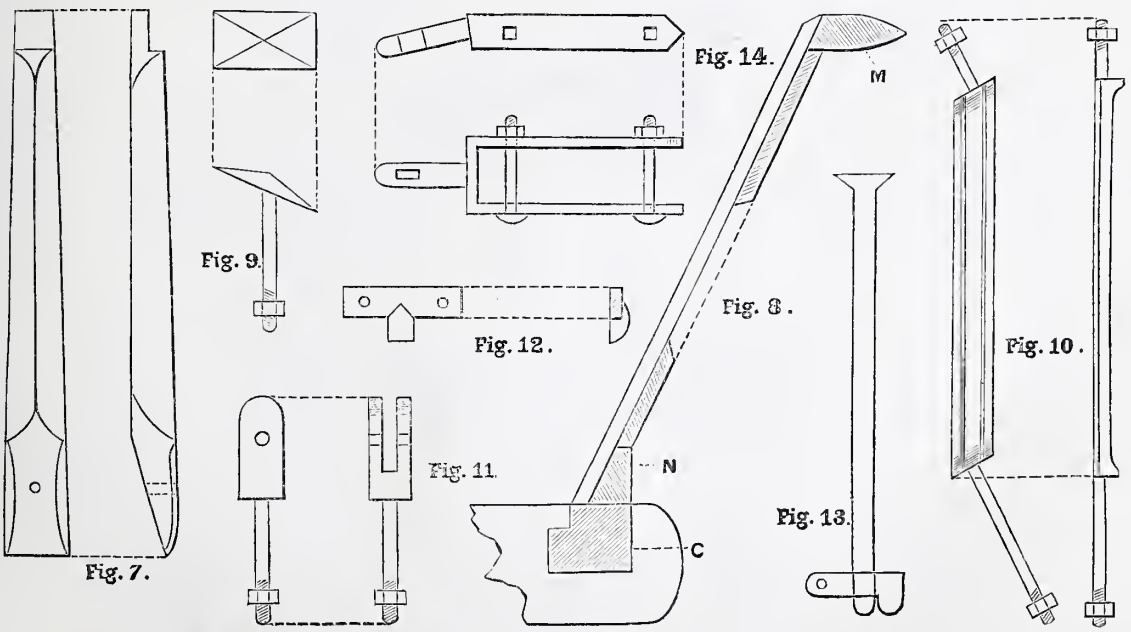



**Fig. 7.—Standards: Wood. Fig. 8.—Section of Front, showing Manner of fixing Boarding. Fig. 9.—Standard Bolts. Fig. 10.—Front Corner Standards: Iron. Fig. 11.—Jaws for holding Tipping Bar. Fig. 12.—Nib-Irons for Tailboard. Fig. 13.—Axle-Pins. Fig. 14.—Rave-Irons to hold Tailboard.**

## ENGINE AND BOILER MANAGEMENT.

BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.,

*Author of "A Handbook for Steam Users," "Wood-working Machinery," "Stone-working Machinery," "Pumps and Pumping," etc.*

### ENGINES.

POUNDING OR KNOCKING OF ENGINES—ENGINE CYLINDERS CRACKING—QUICK METHODS OF SETTING A SLIDE-VALVE—HOT BEARINGS—HOT CRANK PIN BEARINGS.

I NOW bring to a conclusion my remarks on this important subject. For preceding papers the reader is referred to pages 229, 290, and 354.

40. *Pounding or Knocking of Engines.*—Pounding or knocking may arise from a variety of causes. If the knocking is at the end of the stroke when the crank is on the "dead centre," it may arise from wear on the connecting-rod bearings, or from their not being keyed up tight enough, or from the piston-rings being broken too loose at the guide-bar end, or from a ridge or inequalities in the cylinder or guide-bars. Knocking, when the crank is at half-stroke, will not be caused by any of the above reasons except the piston or piston-rings being loose, which

would cause a knocking sound as the crank came over the dead centre and at the end of each stroke. Knocking or clicking of piston-rings may also be caused through water being in the cylinder, either from the boiler priming or from condensation of steam. It may also arise from the engine-shaft, cross-head, or slides being out of line, or from insufficient cushioning of the piston, or from a slack nut at the end of the slide-valve rod, or valve rod bent from an accumulation of dirt. Knocking may also be caused from the axes of all the journals not being parallel.

41. *Engine Cylinders Cracking.*—There is little doubt that the "mysterious" cracking of engine cylinders which occasionally occurs arises in many cases from the want of ordinary precautions on the part of the driver. Drivers often get up steam and start their engines as soon as possible, and the steam is let into the cylinder when it is cold, consequently an immense strain from sudden and unequal expansion is set up. It is, therefore, advisable, especially with large engines—more particularly in frosty weather or exposed situations—that the cylinder be thoroughly warmed before starting. There are, of course, other reasons for cylinders cracking: such as the use of improper or unsound metal in their construction, improper proportion of metal, water or ice in the cylinder, broken piston, engine running away, etc. The cylinder, if steam-jacketed or not, should in all cases be carefully covered with a good non-conducting material to prevent radiation of heat.

42. *Quick Methods of Setting a Slide-Valve.*—(1) Make the eccentric-rod of such a length as will permit the valve to open equally at both ends of the stroke. Then put the crank on the dead centre, and turn the eccentric round the same way as the engine is intended to go, altering until the valve moves through a distance sufficient to give the required lead, and you may rely on its being the same on the opposite side. (2) Another plan (Dunn). Remove lid from steam-chest, revolve the main shaft or slack the set screws in eccentric, and revolve eccentric until full throw of same is made in one direction, opening the port to its largest size. Now make a tapered wedge out of a lath and slip it down in open port, marking with a knife or pencil the edge of wedge on valve-seat. Now revolve eccentric until full throw is made towards opposite end of steam-chest, and until port is open to its largest size; then slip the wedge down in port as before; then with a rule divide the distance between the two lines on edge of wedge, marking a third line in the centre; then, with the eccentric at full throw, lengthen or shorten the cam-rod until the wedge, with its centre line, fits one port neatly, and it will fit the other one as neatly when full throw is made in the opposite direction. Now place your engine on a centre, and revolve eccentric until the port over the end of cylinder, in which the follower is placed, has opened about $\frac{1}{16}$ in., and tighten your set screws. This done, your slide-valve, also your eccentric, is properly adjusted, and no time wasted in hunting dead-centre or chalk-marking fly-wheels.

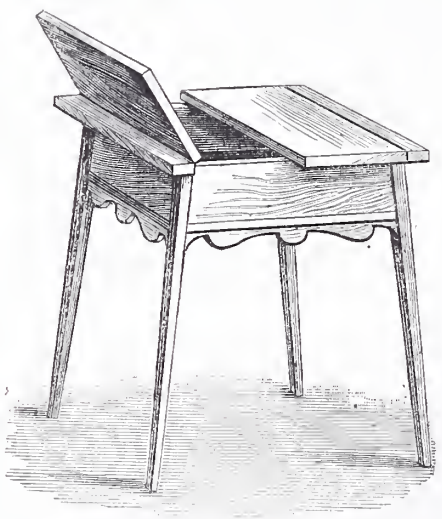
43. *Hot Bearings.*—Heated bearings may arise from a variety of causes: such as (1) Bearings of insufficient area for the pressure or strain put on them; (2) engine running at short centres with a tight belt; (3) bad-fitting or seamy shaft; (4) bearings screwed up too tight; (5) insufficient lubrication, improper or bad oil; (6) dust or dirt in the bearings, oil-grooves too shallow, or oil-ways stopped; (7) bearings will also stretch and pinch the shaft from being allowed to run slack or get out of line or level; (8) from oil-boxes or lubricators being or becoming air-tight, and preventing the proper flow of the oil; (9) from the axes of all the journals not being parallel, or from the shaft not bedding evenly on the bottom of the bearings.

44. *Hot Crank-Pin Bearings.*—More particularly with engines in which the connecting-rod is arranged to work on to a crank-pin, considerable trouble is often experienced through the bearings heating. This may arise from their being poorly fitted, from requiring adjustment, from want of proper lubrication, or from the bearings being made too thin, sufficient metal not being provided to carry off the heat engendered from working when the bearing was slightly out of order. Apparently well-fitted bearings may heat from another cause, and one that has puzzled a good many in detecting, and that is from the connecting-rod being out of line. To detect this, take the connecting-rod out of the cross-head and key it up tightly on the crank-pin. Now move the rod up and down, and see that it drops truly into the bearing on the cross-head; if it does not, you will know it is out of line, and should be overhauled and adjusted at once, as the bearing will never run cool under these conditions, it being very much strained, and the area in contact with the crank-pin being largely reduced. If, on examination, you find the bearings are wearing bell-mouthed, you may conclude it arises from the last-mentioned cause. A similar trouble may arise with engines in which a sweep-crank is used, but it is not so pronounced.

## A BOX-TOP TABLE.

BY JAMES SCOTT.

During a stroll lately among the London streets, the shops in which teem with high-class furniture of every description, my attention was directed to a table similar



A Box-Top Table.

in appearance to the one represented here. Of the utility of it no one should possess one particle of doubt, for it must be apparent in plain boldness that an article of this kind can be used as a storehouse for odd-ments and small knick-knacks which may be deemed indispensable, although troublesome by reason of their smallness. Again, with both wings or flaps opened, allowed to rest horizontally, the under surfaces of them being uppermost, the article could be used as a tea-table, the area of the flaps, when opened, being almost as large as when closed over the box; while, in addition, the cavity would be found suitable for the reception of tea-pot, bread-tray, sugar-basin, etc. Indeed, it might be considered a very advantageous matter to adapt the table solely to purposes of this kind, and, constructing the article in such a way that the capacity of the box portion is sufficient, store all accommodating adjuncts to a tea-meal within the interior when not required for use. Of course, it would be a source of inconvenience to use a cloth with which to cover the table, as occasion might frequently arise for application to the box; but a well-polished or prettily enamelled piece of furniture has no need of being hidden under any sort of cloth.

It may be noticed that there is so little extra labour necessary to construct the table as a box article than would be required to make it in the ordinary way, that it ought not to call forth any objections in this direction; while it must be admitted that the box answers all the facilities of a drawer without necessitating the extra work of making one.

The reader is requested to note that the narrow end top pieces, to which are attached the flaps that form the table-top, must be fastened to the framework of the table.

Some readers may remember (or if they will refer they will see) that I gave a similar suggestion to that contained in this table in reply to a correspondent in page 653, Supplement, No. 92, Vol. II. (issue for December 20, 1890), in the upper portion of a tool-chest. Whether the present article is adapted from my idea in that number I cannot positively say, for it is impossible to keep pace with all fresh improvements; but certainly I can say that on my part originality, and not copying, was foremost. The flaps, as an alternative, could be hinged as shown in the number of Work quoted.

## BOOT AND SHOE REPAIRING.

BY W. GREENFIELD.

### Half-Heeling—A Novel Way to Keep the Heels Level.

In this article of our series I want to impress upon my readers the great importance of keeping heels level, for if they are allowed to wear down low, the ill that is caused by it is difficult to remedy. For it not only tends to throw the heel itself on one side, but it causes the sole to wear away much quicker, runs the stiffener down at G G (Fig. 1), and generally throws the boot or shoe out of position beyond recovery.

Nearly everybody in walking wears down the heels of their boots at one particular spot. This should be most at A (Fig. 1), though with some it happens right at the back of the heel, while a few wear most on the inside. Now, to repair these defects is nearly one of the best jobs that a novice can start upon, inasmuch as the grafting in half-heeling only means butting the new piece of leather against the old, as there is no play or friction to cause them to come asunder. In the boots and shoes that are manufactured now so very cheaply the leather is not what is called "properly worked"—that is, as I have previously mentioned, "wetted, dried, hammered," etc.). This causes what I daresay most of you have experienced—namely, a

new pair of boots worn out in the wet are, when taken off the feet, lower on one side of the heel than the other, although the leather is not actually worn away. This is because it yields to the pressure and weight of the body in walking, and the yielding is their first step to ruin.

To prevent this, when you buy new boots always ask them to put a few extra nails just round the part where you know you wear most. When the heel is only worn down on one side it is not necessary to take the whole of the top piece off, but only half of it, which can be replaced with any hard corner of sole leather that would otherwise be almost useless.

To do this, saw the top piece across at B C, and should the lift be worn, saw or cut that through as well at D E; tack a piece of leather on to take the place of the worn piece of lift, putting the tacks in at F and F. Then trim it round, and put some odd hard corner of sole leather on in a like manner, to take the place of the worn part of the top piece. Trim this up also, and nail as shown in Fig. 2. In this case you will need to put four of the rivets in, quite ¾ in. long, at A, B, C, and D, so as to hold the lift as well as the top piece. Of course, you can put one, two, three, or four rows, as you please, but they are not much use unless they are close together; and two rivets should be put in, one on each side, as shown at E, F, G, and H. This done, file them up, and finish in the ordinary way.

Now, as I have said above, it is all important to keep the heels level. You will not be surprised, I hope, that I have tried to gain or obtain this desideratum with the idea (simple as it may appear) that it is of great importance to those who mend and study their own boots.

Certainly, half-heeling, with plenty of nails close together, and regularly done, will keep them in proper order; but everyone cannot always spare their boots or spare the time to do them properly in this way, and it is a job that, once started, the boots cannot be worn again until they are finished. Hence the need of a method that is either quicker or that can, in some way or other, be more divided.

Now, the best thing is never to wear a top piece quite through, for you touch the lift if you do; and, no matter how little this may be, it will need either replacing as described above, or repairing by means of a skiver put under.

But, prior to letting them wear away, take a piece of paper with one straight side and lay this across the heel, from J to H, Fig. 2; hold it with two fingers of the left hand quite firm at F and G; then with the right hand smooth it down over the edge from J, passing A, B, C, and D on to I. This will leave a mark on the paper; cut it out to this mark, and it will give you a good pattern of a half-heel piece, as Fig. 3, without the outside line A. To this you can cut another pattern out of stiff cardboard, as you will want to use it very often.

This done, and you have any more leisure, cut a piece of sole leather out to this pattern, leaving ¼ in. on all round the curved side A, Fig. 3—this to give room for nailing. But before I show how this should be done it will be necessary to explain how to make a certain awl for this purpose. They cannot be bought, like all other awls, ready for use, but as it is a tool that saves much time and disappointment, I will describe how it can be made, and also a suitable handle for it.

Now, to make this tool you want, first of all, an ordinary peg-awl handle, as A, Fig. 4, and put two pieces of sole leather on top, as B and C. To secure these, put one short stout screw in the centre, and then put a third piece on, as D, first cutting a hole in the centre, a little larger than the head of the screw, as A, Fig. 5, and then put about five rivets in, as B, C, D, E, and F. This is done because the awl, when finished, is very stumpy, and requires such hard blows to get it in that it would split the wood, and by this means you throw all force on the leather, and the hole in the centre will admit of tightening the screw when necessary. This done, and the edge trimmed up all round, put into the other end a carpenter's large bradawl. This kind of awl, as most people know, has a square shoulder to it, therefore the heavy blows will not drive it up into the handle. When the awl has been put into the handle, break it off to about an inch of the shoulder; then with a fine file, or on a grindstone, if you have one, taper it to a long, flat, square point, as E, Fig. 4; in fact, it should be just the size and shape of a French brad, only about ⅛ in. longer, and, of course, smooth.

The piece of leather in Fig. 3 should be of good substance, and should be wet, but not soddened; then mark a line round the curved side from B to C, ¼ in. from the edge, and from these two points make two rows of holes with the new awl, which should, by the way, be dipped each time before using into a piece of soap. A hole can be missed in the second line of holes at each of the four places D, D, D, D, and a small round hole made instead; and four more also made at E, E, E, E, and then let the leather get nearly dry, that you may hammer it as before explained.

This will make the holes smaller and look more irregular, as shown in Fig. 3; but that does not matter so long as the awl was held in the same position for each hole, for the brads are sure to follow into their proper place.

I said above that the awl should be of the same shape as a French brad, which is as B in Fig. 6; but there is another kind of brad the same shape, only it is much shorter and a little stouter, as A in Fig. 6. These are called cut-bills, and it is this brad you must use to put into the holes made in Fig. 3. Let the length be as near the substance of the leather as possible, knock them in the square holes one at a time, and when they are all in take the leather off the wood (the best thing to do the bradding on), and lay it on the lap-iron with the points of the brads upwards. These, if they are not too far through, can be clenched and made smooth by tapping down with a hammer, but if they are through far they must be cut off with a pair of cutting tongs close to the leather before trying to clench them.

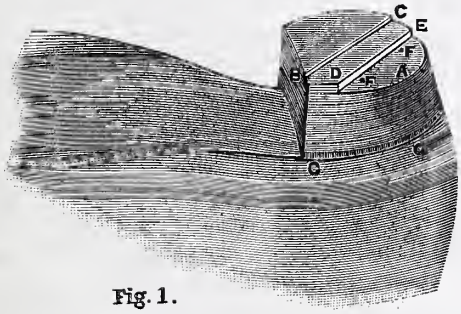


Fig. 1.

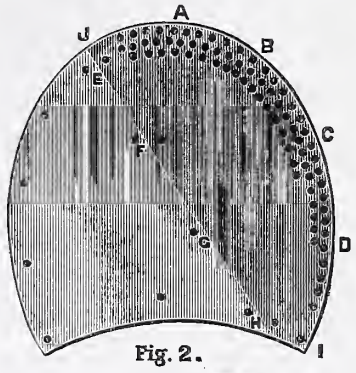


Fig. 2.

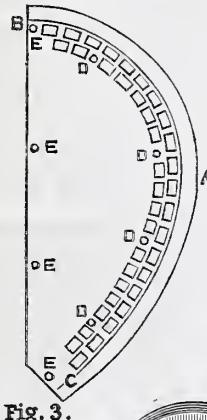


Fig. 3.

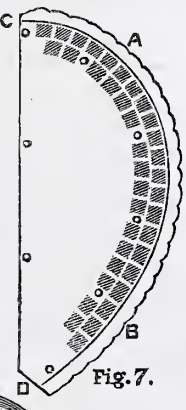


Fig. 7.

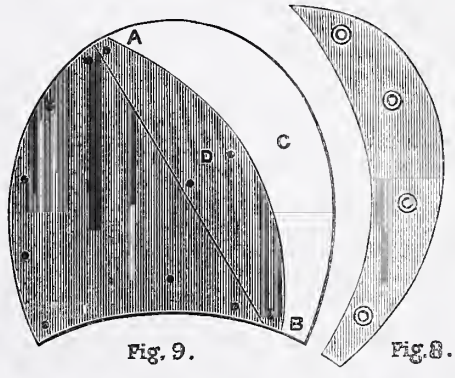


Fig. 9.


Fig. 8.

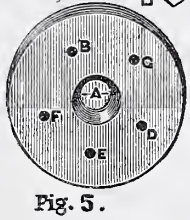


Fig. 5.

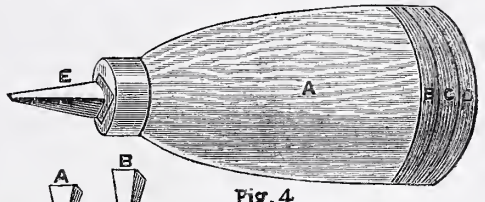


Fig. 4.

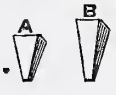


Fig. 6.

**Fig. 1.—Heel with Worn Part of Lift and Top Piece cut away to receive Piece Lift and Half-Heel. Fig. 2.—Top Piece levelled by Half-Heeling, with three Rows of Rivets close together to resist wear. Fig. 3.—Half-Heel Piece holed and hammered. Fig. 4.—Home-made Awl and Handle. Fig. 5.—Top of Awl Handle with Hole through Centre. Fig. 6.—A, Cut-bill; B, French Brad. Fig. 7.—Half-Heel Piece bradded, ready for future use. Fig. 8.—Snow's Patent Leather-Plugged Half-Tip. Fig. 9.—Top of Heel, showing how to fit for Half-Tip.**

This done, they are ready for use, and you can keep as many prepared as you wish, and all that is necessary then to half-heel the boots is to cut the top piece across, as shown, from J to H, Fig. 2, take the worn part away, and replace it with the new piece (Fig. 7), which shows the way it should be bradded, and also the eight places for a like number of ⅝ in. rivets, which is all that is necessary to hold it on, and will let it be taken off easily when another piece is wanted on.

It will be found that the small margin, A B, Fig. 7, after the brads have been put in, has become somewhat contracted. This is why the extra ¼ in. is left on, for if nailed close to the edge the leather would break out, whereas now you can trim up the edge of the piece to the edge of the heel, cutting right close to the brads, as the line C to D, and finish in the ordinary way.

It will be necessary to put four rivets in the old leather at E, F, G, and H, Fig. 2, the first time they are half-heeled, to keep it from ripping off.

Another good and easy way is to get a pair of Snow's patent leather-plugged half-tips (Fig. 8), price 1½d. Put it on the heel in its proper position, and mark round the inside from A to B, Fig. 9, and cut that part away that the tip is going to replace, as C. Lay the tip on the lap-iron face down, and tap it in the centre, that it may grip well at both ends, then just dip it in water to soften the leather plugs, and put it on the heel; with a fine awl make a hole through the centre of each plug, and put a long rivet (which they should give with the tips) in each hole; file it up anywhere where rough, and you have a new lease of heel wear for 1½d., and a very little trouble.

Should you find it difficult to cut the curved line to fit the tip from A and B, cut it straight across, as you did in Fig. 2, from J to H, and after the tip is on cut a small piece, as D, Fig, 9, and nail it in with four rivets.

To get D the proper shape, let it have one straight side, press that against the old leather, and hammer the new on the tip. This will make a mark underneath: cut through this line, and you have the shape required.

## FRENCH POLISHING—"DRY-SHINING."

BY DAVID DENNING.

EMPLOYMENT—METHOD OF WORKING.

THE ordinary methods of French polishing having been fully described, the novice who has managed to do "bodying up" and "spiriting off," or even "glazing," will find the operation of "dry-shining," which is the subject of the present article, mere child's play in comparison.

From this remark it must not be understood that dry-shining can be done "right off the reel" by the novice, for, like everything else in polishing, it requires attention and a certain degree of skill, though not by any means to the same extent as spiriting off. It is not, however, like glazing, in some degree a substitute for that difficult process; and those who may think that they can get a high degree of finish on their work by means of dry-shining it may as well give up the illusion at once. If a really good finish is wanted, French polish, as it is ordinarily understood by members of the craft, must be done, for there is no efficient substitute with which a like result can be got. What, then, is dry-shining, and what is it used for?

Well, let the latter part of the question be answered first. It is useful for finishing inside work—such as the insides of boxes, drawers, cabinets, and interior parts generally—and is often seen on the fronts of drawers and trays enclosed in a wardrobe. In fact, it can be used in any position where a high degree of finish is not necessary or customary. The chief advantages in connection with it are that it can be done expeditiously, and therefore cheaply; that it sufficiently closes the grain of the wood to prevent dust getting in and clogging it up; and lastly, it gives a degree of finish which wood left "in the white" or altogether unpolished does not possess.

Now, to answer the question as to what dry-shining is, shall we add how it is done? Roughly speaking, it is the nearest approach to varnishing by means of a rubber, instead of a brush, that polishers practise with ordinary French polish. The wood, if it may be so said, is varnished with this, applied by means of the polisher's special appliance—the rubber. In practice, dry-shining is done almost as bodying in, or, to be more accurate, is bodied-in work finished as in glazing, but with French polish used instead of glaze.

The wood is bodied in without any preparatory filling, but otherwise precisely in the ordinary manner, as directed in a previous article. It is not, however, customary to take such precautions to get up a good body as was then recommended; in fact, bodying up for dry-shining is somewhat of a misnomer as the work is generally done. A better idea would almost be conveyed by saying that the wood is wiped over with the polish rubber, as not much trouble is usually taken to do more than get the preliminary body worked on. Of course, something in this respect depends on the position of the part and the class of work being "dry-shined," for there is no reason why the first body should not be allowed to sink, and then be re-bodied if necessary. To do much bodying in, however, would make the amount of work almost equal to that involved by ordinary French polishing, so that ordinarily dry-shining is practised as stated. When a superior finish is wanted, there is, of course, no objection to French polishing the parts which have been mentioned as suitable for dry-shining. Beyond the fact that this answers well enough, there is no practical reason, except that it is less costly, why it is adopted.

When the bodying up, then, has been done to the satisfaction of the polisher, it only remains to finish it. To do this, the rubber is charged with French polish: if anything, rather more fully than was recommended for bodying, and instead of being rubbed all over the wood in any direction, is wiped over in the direction of the grain from end to end of the piece, very much in the same manner as was mentioned in connection with glazing. The rubber may be moved backwards and forwards till dry, if desired, but a better way under ordinary circumstances is to let the polish deposited by each rub dry before going over the same place again. When using the rubber in finishing, it should have no oil; and, if the former of these two methods is done, it will be difficult to prevent the polish dragging, so that the easier course may as well be adopted.

This method of finishing work—viz., by dry-shining, which, by the way, is a technical expression seldom heard outside the workshop, as to the general public it is included in the general term of French polishing—is the crudest and simplest way in which a gloss can be got on the surface of wood by means of a thin varnish of shellac and methylated spirit. It must not be mistaken for varnishing, as this process is ordinarily understood, for it is distinctly a French polishing one.

## SOMETHING ABOUT THE "PUFFS" OF A LOCOMOTIVE.

BY P. H. D.

THERE must be something strangely attractive and wonderful about the "puffs or beats of the exhaust" of a locomotive, as they are the first to attract the attention of a speechless baby when taken by rail, and it generally shows its joy and surprise by smiling, and trying to reach them with its tiny hand. But I am sorry to say that, as the majority of these children grow up, their curiosity gradually subsides, though to anyone interested there is a great deal to be learnt therefrom. How many of the thousands of passengers who daily make use of the railways in and about London, if asked, "How many puffs does a locomotive emit when travelling a given distance?" could give even a suitable answer, by which the problem could be solved correctly? Yet, while waiting on the platforms, each person sees on an average twenty trains daily, entering and departing, and no curiosity seems to be aroused in their minds, which I can only account for by the very familiarity of the object. Probably, a few remarks will not be uninteresting to those readers who are fond of railways, and all things appertaining to them.

I will first endeavour to answer the question in the foregoing paragraph. The number of "exhausts" emitted by an engine are proportionate to the number of revolutions of the driving-wheels, and not, as some people suppose, more numerous when running at a greater speed than when covering the same distance slowly—that is to say, the same engine would exhaust the same number of times in travelling twenty miles, whether it moved slowly or quickly. Of course, the quicker the speed the quicker the exhaust, but then the engine gets over the ground at a proportionately increased speed.

The number of "exhausts" emitted by an ordinary locomotive is four for every revolution of the driving-wheel, and these can be easily counted when an engine is leaving a station with a good heavy load, as it moves slowly, and the "puffs" are distinct, and take place as the crank-pin passes the right, upper, left, and lower centres. As an example, I will take a Midland express engine, and work out the number of "puffs" it emits in going a given distance. We will take the run from London (St. Pancras) to Leicester, 100 miles (99¼ miles is the correct distance, but for simplicity we will take the former figure). The diameter of the driving-wheel is about 7 feet: this, multiplied by 3·1415, will give us the circumference, which comes to nearly 22 ft., which we will consider as correct. Now, if we divide 100 miles (the distance traversed) by 22 ft. (the circumference of driving-wheel), we shall get the number of revolutions of the main-wheel in running this distance. There are 528,000 ft. in 100 miles: this, divided by 22, gives 24,000 as the number of revolutions. Now, as there are four "puffs" to each revolution, 24,000 by 4 will give us the number of "puffs" in running 100 miles, which amounts to 96,000. The express trains

are allowed a little over two hours to do this journey, but I have a record before me which gives the details of a fine run by the Scotch express from Leicester to London on April 28th, in which the whole journey was accomplished in 1 hour and 46 minutes, or at an average rate of nearly 57 miles an hour. This was an altogether exceptional run. So we will allow two hours for the journey, when we shall find that the number of "puffs" per hour is 48,000, or an average of 800 per minute.

Edinburgh is 400 miles from King's Cross, so that an engine with the same size of driving-wheel as just mentioned would give a grand total of 384,000 "puffs" in accomplishing that distance.

There are, however, some express engines, termed "compounds," which, with the same diameter of driving-wheel as above-mentioned, would only give one-half the number of "puffs" in going the same distance. Such engines are to be met with on the North Eastern, but the principal railway employing them is the London and North Western, on which there are a great number in general use. The reason the number of "puffs" is diminished is that the steam, after having done its work in the high-pressure cylinder or cylinders, instead of blowing out into the air, passes into a larger one, and the steam is only allowed to escape into the air after having done its work there, so there are only the two exhausts from this one cylinder, instead of four from two cylinders, as in the preceding cases.

The size of driving-wheels, as a great many readers will know, depends on the kind of traffic to be dealt with. If the engines are to start quickly and pull a good load, as in the suburban passenger traffic at certain times of the day, the wheels are reduced in size, and often two or more are coupled together, till the extreme is found in the goods engines, which have the smallest wheels, and generally six of them are coupled together, as they have to draw heavy loads at a medium pace.

The exhaust is also a good indicator of the setting of the valves. If the "puffs" come regularly and clearly, then we know that the valves are correct; on the contrary, should the "puffs" be irregular, then the presumption is that the valves are wrong in some way, and the defect should be corrected.

There are very few persons who cannot tell when a locomotive is pulling a good load, and still very few would be able to say on what they base their opinion. In most of the cases it would be from the great noise made by the exhaust steam escaping in such quantities from the chimney.

Another peculiarity is that the exhaust steam issuing from the chimney emits quite different sounds on the several lines, which is accounted for by the difference in the tastes and ideas of the various locomotive engineers of the different lines. If you were to listen attentively and frequently, you could very easily distinguish some of the railways by this means, as the variation of sound in the exhaust is very marked. Again, in others, this difference is very slight. A great many engineers would be able to tell to what line a locomotive belonged, simply by the sound of the exhaust alone, without seeing it.

I hope these few remarks will be serviceable to someone among the many readers of this paper, as I think the study of the subject will be interesting. Like many other things, much may be learnt from it if properly investigated.

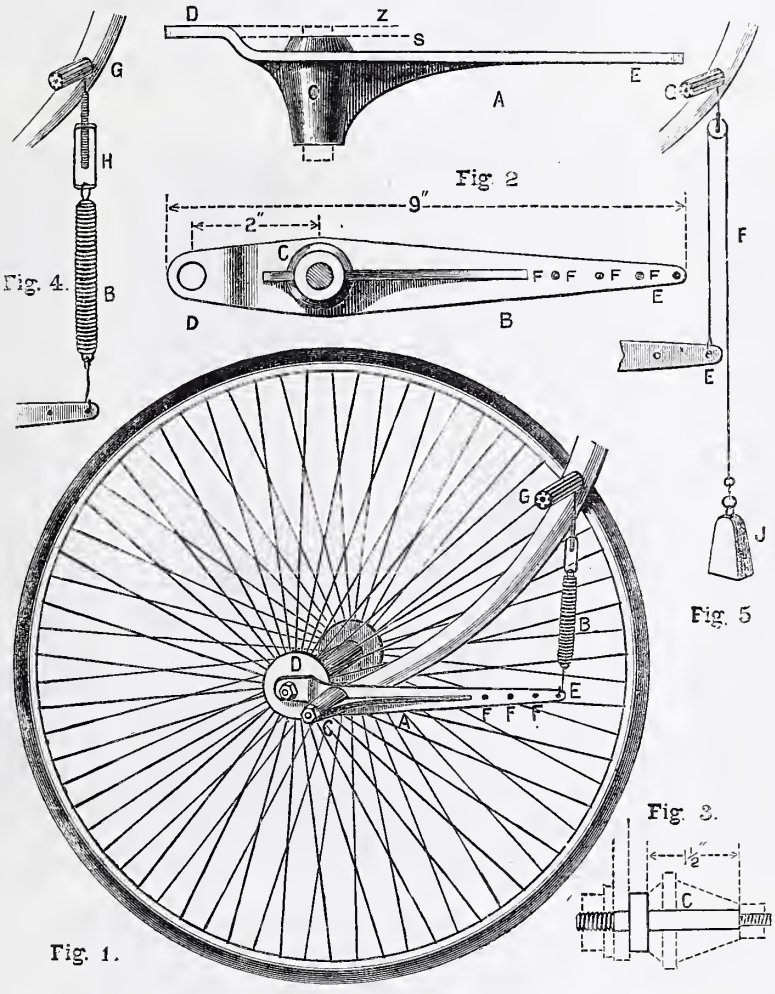



**Fig. 1.—Bicycle Wheel fitted with Anti-Vibrator. Fig. 2.—Lever—A, Side View; B, Plan. Fig. 3.—Form of Spindle. Fig. 4.—Attachment of Spring to Lever and Foot-Rest. Fig. 5.—Diagram showing how to determine Tension of Spring.**

## A SIMPLE ANTI-VIBRATOR FOR BICYCLES.

BY CYCLOPS.

Even though it may be late in the cycling season, there may be many readers of this paper who will be thinking of "going in" for a machine, or who, having an old one, feel inclined for a change.

One of the first questions which will occupy their minds is what kind of a machine they intend to ride.

Those whose pockets are minus the useful metal will look with envy on the purchasers of cushion or pneumatic-tired machines, and many of these have been in use this season.

The tire question is the all-absorbing subject of talk and discussion in cycling circles, and no doubt most of the machines sold this year will be fitted with one or the other of these luxuriant appliances.

To the attention of those readers of Work who are not in a position to purchase new machines this paper is especially directed, and the anti-vibrator which the writer is about to describe is one which may go a long way towards making up for the want of a cushioned tire.

As will be seen from a glance at Fig. 1, the appliance consists essentially of a lever, A, and a spring, B, which so act on the wheel and frame as to intercept any vibration which may be caused by rough roads.

The spindle carrying the long bearing, C, of the lever, A, is attached to the end of the fork by a nut and washer in the same manner as the wheel spindle was attached to it. The wheel spindle is attached to the end of the lever by its own nuts and washers in the same way as it was attached to the fork ends.

The lever, A, moves on the long bearing, C, and the spring, B, keeps it in place until some obstacle is encountered, when the wheel, in jumping over it, forces down the end, E, of the lever, and expands the spring, B, which thus takes the vibration which would otherwise be conveyed by the rigid fork to the rider.

A reference to A, in Fig. 2, will show the form of the lever, which will be best made of malleable iron. The pattern for casting will be exactly of the form of the lever itself, except it is intended to turn out the bearing, C, to fit its spindle, in which case the hole through the boss, C, being small, need not be made by prints, but be drilled from the solid. It will, of course, be understood that all parts are in duplicate, there being one for each side of the wheel. The side view of the lever is shown at B, in Fig. 2; the holes shown at F, F, F, F, are for the hook end of the spring, and can be bored in the lever after casting. The width between the lines S and Z, in A, Fig. 2, will have to be the same as the thickness of the spindle collar and fork-end. This will be obvious after consideration. By making both top and bottom half of the lever of the same form, only one pattern will be required for the two, which will be an advantage.

The form of the spindle on which the long bearing oscillates is shown at Fig. 3. The spindle should be made of forged steel, turned up and screwed to fit its nuts and the long bearing.

The dotted lines in Fig. 3 show the nuts, washers, fork-end, and long bearing.

The spring, B, is attached to the lever, A, and the foot-rest, G, by hooks, as shown in

Fig. 4, the screw joint, H, being to regulate the tension of the spring. These hooks should be closed when the spring has been satisfactorily fixed. The tension of the spring can be determined by attaching weights at J, as shown in Fig. 5, by means of a cord passing over a pulley temporarily attached to the foot-rest, G.

When the weight of the rider balances properly with the weights at J, the reader will know that this is the weight required for the tension of the spring. This spring can be obtained of any spring maker by sending particulars of the tension, length, and thickness required. If any difficulty is experienced in obtaining this spring, a question in "Shop" will elicit the required information.

Cyclists will find that this little appliance, when fixed to their machines, will amply repay the trouble of making, besides giving the satisfaction of knowing that it is of their own manufacture.

The writer has made one and fixed it to his machine (a "Premier"), with the result that the vibration, especially on the arms and hands, is minimised to an extent which will hardly be credited, and he can, therefore, offer these suggestions to readers with the satisfaction of knowing that they will amply repay the labour expended, and that they may be instrumental in overcoming the difficulties encountered by many country cyclists by reason of rough and ill-kept roads.

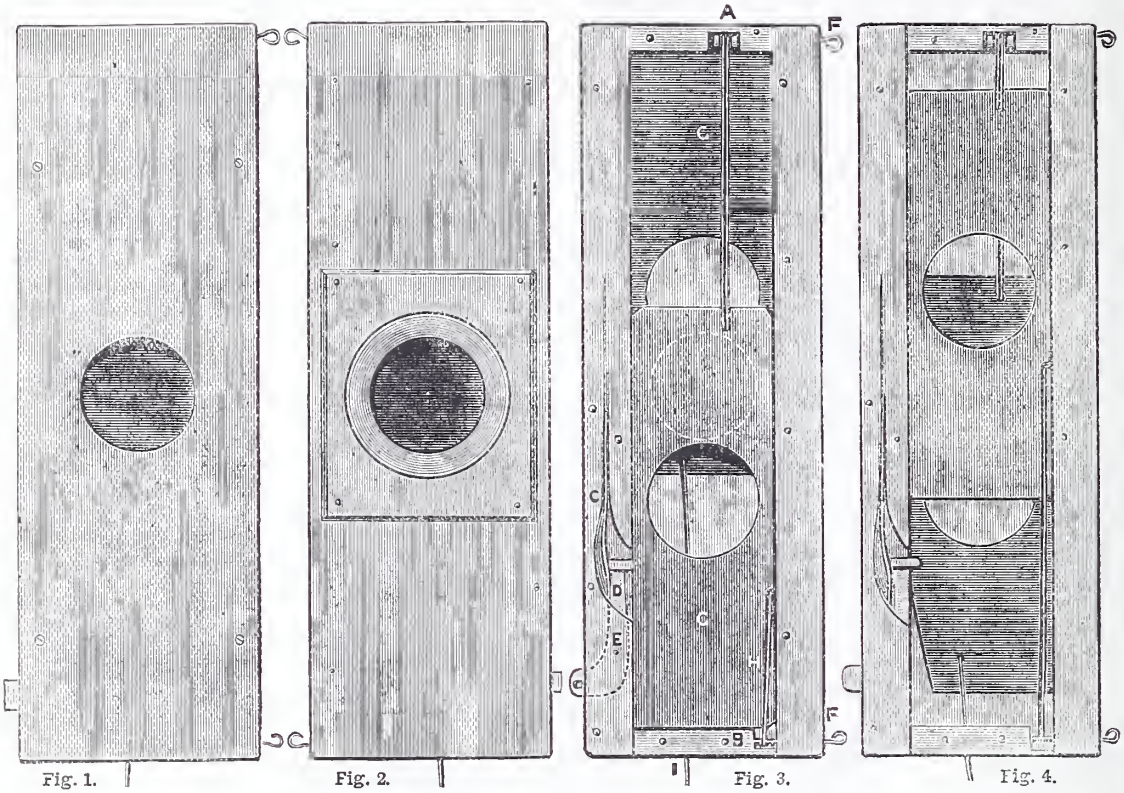



Fig. 1.—Shutter Front. Fig. 2.—Shutter Back, showing Collar to fit Lens Tube. Fig. 3.—Inside of Shutter as it appears after Exposure. Fig. 4.—Inside of Shutter as it appears when set for Exposure.

## AN EASILY-MADE INSTANTANEOUS SHUTTER.

BY FRANK S. MORTON.

EVERYONE who practises photography as a pastime, and many who do it as a business, have more or less occasion to use an instantaneous shutter. There are shutters complicated and shutters simple for all uses, and one of the principal requisites in their make-up is a certainty of action and a lack of jarring propensities, together with a method of regulating their speed for slow or fast exposures. To be complete, they must also be constructed so as time exposures can be made with them readily. An instantaneous exposure can be made with the very simplest arrangement, all that is required, of course, being a couple of pieces of wood with a hole in each, so arranged that one piece is attached to the lens tube and the other is slipped or dropped by it, so that when the two holes are opposite the exposure is made. But a shutter having all the qualities above mentioned must needs be a little more elaborate in its construction. A shutter possessing all these qualifications, and one which can be made at home by anyone, is shown in Fig. 1, the illustration being about half-size. But very little work is required other than can be done with the very simplest of tools, and if rightly made its action is certain and sure, its operation accompanied with not the slightest jar, and the regulating of the speed but the work of a moment. I can best tell how it is made by describing the one made by myself, and I will try and make my description clear, so that those readers of WORK who desire to do so can make one like it with no more difficulty than I had.

I first cut out two pieces of thin wood, $\frac{1}{8}$ in. thick and $2\frac{1}{2}$ in. by $7\frac{3}{4}$ in. Exactly in the centre of each I cut a hole 1 in. in diameter. I used a fret-saw, but careful work with a sharp pocket-knife will answer the same purpose. Of wood $\frac{3}{16}$ in. thick I cut pieces $\frac{1}{2}$ in. wide for the sides and $\frac{1}{4}$ in. wide for the ends, to form a box which, when put together, would be $\frac{3}{16}$ in. deep inside, $1\frac{1}{2}$ in. wide, and $7\frac{1}{4}$ in. long. Before tacking these side and end pieces in place, they were fitted for the working parts as follows:—The two end pieces were notched as shown in Fig. 3 at A and B—at A to allow room for a small brass pulley to run in, and at B in which to fasten a rubber band. The brass pulley may be omitted if too much trouble to make it, as the strings will work all right over the plain wire. The pulley makes things run easier, however. One side piece was cut with a fret-saw, as shown at C, and another cut was made through it at right angles with this, in which the brass catch, D, was to work on the pivot, E. This catch was made of sheet brass of the shape shown by the dotted lines, and had a piece of thicker brass soldered on the end which engages the shutter flap. It is held against the flap, and pressed into the notch at the right moment by the thin brass spring above it. This part of the shutter was all placed in working order before the side piece was nailed to the back; then the side and end pieces were nailed in place, and holes bored for the wires, F, F, to run in. These wires were allowed to project from the outside, to allow of more easy adjustment. Next, the two flaps, G, G, were made. These were made of thin hard rubber, but, of course, any similar material can be used. They were made $4\frac{1}{4}$ in. by $1\frac{1}{2}$ in., with a 1 in. hole in the centre of each. Notches were cut in the edge of one for the catch and the other for the rubber bands, and holes for the cords by which they are worked. To ascertain where these notches were to be cut, one of the flaps was placed in the bottom of the casing and pushed towards the end where the catch was located until the hole in the casing was well covered by the flap. Where the catch was, there the notch was cut The corner of this flap was trimmed off so as to pass by the catch smoothly without interfering with it. A small but stout string was then fastened to a hole in the other end of the flaps, and passed up under and over the brass pulley and back to the second flap, now laid in place, and tied there. In the tying of this string, care should be taken that when it is stretched taut the holes in the flap and the outer cases are exactly coincident. It requires patience to get them so, but the successful working of the shutter depends upon it. Now, from the notch in the top flap stretch a small elastic band, as at H, down to the notch in the end pieces at B, and slip in the wire to hold it in place. In the illustration but one notch is shown, but, to change the speed, have several cut along the edge, so as to give more or less stretch to the elastic, and, consequently, faster or slower working of the flaps. Different lengths and sizes of rubber bands can also be used for the same purpose. A string running from the under flap down through a hole in the end completed the arrangement, and the top was screwed in place. A collar to fit the lens tube was cut out and attached to the back, as in Fig. 2. To set the shutter, pull the string, I, until the catch, D, engages with the notch in the edge of the flap. To release it, press the projecting part

of the catch, which releases the flap, and the two are pulled rapidly past each other by the rubber band, and the exposure is made. Fig. 4 shows the shutter set for exposure, and Fig. 3 shows it after exposure is made. As the two flaps are pulled in opposite directions, they counteract any jar, and the camera is not moved a particle. Time exposures are made the same as the shutter is set for instantaneous. Pull the string until the shutter is open and hold as long as necessary, and then pull out until it catches. A little French polish puts a nice finish on the outside. Being light and of the right shape, the shutter can be easily carried in the pocket.

I have myself found this kind of instantaneous shutter extremely useful, and without doubt it will prove equally useful to such readers of Work as may be induced to make it and try it. It is possible that some may think the mention and description of a home-made appliance such as this unnecessary, on the ground that articles of this kind are sufficiently numerous, and are to be acquired at no great outlay. This is true, without doubt, but it must always be borne in mind that there is, generally speaking, far more pleasure in using any article, be it what it may, that one has made than one that has been acquired by purchase; and then, again, there are many who are compelled to look twice at a shilling before they part with it, and that to such as these, the instructions given will be of importance.

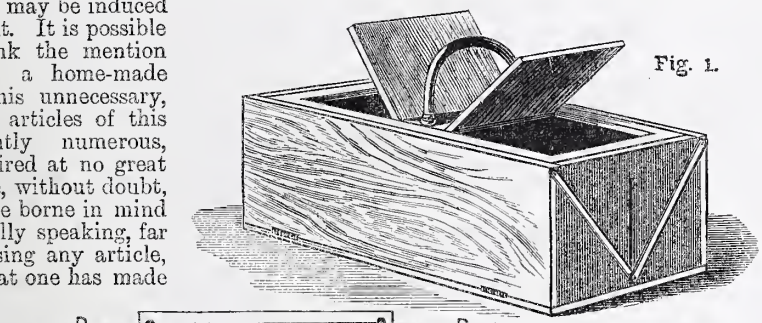


Fig. 1.

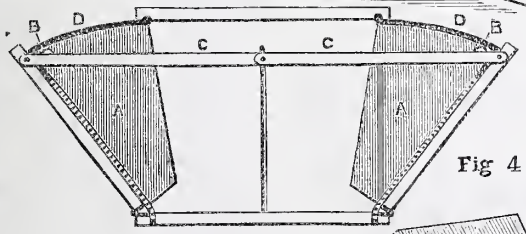


Fig 4

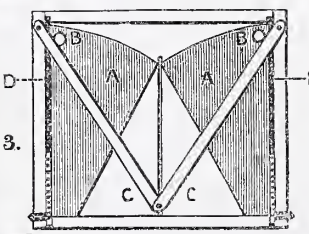


Fig. 3.

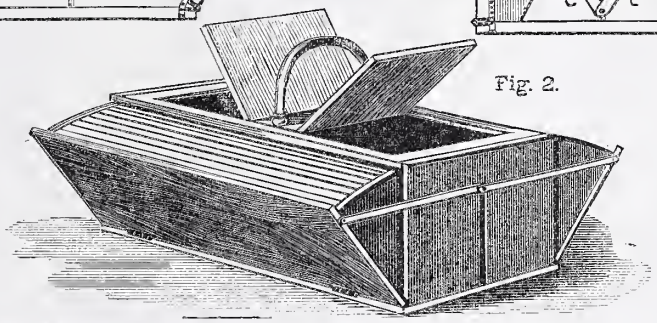


Fig. 2.

Fig. 1.—Casket with Lids open. Fig. 2.—Casket with Sides expanded. Fig. 3. —End Elevation of Fig. 1. Fig. 4.—Side Elevation of Fig. 2—A, A, A, A, Boards attached to Side Boards of Casket; B, B, Rods between Opposite Pairs of Boards; C, C, Movable Side Rails; D, D, Section of Laths to cover extra Openings. Dotted Lines connected with the last-named represent Elastic.

## AN EXPANDING TRAVELLING OR SHOPPING CASKET.

BY JAMES SCOTT.

Its Object — Extra Available Space — Construction — The Body of Article—Adjusting Bars—Coverings for Extra Openings.

*Its Object.* — The members of the working portion of the British community have a notable relish for partaking in excursions to the country or seaside which begin and terminate in a single day, and whilst travelling among them during a journey, it will be seen that there is sufficient evidence forthcoming to warrant the conclusion that working men (and women) lose not one atom of their appetites on such occasions. Sandwiches and bottled beer for the support and stimulation of the adults; sweets, cakes, and tarts for the delight of the youngsters: these constitute a large proportion of the contents of their bags, baskets, etc. And who shall say that these self-same bags, baskets, etc., shall return empty in their owner's possession? Toys, shells, and anything pretty, useful, or memorable, are, if opportunity offers for their security, concealed within them until home is reached.

This being so, it is impossible to say with certainty whether *paterfamilias* will be acting correctly by taking in his custody the market basket, or box, or other receptacle, seeing that to determine whether it will chance to be sufficiently large or not for the purpose may be a difficult task, and to take one of dimensions too bulky to carry about conveniently during the day is not desired.

Under these circumstances, then, a casket, box, or whatever else it may be termed, should be welcomed on numerous occasions as affording means of conveying, either there or back, eatables, drinkables, breakables, etc., the quantity of which may accumulate beyond expectation.

When once I see an ingenious idea embodied in an article of practical utility, and am convinced that that idea enhances that utility, I carry it in my memory. Thus, when my attention was drawn to a representation in a London tradesman's catalogue of a novel form of wicker-work basket, whose sides could be lowered outwards, and whose upright corner edges were covered with silk to prevent any article within from falling out, I decided to remember it; and although I am not by any means barren of original ideas, I fail to see any weak spot within which any reader may reasonably insert the wedge of disapproval in my determination to embody that idea, in a different form, for the use of whomsoever may consider it to contain any merit.

It was while working out a novel form of screen for my readers that I hit upon an arrangement whereby an expanding box might be constructed which could be adjustable to and fixable at any degree of openness within its extreme. That arrangement is shown in the sketches. To have silk or other fabric attached to the corners of a four-side dropping box would hardly be compatible with the rough usage such an article as this would be called upon to undergo; and in the original basket, so far as I could understand it, it must be either in its closed condition or opened to the extreme.

For shopping, too, my working friends might find the casket useful, for the cry would not then be, when the "missus" besought her husband to purchase a few luxuries on Saturday night, "Oh, let it be now; the basket's full"; as the "missus" would retaliate by condemning him for not making an expanding article.

Let us see where extended utility steps in by adopting this suggestion. Presuming that the proportions of the article are always as in Fig. 1, more commodities might be purchased than it would hold; and supposing that it were always as shown in Fig. 2, and that but few articles were purchased: in the former case an extra parcel would have to be carried, and in the latter a bulkier receptacle than required. The difference, then, is struck by having it to expand. This will be much better than carrying two boxes or baskets on the chance of filling both or one and a half.

*Extra Available Space.*—A glance at the drawings will show that the extra space available will be in area about equal to half of that contained within the article when in its smallest compass; in other words, the box is adjustable to an extent almost half as large again as itself, as shown in Fig. 1.

*Construction.*—It is time now that the details are dealt with. Before beginning, however, with them, let me tell my readers that the size of the article is purely a matter of personal consideration; and I shall say no more about this part than to add that the shallower and longer it is made the better, provided sufficient room is allowed for the play of the movable side rails. There is no need to advance reasons for these conclusions; the reader must trust my assertion.

*The Body of Article.*—A bottom board, two sides, and two ends will be required, all to be fitted in such a manner that the surfaces of the upright boards will be flush with the edges of the bottom board, and the end edges of the side boards flush with the surfaces of the end boards. Permanently join the ends to the bottom board and hinge the sides to the same. Fit a frame, having a middle cross rail, between the ends at the top. On each side of the middle cross rail hinge a lid as shown. To the inner side of each side board join a board of the shape A (Figs. 3 and 4) to it at each end, permitting it to work alongside the inner surface of the end board to which it is adjacent. Of the form of handle to be attached to the top I shall say nothing, leaving its choice to the reader's discretion.

*The Adjusting Bars.*—The adjusting bars, which open the two sides of the box to an equal extent, and can be used to retain them at any desired angle within the extreme limit, should consist of a pair of thin rails pivoted at their outer end to the edges of the side boards, and having a hole at each opposite end, through both of which will pass a small thumb-screw, the latter being connected with a nut on the inside of the

casket. A narrow slot should be cut in the end board, to allow of the free play of the thumb-screw. It will be obvious to those who give it a thought that the thumb-screws may be either loosened to permit the rails to work upwards and downwards, or tightened on to the nut to retain them in any desired position. I advise the use of a pair of rails and screw and nut on each side of the box, although not really essential.

*Coverings for Extra Openings.*—The detail which now remains for consideration is that of the covering of the extra openings. It should be plain to all that solid wood tops will be comparatively useless, by reason of acting as obstacles in the way of easy communication with the interior of the case.

After due attention, I have decided that very narrow laths glued to canvas and travelling along the inner surfaces of boards, A, A, A, A, will be the best for our purpose. To the under surface of the top framing securely fasten the upper lath (all of the laths combined should be just sufficient to cover the openings), and carry them over a rod (B, Figs. 3 and 4) fixed between the movable parts, A (of which I have not previously spoken). Attach two or more pieces of stout elastic to the lower edge of it, and finally fasten the remaining ends, without stretching it, to the bottom board. This completes the constructive details.

It may be preferred to discard the laths for some reason or another; if this is so, it will only be necessary to substitute some such material as leather-cloth in place of canvas and laths, and attach it in precisely the same manner as that described in connection with the laths.

I have studied simplicity of appearance for the purpose of making clear the movements of the article, and also to leave free scope for the imagination of my readers to add ornamentation in whichever shape or form they prefer.

## OUR GUIDE TO GOOD THINGS.

*Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 60.—The Copus-Booth "Ideal" Patent Castor.

Very recently two kinds of castors that seemed to present certain advantages have been noticed in Work. Here is yet another—the Copus-Booth "Ideal" Patent Castor, which is manufactured in all sizes and forms, plain and ornamental, by the patentee, Mr. Cyrus Copus, 22, Clapham Road, London, S.W., who will send a price list to any applicant, and will show it in action, affixed to tables and chairs, etc., to anyone who may wish to see it. The construction of the castor is very simple, as may be seen from Fig. 1, which shows a plate castor, to be screwed on to the bottom of the leg of any piece of furniture, but the principle is the same in this as in socket castors and any other form. From a horizontal plate at the bottom of a hollow cup, two ears or lugs project, through which an axis—also horizontal—is passed. This axis also passes through a ball, which forms the castor, revolving, *but in one direction only*, on the axis. Now it will seem somewhat strange to some readers that a castor which is an axle castor, and which will run only in a direction at right angles to its axis, should work satisfactorily when attached to furniture of any kind. The utility and good service of the castor depend entirely on the way in which the castor is fixed; and this

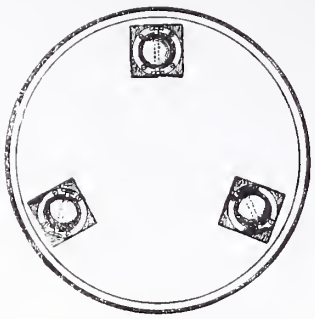


Fig. 2.—Mode of fixing Castors on Round Table.

must be done in a particular way, and generally in a different way, for different pieces of furniture. On looking at Fig. 2, showing how to fix the castors to a round table, it will be seen that the axes of the castors, shown by dotted lines, all point to a vertical line dropped from the centre

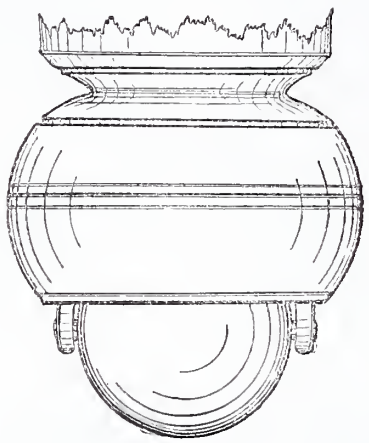


Fig. 1.—The Copus-Booth "Ideal" Patent Castor.

of the table; and in Fig. 3, showing castors fixed to a single chair, the axes of the front castors are parallel to the edge of the front of the chair, and the axes of those behind are at an angle of 45° or thereabouts with it. The proper way of fixing for any piece of furniture is shown in the

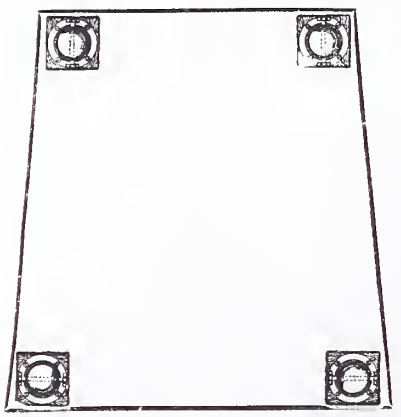


Fig. 3.—Mode of fixing Castors on Single Chairs.

price list issued by Mr. Copus. The prices per set of four range from 8d. to 6s. 6d., according to size and make. I have much pleasure in saying that the "Ideal" Patent Castor is by far the best thing of the kind I have ever yet seen, and should be—as it doubtless will be—in use in every house all the world over. The Editor.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Waterproof Cloth.—Despite the almost universal use of indiarubber material for waterproof coats and leggings on the part of landsmen, sailors—and, we may add, experienced travellers—still adhere to the more lasting, if cumbrous, fabrics composed of calico or similar material, submitted to a process in which rubber finds no place. This results from two reasons: one, that the beautiful light cloths produced by the rubber factories will not stand much wear and tear; and the other, that a hot climate deteriorates them rapidly, however well faced they may be. A third reason is, of course, the price demanded for really good waterproofs. Many people, moreover, are anxious to know how to make waterproof cloth for purposes other than clothing—such as light tents, awnings, etc. It may, therefore, be useful to state that the best material for both uses is strong grey or twilled calico, made up into the garments, if for wear; or kept in the piece, if for conversion into awnings, etc. When a more substantial cloth is required—such as for travelling tents, etc.—a light canvas may be used, one number lighter than that usually supplied. The cloth being ready, it should be thoroughly dipped in bullock's blood until well saturated, and then hung out to dry in a strong current of air. When perfectly dry, the cloth should be slightly worked with the hands, so as to soften it. Then take ordinary linseed oil and litharge, in the proportion of twenty parts of oil to one of litharge, and mix thoroughly, applying this to the prepared cloth. Repeat the coating twice or thrice, as seems necessary, allowing each coat to dry thoroughly before the next one is applied; but do not expose to the sun. When completed, the cloth will be thoroughly waterproof.

Aquarium Cement.—A good many of our readers take an interest in aquariums; and how to cement the glass sides in an absolutely waterproof manner is, to many, an unsolved problem. Most of the recipes given, although of easy application by manufacturers, are by no means available to amateurs. The latter may be glad to know that twenty-five parts of gutta-percha, carefully melted, seventy-five parts of ground pumice-stone, and one hundred parts of Burgundy pitch, all mixed and melted together, form the best known cement for the purpose. A little deftness in applying (after the fashion of puttying glass in an ordinary window-frame) is necessary; but once properly in place, it forms a leak-defying cement.

Gutta-Percha Substitute.—The growing want of a substitute for gutta-percha is evidenced by the fact that the Société d'Encouragement pour l'Industrie Nationale, of Paris, is offering a prize of 3,000 francs for the discovery of a substance even partially taking its place. Failing this, the prizes will be awarded to anyone giving the most practical hints upon the cultivation of the gutta tree. A second prize of 2,000 francs will be given for the best device for measuring the insulation of the various portions of an electrical plant while the current is passing. The substitute for which the first prize is offered may be natural or artificial. Communications must be sent before the end of November, 1892, to 44, Rue des Rennes, Paris.

Wants.—Amongst the various articles which are advertised for in the technical journals as desiderata are a good process for the Recovery of the Precious Metals, a New Lock, an Improvement in Wood Flooring, and an Improved Brick- and Tile-Making Machine. One would almost imagine that practical finality, in some of these at least, had been reached. But there is evidently scope for inventive genius in directions not apparent to superficial observers. To our minds, the most obvious want of the day in domestic matters is an *absolutely* safe and cheap paraffin lamp. Its principal desiderata are—a provision against any rise in temperature in the oil reservoir, and its immediate extinction when upset. Such lamps can be bought, but the price of present patterns is prohibitive.

## SHOP:

### CORNER FOR THOSE WHO WANT TO TALK IT.

** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**China and Glass Drills.**—W. J. C. (*Jersey*).—You seem to have misread my replies most thoroughly; (*a*) I did not say that *I* wished to try experiments, but if *you* wished to do so, I would forward recipes. I certainly have not the time to try them. (*b*) Again, read reply to H. S. B., and you will see I did not say two different kinds of drills are used for glass and china. I know of only one drill (or bit, which you like to call it), and that, as I said in reply, is a diamond chip mounted in tin holder. You do not say what your difficulties are. Finally, although I do not object to writing direct, I prefer answers to appear in "Shop," so that all can share the information.—W. E. D.

**Heat for Hatching.**—J. W. C. (*Tottenham*).—The temperature ought to be maintained as nearly as possible at 98°. It might, on occasion, rise to 100° without injuring the eggs, but it should never go as high as 104°. These temperatures are on the Fahrenheit scale.—J. L. D.

**Varnish and Paints.**—TRIO.—In reply to Question A: Oil stain is most suitable for floor margins, etc. You can buy "antique" oak (oil) stain, and this, thinned with turpentine, will make various depths of colour; *burnt Turkey umber* (in oil), used with turps and varnish, also makes a rich and warm stain, hut to those readers who want, before all things, simplicity and cheapness, there is nothing better than a small sample tin of Mathieson Bros.' (Ardrossan, N.B.) dark oak "scumhling." This only requires thinning with good linseed oil, or oil and turps mixed, to be ready for use, and will he sent, carriage paid, for 9d. Further particulars in fifth paper of "Graining" series. For finishing the work, two coats of *hard-drying* oak varnish is best and cheapest in the long run. If one coat of varnish only can be given, the stain must be once coated with warm "patent" or glue size. If a *water* stain is used, the work must be twice sized; hut when size is used, the varnish does not wear half so well, as it forms a film between stain and varnish, instead of these two hecoming one mass—like when painting successive coats of oil paint. A dirty-looking floor will stain *dark* to most advantage. The crevices should be stopped with slips of wood, wedged and glued in, and then chiselled or planed off when set. Query B: The lead work of your stained glass should be ruhhed with turps and rag, and cleanly painted once with quick-drying white lead paint; then a hare coat of oil gold size, and gilded with gold leaf (see "Shop," replies on gilding). Finish with a coat of carriage varnish, stained (if "old gold" colour is desired) with a little finest hurnt Turkey umber. Question C: The answer in "Shop," No. 59, p. 112, "Imitation Marhle," contains all the desired details of painting new wood which you ask for. H. B.'s was a clock case, your article a hookcase; hut the nature and treatment are identical, the colour only differing. Your successive coats should he brought on a little darker than the desired finishing enamel colour. Thanks for your tribute to "WORK's great usefulness"—your "trio" of queries is a very practical demonstration thereof.—F. P.

**Electro-Deposition.**—W. G. (*No Address*).—You make the very common mistake of confounding the electro-motive force of a hattery with its strength. The electro-motive force of a hattery is the pressure of the force in its closed circuit, and is nearly analogous to that of a head of water. This E.M.F. is the same in a tiny cell made from a pipe howl, and one made up in a 10 gallon jar. The strength of a hattery current is not only its E.M.F., or difference of potential between its poles, hut also its volume of current. It is not only the head, but also the volume impelled hy that head. I cannot in this small space answer all your questions relative to the deposition of "gold, silver, copper, iron, nickel, etc." The E.M.F. needed to decompose a solution of any of the metals and deposit the metal in a reguline condition, varies considerably with the composition and tenuity of the solution, and is found by practice. It is usually very low, and rarely exceeds some 3 to 4 volts. The E.M.F. of the current is found hy a volt-meter, and the volume hy an ammeter. Those instruments will he described in WORK when space can be found for the articles.—G. E. B.

**Fixing Pencil Drawings.**—NO NAME.—There are several solutions used for this purpose. The following are the best:—(1) Prepare thin water starch the same as the laundress does, of such a strength as to form a jelly when cold. (2) Thin isinglass reduced hy water to a size. (3) Rice water. These solutions are all applied in the same manner. If the drawing he small, you can immerse it for a few moments in a hath of any one of these you select; if large, apply with hroad camel-hair hrush, as in varnishing. There is no satisfactory mode of fixing crayons.—F. B.

**Toothed Wheels.**—BOWTON LAD.—The question you ask, "How to mark out toothed wheels," is not quite explicit enough, as there are so many different kinds of wheels and teeth, a description of which could not be condensed into the limits of a whole number of WORK, let alone the limited space of "Shop" at disposal. I will explain the method of marking out a simple form of teeth on a spur-wheel, which I hope will be sufficient for your purpose. The term "pitch line or circle" will have to be used somewhat frequently, so I will commence hy describing what it is and how it is obtained. Suppose there are two shafts, *a* and *b*, Fig. 1, to be connected, the one to drive the other at the same speed, hut in an opposite direction to itself. The simplest way would he, supposing the shafts were near enough, and if friction alone could he relied on, to key discs of the same diameter on the two shafts forming their point of contact in *c*, then the one would turn the other as desired. In practice, however, it is found that friction in such cases is useless. So the easiest method of overcoming the difficulty is to cast the wheels with teeth on. Though the outer ends, or faces, of the teeth of each of the wheels overlap the pitch circle of the other wheel, the diameter is always measured, not over the teeth, hut on the pitch circles, which are represented by the two circles, Fig. 1, which, on the teeth of cast-iron wheels, are only imaginary lines, though on the pattern they should he distinct, as most measurements are made either

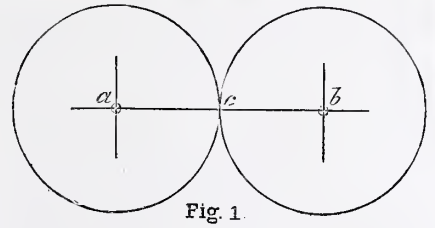
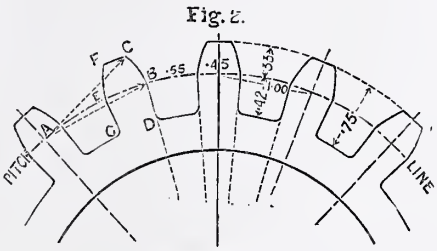



Fig. 1.

Fig. 2.




Toothed Wheels.

on or from them. I have here taken the case of the two shafts going at the same speed; hut suppose *a* were to drive *b* at one half its own speed, then the wheel on *b* would have to he douhle the size of the wheel *a*, measured on the "pitch line"—that is, as if they were two discs just touching. Suppose the big wheel on *b* changed to *a*, and the small wheel on *a* to *b*, then the shaft *b* would run twice as fast as *a*. The greater the pitch of the teeth of a wheel, the more the points overlap the pitch circle of the wheel it gears with. So that it would not do to calculate the diameter on such a shifting quantity as over the ends of the teeth. I have lengthened out these remarks to engraft the fact of what the pitch circle really is, and why the diameters of wheels are measured on them. The "pitch" of the teeth is the distance between the centres of two adjacent teeth or, for facility in measuring in practice, from the edge of one tooth to the corresponding edge of the next *on the pitch line*. Having decided on the diameter of the wheel and the pitch of the teeth, you proceed as follows:—Draw the "pitch circle" (Fig. 2) equal to the diameter of the wheel wanted, and then, with a pair of spring dividers, set off the pitch round the circle, taking care that the compass point in the last division coincides with the point from which you started—that is to say, the divisions must be exact, and a little extra time spent in setting them out will well repay the trouble. Molesworth, in his "Pocket-book of Engineering Formulæ," gives a simple way of ohtaining the shape of the teeth, the dimensions of which are as follow:—

| | | | |
|---|---|---|---|
| From the pitch line to the top of tooth | = | pitch | × 0·33 |
| Total depth of tooth | = | ,, | × 0·75 |
| Thickness of tooth on pitch line | = | ,, | × 0·45 |
| Space hetween teeth on pitch line | = | ,, | × 0·55 |
| Thickness of rim of wheel | = | ,, | × 0·45 |

If we now add ·33 of the pitch to the radius of the pitch line, and describe a circle, we shall have a boundary which gives us the limit of the ends of the teeth. Similarly, if we diminish the pitch circle radius by ·42, and describe another circle, we shall ohtain the hottom of the tooth. And by again diminishing this last one by ·45, we shall ohtain the thickness of the rim. We must now proceed to set off the half of ·45 (the thickness of tooth) on each side of all the pitch divisions and on the pitch circle, when we shall ohtain the thickness of all the teeth, as at B E, Fig. 2. I may here remark that the part, B E F C, outside the pitch line is called the face, and B E G D within is the flank. In order to ohtain the curve, B C, of the face, we take the centre of the next tooth on the pitch line as centre, and A B as radius, and describe the arc, B C; in a similar manner the face curves of all the other teeth are ohtained. The lines, B D and E C, forming the flank, are simply drawn from E and B to the centre of the wheel, and the corners, G and D, rounded off. From these particulars, you should he able to set out teeth of this form, which are called "straight-flanked epicycloidal teeth," and are almost the simplest form of teeth used. I have chosen to illustrate these, as "Shop" space, as hefore mentioned, is too limited to allow of the somewhat intricate description of some of the more general forms employed. There are also the teeth of bevel and mitre wheels to he described, so I should strongly advise you to ohtain a hook on the subject, as "Elements of Machine Design," hy Unwin, and study the subject thoroughly. "Machinery and Millwork," hy Professor Rankine, also goes into the subject at some length.—P. B. H.

**Water Motor.**—H. V. A. (*Newton Abbot*).—I could not give any guarantee of the efficiency of the motor named. There is, however, no difficulty in getting good water motors. You should write to Messrs. Gwynne & Co., hydraulic engineers, Hammersmith, London, for particulars.—F. C.

**Red Stain and Polish.**—E. J. A. (*Southampton*).—The red stain as seen on the inside of drawers, hookcases, etc., which does not show the grain of the wood, is usually done by mixing Venetian red with patent or glue size, and applied with a hrush. Personally, I prefer to mix with polish or varnish, one part polish to three parts spirits; though I generally save and use for such a purpose any waste stuff, such as may he left from washing out varnish hrushes, pots, etc. If it is desired that the grain of the wood should show, this is done hy giving one or more coats of polish or varnish, which has been previously stained by adding a few drops of red stain, made hy putting twopenny-worth of Bismarck brown in a quarter-pint bottle of methylated spirits. I cannot tell you any particular shop in your neighbourhood where the Bismarck brown may he hought, hut it is sold hy most oil and colour merchants and druggists that sell shellac and spirits. It will be found a most useful stain if made and used as directed. For particulars of how to polish the outside of your bookcase we must refer you to the series of articles on French polishing, which have appeared in Nos. 105, 108, 115, 119, and 123 of WORK. The latter, which has appeared since your letter was written, treats of one of the final stages—*i.e.*, spiriting off.—LIFEBOAT.

**Electric Lights.**—SEPTIMUS.—(1) You ask, What candle-power incandescent lamp will light an ordinary room? This depends upon what your idea of an ordinary room may be, and what sort of light you expect. You should give the size of the room, and say how it is lighted. An ordinary room 12 ft. hy 12 ft. by 10 ft., will require three lamps of 10 c.-p., or two lamps of 16 c.-p., placed at a height of 7 ft. 6 in. above the floor level. (2) Do you think ten (45 volt, 12 c.-p.) lamps would light, ordinarily, a six-roomed house? Here, again, my reply must be qualified hy an explanation of what is meant hy a six-roomed house. If the six-roomed house is at all like a large number of eligible jerry-built structures erected in London for the accommodation (?) of workmen, consisting of a front parlour, 8 ft. hy 8 ft. hy 9 ft.; a back parlour, 6 ft. by 9 ft. hy 9 ft.; a hack kitchen, 4 ft. by 6 ft. by 7 ft., with bedrooms over to correspond, then we might manage to light up the house with the number of lamps mentioned. But, if the rooms are large, and you wish to have them well lighted, you will want at least three such lamps in each of the principal rooms. (3) If you have a dynamo of 120 c.-p., you should have a ½ horse-power Otto gas engine to drive it, as 120 c.-p. will ahsorh rather more than ½ horse-power and an Otto will work up to meet the excess. (4) I do not care to recommend a water motor in your case, as you would not get sufficient pressure to work one economically.—G. E. B.

**Galvanic Battery.**—H. A. O. (*Finsbury Park*).—Although you ask for a galvanic battery, I gather from the other part of your letter that you really want a medical coil. This will he fully described and illustrated in a series of articles on coils, forthcoming when space can be found for them.—G. E. B.

**Banjo.**—H. H. P. (*Bristol*).—If you put a 16½ in. finger-board to a 12 in. hoop, the strings certainly will wear longer. If you tune your 18 in. by 12 in. and 16½ in. by 12 in. hoth to concert pitch, you will find, providing you have strung them both with strings of the same gauge, that the 16½ in. one will feel much looser to the touch, and will, in my opinion, be inferior in quality of tone. I should myself string the 16½ in. one with strings a little thicker than those on the 18 in., and thus make up for the difference in the lengths of finger-board. By doing this, the pull would feel about the same as the 18 in. one; the wear of the strings, I should say, would he about the same. Stringing the short banjo with heavier strings would increase the tension of them to get them up to pitch, so in that case there would be really no advantage. Putting on strings of the right thickness has a lot to do with the wear of them. If the strings are too thick they will not stand the increased tension to pull

them up to pitch, and consequently break. Again, the quality of the strings has to be taken into consideration. Some players *will* buy the cheapest strings they can procure; the consequence is, they are continually breaking, and no wonder—how can a string costing 2d. be expected to be as true and wear as well as one costing 4d.? The higher-priced string is really the cheapest in the end, providing the dealer selling them is conscientious, and tests the strings he buys from wholesale houses before offering them for sale to the public. No one would believe, except those who have experienced it, the trouble it is for a maker or dealer to get really good strings for the banjo, and which can be sold at a reasonable price. Strings from a certain maker may be very good, but the next consignment from the same maker may turn out worthless. Then, again, some players' hands perspire very much in warm weather, which means to them an endless breaking of strings; some do not keep their nails short enough, and therefore cut the strings; others do not acquire a proper touch; the nut, tail-piece, or machine-head (if one is used) may have sharp edges and cut them: so you see there are several points to be studied in stringing that much-abused and maligned (but very popular) instrument—the poor old banjo! Wire strings on an ordinary banjo are an abomination, and are not suitable for an instrument without raised frets. There is a string made, or supposed to be made, from Japanese silk, which stands very well, and would be very suitable for players with warm and perspiring hands. The tone is not so good in quality as gut, and when it gets a bit frayed the tone seems to leave it altogether, which are its disadvantages; on the other hand, it stands well. I have also tried a string made from silk exactly similar to "Acribelle" string for the violin, but thinner. The tone of this is also not so good, and pulls much harder than gut, which would prove a great annoyance to a *good* player. On a banjo with a short finger-board the fingering for the high notes would be closer, the frets not being so wide apart as on a long one, which would be considered a disadvantage by some players. I should certainly say the 18 in. by 12 in. "jo" would be the most saleable. At any rate, it is with me.—J. G. W.

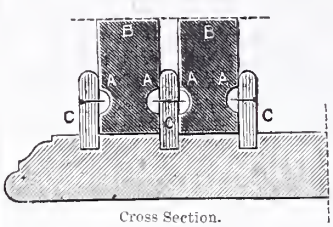
**Banjo-Making.**—A. E. (*London, N.*).—To answer your query in full would take up too much space here. Refer to back numbers for July 27, 1889, November 2, 1890, Nos. 70, 75, 79, 81, 93, 106, 109, 113, 121, 124. I presume, from your letter, that you are a novice in banjo-making, so should advise you to make an instrument not quite so elaborate as one with an engraved metal finger-board and engraved hoop. You would then be able to see and correct the little faults which would be almost sure to appear in your first attempt, when making your second and more elaborate instrument. I must refer you to the articles that have appeared in WORK for instructions how to engrave your hoop. Metal facings on the handle are generally made of German or nickel silver, and fixed on by drilling a series of holes in the metal, countersinking the holes a little to receive the heads of the screws, then filing down screw-heads level with finger-board. Use screws made of German silver. To engrave and nickel-plate the metal as you propose, you would have to solder pins on the underside of metal to drive in and fix to the handle. You would not be able to fix it from the face side after it was plated. I should advise you to use the German or nickel silver in preference to the last-mentioned; you can true it up and make a good job of it, which is more than you could do with the plated face. If you intend to use gut strings, do not fix a machine to your banjo. They are a nuisance; you will rarely find a player of experience using them. They are all right for show, but you should make appearance a secondary consideration, placing utility and comfort in playing first.—J. G. W.

**Iron Feet for Boots.**—L. L. (*Nottingham*).—The makers of the iron feet marked $\frac{\text{U. \& Co.}}{\text{L}}$ are Ullathorne & Co., 9, Gate Street, London, W.C., and Albert Street, Birmingham.—W. G.

**Instruction in Fretwork.**—T. M. (*Birmingham*).—There has not, so far as I am aware, been any article in WORK specially devoted to elementary instruction in fretwork; but from the very first number designs for this art, correspondence regarding it, and useful suggestions for those who follow it, have been of frequent occurrence—so frequent, in fact, that it would be useless for me to attempt any list of them. T. M. would find an advantage in getting a complete set of the back numbers.—M. M.

**Picture-Frame Gilding.**—G. F. R. (*Redditch*).—On p. 262 (third column) you will find preparations for oil-gilding in their order. First, thin white: then stop up defects in frame; second, clay; and so on. Thick white is only used as a solid foundation for burnishes or flat work, and must not be used on ornamental work, as it would fill up the ornament; also matt and burnish gold-size are only used for burnished parts of frame or flats that fit inside other frames. Clay is procured at the artists' colourman's—Rowney's, for instance—and is ground fine by machinery, known as gilders' clay. Make a weak size (such as described on p. 263) for finish size; and as this is to be put on after gilding, a little colouring matter is mostly used. A few drops of white lacquer and metbylated spirits in the finish size will give a white appearance to the gold, or a little saffron will give a yellow tinge, according to taste. Spanish annatto is sometimes used, or other dyes.—H. E. M.

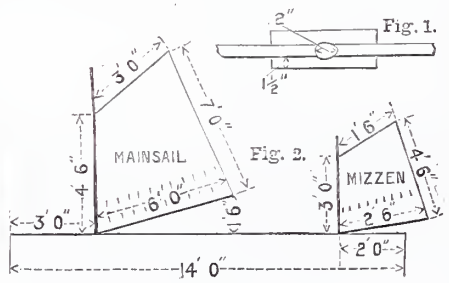
**To Guide Sliding Doors of Bookcase.** — A READER OF "WORK."—Perhaps you may be acquainted with the ordinary way in which sliding doors of bookcases are made to travel. The sketch is a cross section illustrating the details of the method, with the exception of the pieces A, which I have introduced, and which I will presently explain. Your grievance seems to be centred in the annoyance created by the difficulty of sliding a long, narrow door comfortably and regularly. There is one way by which I think you may effectually overcome the difficulty; and in full justice I must say that my present suggestions result from the simple but excellent device for running drawers truly given by E. W. in No. 121, page 258, Vol. III. B, B, represent the thicknesses of doors; C, C, C, of door runners fixed completely along the front at top and bottom of the top carcase of the bookcase; and A, A, A, A, are the beads screwed along the runners in the positions shown in connection with them. You must groove the top and bottom styles of each door, and place the beads loosely into the grooves, after having taken note of the correct distance each is situated from the outside bottom and top edges of the doors respectively. Then fit the doors within the runners, and screw A, A, A, A, in position, along which will then travel the doors; A, A, A, A, serving as guides to retain them as parallel as possible to the plane of the bookcase. If guides could be fitted to the middle of the doors, so much the better; but with only the amount of opportunity I have at present, I cannot evolve any convenient way. You will find these details rather "ticklish" to fit, but undoubtedly they will tend to prevent the stickiness you righteously complain of.—J. S.



Cross Section.

**Sliding Doors of Bookcase—A, A, A, A, Beads, as Guides to be fitted to Top and Bottom Runners respectively; B, B, C, C, C, Door Runners.**

**Canvas Canoe Sail.**—T. R. (*Stoke Newington*).—I do not think it would be safe to use a sail on a canoe as described, for use on the sea; but it might be used with a sail as follows on a river if the captain could swim. If a sailing canoe is desired, I should advise the following alterations to be made: 2 ft. 8 in. wide, with straight stern-post for fixing rudder to; also make provision for fixing two masts, as shown in Fig. 1., and in position shown in Fig. 2. The foot of mast should rest in wood shoe in keel. I think a standing lug-sail would be best, with two reefs in mainsail and one in mizzen. When trying the sail, T. R. could trim the canoe with a few sand-bags as ballast. A canoe like this would easily accommodate two, and would be much safer, the crew acting as shifting ballast.—J. B. F.



A Canvas Canoe.

**Watch-Case—Engine-Turning or Engraving?**—T. H. (*Ballina*).—Which is it that wants doing to your watch-case? If it is engraving, send to Corke Brothers, 29, Northampton Square, Clerkenwell, E.C. If it is engine-turning, then send to J. A. Groom, 8, Sekforde Street, Clerkenwell, E.C. To either you can send the watch-case with perfect confidence, for it will be well and reasonably done. If you particularly desire an estimate, then send a sketch of its size, with full details, and you will doubtless obtain one by return of post. Insufficient details are sent in your letter for forming any idea of cost.—H. S. G.

**Improvements on Patents.**—IDEAS.—It is quite within the province of any person to make an improvement or improvements on an existing patent or patents, but he will not be allowed to apply it or them to, or use them with, the original patent during the duration of the patentee's exclusive right, except by a licence from the owner of the existing patent. Justice Tindal has said: "When a party has obtained a patent for a new invention made by his own ingenuity, it is not in the power of any other person, simply by varying in form, or in other immaterial circumstances, the nature or subject matter of that invention, to obtain either a patent for it himself or to use it without the leave of the patentee, because that would be, in effect and substance, an evasion of the right." Vice-Chancellor Malins has held that "No doubt a man may make an invention which is partly covered by an existing patent, but he cannot use it without the licence of the patentee. He may wait for the expiration of the patent, and take out one himself, if his invention be novel; and that patent will be valid." Lord Westbury has said: "It is extremely desirable that when a beneficial idea has been started by one man he should have the benefit of his invention, and that it should not be curtailed or destroyed by another man simply improving upon that idea; but if the idea be nothing in the world more than the discovery of a road to attain a particular end, it does not at all interfere with another man discovering another road to attain that end." Lord Chief Justice Hope has said: "A patent cannot be taken out solely for an abstract philosophical principle—for instance, for any law of nature or property of matter apart from any mode of turning it to account in the practical operations of manufacture or the business and arts and utilities of life. The mere discovery of such a principle is not an invention in the patent law sense of the term without the application of the principle to a practical object and end; and without the application of it to human industry or to the purposes of human enjoyment, a person cannot, in the abstract, appropriate a principle to himself." Chief Justice Eyre has said: "Undoubtedly there can be no patent for a mere principle, but for a principle so far embodied and connected with corporeal substances as to be in a condition to act and produce effects in any art, trade, mystery, or manual occupation, I think there may be a patent." Justice Kekewich has held that "A man may invent an idea or a principle—that is to say, a man in his studio may by study, with or without illustrations and experiments, evolve the principle or idea that such a result may be produced by such and such means, and that is, in truth, an invention, supposing it to be new. But that is not an invention according to Patent Law. It is not an invention for which he can receive any protection. In order to bring himself within the law, and reap any advantage from his invention, he must apply it in some concrete form." It should be well understood that a legal patent cannot be obtained for an "idea," which is not by any means an invention or a "property," and can only be made one by giving it a practical form—*i.e.*, by showing the mode in which the "idea" can be made useful, or in other words, by devising a means or mode by which this "idea" may be brought into a practical shape. Unless this is done, the "idea" is useless, of no value to anyone, and must remain so until it receives a practical development. Now, if our correspondent has embodied his "ideas" of improvements in a complete manner, so as to be satisfied of their practicability, and got them into the shape of models or drawings to prove that they are practicable, then he should ascertain that they are novel, and likely to be useful. When, however, he has done this, there still remains the difficulty of having to deal with unprotected inventions, and having to submit them in this state to the inspection and *bona fides* of others whose interests are not those of the inventor. Most persons would say, "Apply for 'provisional protection.'" But then comes the question, is it worth while to do so? seeing what views the law holds on the subject, and the possibility of the existing patentees declining to take them up? Not knowing in what direction our correspondent's improvements lie, we are unable to give him any useful advice, as it might turn out that the patents he alludes to are invalid, in which case the advice would be quite different, cases are so dependent on circumstances. The best thing we can recommend our correspondent to do is to refer to, and read and study, the article relating to patents in WORK, No. 44, Vol. I., p. 694; the reply to R. S. W. (*Leeds*) in No. 109, Vol. III., p. 77; and the reply to F. S. S. (*Leicester*) in No. 118, Vol. III., p. 222. The want of general knowledge of, and a correct understanding of, patent law and its requirements, are great difficulties to inventors, and these are greatly increased by the ignorant, incapable, and presumptuous crudities and lucubrations of amateur dabblers and incapables, who are so fond of parading their ignorant *dicta* as proofs of their erudition and capability, which act prejudicially to the interests of such as are foolish enough to be caught by them.—C. E.

**Unworkable Gold.**—SILVERSMITH.—The quantity of gold in question being so small, it will be cheapest to sell it to the refiner; but if you have a small melting-pot to hand, and can run it down in a furnace where the fumes can be carried away by the flue, then re-melt it, and when fluid use corrosive sublimate as a flux. Be very careful with this, for it is a deadly poison; and the chemist, before selling it, must be satisfied that it is for a genuine purpose. Have you tried stirring it up, when in a fluid condition, with sal-ammoniac? There is a chance that this might make it workable. Details of the colour and grain of the fracture would have been of assistance, for other causes may be at work than the two I have in my mind in advising the two fluxes above; for example, certain proportions of copper in alloys will very often make gold difficult to use. Your way of making rings from a grain of gold is the same that sailors have when they wish to make a silver coin into a ring—viz., by driving a hole through the centre and then

hammering it into shape on a marlinespike. This is too rough a method for anything but fine gold or silver. Why not follow out the method given in two replies to INDEX on p. 357, No. 74, and p. 648, No. 92, of Vol. II. of WORK? In these I warned him, too, of the very fix you are in with your bad gold.—H. S. G.

**Waterproof Sole Leather.**—A READER.—You ask "the best way for rendering sole leather—that is, hard leather—used in pump work, waterproof." Now, as all boots or shoes, made pumps, are made inside out, and turned to their right side after they are sewn, hard leatber is never used. Moreover, pumps are nearly always used for dancing and evening wear, where waterproofing would not be necessary. I hope I may be excused for the above, but I mention it that I in future may answer a question without jumping at a conclusion; for in this case my conclusion is tbat you want waterproof leather for washers, etc., in suckers of water pumps (plumbers' work). For this purpose, get a shallow vessel—as a frying-pan—and put some water in it. Put some tallow and neatsfoot oil (equal parts) into a jar, or any stone vessel large enough to receive the pieces of leather; put the leather in the jar with the oil and tallow, and jar into the pan, and put it on a slow fire to simmer (not boil). It is best not to stand the jar on the bottom of the pan, but on a piece of wood ½ in. thick. It will not be necessary to use leather very hard, for, when taken out of the oils and let get cold, it becomes harder than it originally was. The stout but inferior portions are most absorbent, as the fibre is not so dense. It will not want to be left in the oils—only about five minutes—and when taken out it can be thrown into warm water. This will take the surplus grease off the outside, and when tbe water is cold it can be taken off the top, and put again into the jar, ready to use again.—W. G.

**Two-Foot Slide Rule.**—L. W. (*Somerset*).—I may say that with this rule there can be a great variety of calculations made upon it. In timber measuring L. W. will be able to measure up boards and planks, round timber and round taper timber, as well as painters' and glaziers' work, tiling and slating, bricklayers' work, mensuration, etc. Also liquid measure and the calculation of the mechanical powers, such as the wedge, levers, wheel and axle, etc. There is no doubt that to have an instrument like the slide rule it may be very handy when one is in a hurry. I may say that I never use one myself; not that they are inaccurate—far from it; if the slide is worked properly, according to Rabone's instructions, everything will be well—but one might make a mistake. I would sooner depend upon calculating; but, of course, that is only my opinion, and everyone has his likes and dislikes on such matters. I cannot give here the tables for calculating by the slide rule, that would be an infringement on Rabone's copyright; but if L. W. would like it, I will send him a book I have on his slide rule, if he will pay the postage.—T. R. B.

**Artificial Foot.**—DUNDEE.—You cannot do better than write to James Gillingham, surgical mechanician, Cbard, Somersetshire, who has made this subject his special study.

**Surveying.**—KELLY.—A cheap way for you to gain information would be to write to the Civil Service Commissioners, Cannon Row, London, W.; and if, after receiving their answer, you do not think tbe matter is sufficiently clear, I should advise you to get Cassell's "Guide to Employment in the Civil Service" (3s. 6d.).—E. D.

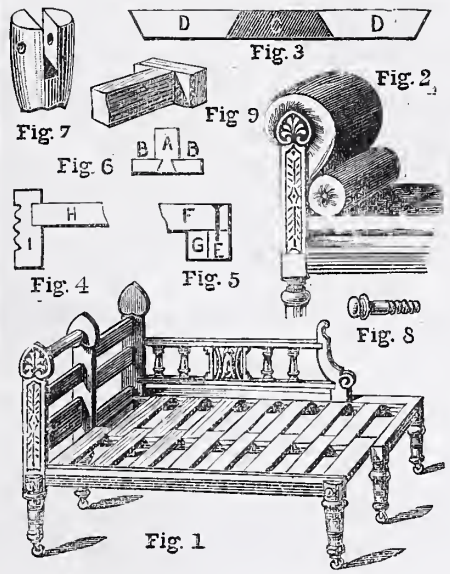
**Sundial.**—A. R. (*Birmingham*).—You will find the information you want in Vol. II., pp. 18, 104, and 139 (Nos. 54, 59, and 61). The first article treats of horizontal, tbe other two of vertical, dials. Probably that in No. 54 will serve your turn. When you have read it, you will see whether your gnomon will suit, and why it will or will not. For engraving on your sheet of brass you will need a graver, which you can buy at any tool maker's in your town—say at Townley's in Ball Street.—A. Y.

**Angle for Lathe Centres.**—INQUIRING SUBSCRIBER.—There is no settled standard for the point of the lathe centres, but there ought to be, as it is impossible to ensure your work running true if transferred to another lathe, which bas the centres of a different angle. In America the angle of 60° is almost universal, and all American mandrels, taps, etc., have centres in them of that angle. This angle is thought rather too sharp in England; yet, from the convenience of having a standard, and from the ease with which a gauge for 60° can be made in a bit of sheet metal with a "three-square" file, this angle appears to be gradually becoming the standard in England too.—F. A. M.

**Golf Balls.**—GOLFER will probably find his difficulty disappear if, instead of softening his gutta-percha by immersing it directly in the water, he softens it in a *water-jacketed* vessel, such as a glue kettle, as tbe gutta-percha softened by this means will be perfectly dry. In the absence of a glue kettle a double porridge pan would be found to answer equally well; or a tin can of sufficient size, and having a well-fitting lid, might be utilised by placing the gutta-percha therein, and tben heating in an ordinary saucepan partly filled with water.—QUI VIVE.

**Bending Brass Tube.**—MIKADO.—I should like to know what shape you wish to bend the tube—whether into a circle or part of a circle; and if so, what is the size or radius of same? And are you quite certain that it is brass tube, or is it brass-cased, which very many people call brass tube? If you will kindly supply these particulars, I shall, no doubt, be able to help you.—R. A.

**Couch Bedstead.**—PATTERN MAKER.—I have overbauled your letter and sketch, and have applied the fullest possible care thereto. I have decided that the form of couch I have drawn herewith will be preferable on both tbe points of strength and facility of action. First, concerning strength. Your sketch shows the front leg blocks of the couch as drawn away from the back parts with the movable framing. This course, if not quite impossible, will prove a source of extreme weakness. All true leg blocks *must* be fixtures to afford accommodation for the framing; otherwise, in the event of tbe seat-front blocks being drawn forth with the movable slides, no substantial support can possibly be substituted, meanwhile, at the corners where the front rail meets the side rails. The sketcb will show you the general construction advisable. Between the blocks of the legs in connection with the couch head-rest should be mortised a stout rail (A, Fig. 6), to which, in turn, will be joined two slips (B, B, Fig. 6). The back ribs will best suit the purpose if dowelled or screwed *above* the back and front rails of the seat proper. Each




**Couch Bedstead. Fig. 1.—Frame of Couch: the front portions slide horizontally backwards and forwards upon the back portions. Fig. 2.—Upholstered Scroll and Cushions of Couch. Fig. 3.—Section—C, Front Slide; D, D, Back Fixed Rib. Fig. 4.—Section—H, Movable Slide; I, Extreme Front Rail. Fig. 5.—Section—E, Very Long Rail passing the whole of Couch; F, Movable Slide; G, Front Rail of Back Frame (middle in the sketch). Fig. 6.—Section—A and B, B, Rails fixed between Back Couch Heads, above Leg Blocks. Figs. 7 and 8.—Top of Extreme Front Legs and Attaching Screw respectively. Fig. 9.—Back of Couch-Head Slides. (The Front Legs are quite detachable.)**

should be in section (as D, D, Fig. 3), as the movable slides will retain their position better, and act more firmly, if they are made in section (as C, Fig. 3). Over the top of the back and end seat rails respectively might be glued narrow strips to form a rebate for the purpose of accommodating tbe cushions. The front extremity of the end strip ought to be mitred, and project slightly, to meet the end of the movable front (extreme) rail, which should be similarly mitred. Something must be provided to prevent the front slides from coming completely away from the back part of the article; and this is found by screwing a rail (E, Fig. 5) from one end of the couch to tbe other, and within the framing, underneath, and to the ends of the movable slides. This necessitates having the exposed portions of these rails or slides shorter by the tbickness of the back rail of the framing than the fixed or back ribs, as it will be understood that the rail E (Fig. 5) will prevent the movable slides from passing over the back frame rail. The front slides should be mortised into the movable front rail (as H, Fig. 4). This permits the top of the rail I (Fig. 4) to act in correspondence with the strips mentioned previously as forming a rebate for seat-cushion. You will probably understand that the front couch-head slides are mortised to it (the couch head), and travel between the fixed mortise rails between the two back uprights. To each of these slides screw a stop-piece (Fig. 9). The only important point which now remains, and one which I do not think you can possibly improve upon, is the support of the fronts of the slides as a whole. Seeing that the front leg blocks proper cannot be moved, it would be folly, so far as the appearance of the *couch* is concerned, to have, on the movable rail and under the movable couch head respectively, blocks of the same size as the fixed ones, to receive the needful detached legs; therefore I advise you to bave thin strong blocks, and legs sbaped at top (as in Fig. 7). The top mortise will then fit over the blocks, and if holes are pierced through them and the legs, wooden or metal screws could be used to securo them in position. Used as a bedstead, tbe appearance of these legs will be of little consequence (I show them different in character for the obvious reason of distinguishing them from the back ones, to avoid misconception as to which are fixtures); but if you consider the holes in the blocks detrimental, you must fill them during the daytime with small patères. The best shape for tbe stuffing is shown in Fig. 2. It should be so attached tbat only the thickness of the movable couch head will show when all is closed. A removable bolster used in connection with it will answer well. It seems to me that your sketch represents a band of material round the two long seat cushions to form a hinge. Now, I advise you to dispense with tbis method, and, instead, completely finish the two separate cushions, and then stitch a piece of material the whole length of the cushions, of a width equal to the two combined, neatly and securely to both edges at one side. They can then be opened, as you desire, to cover the whole hedstead. You must determine the sizes of the couch—perhaps 6 ft. long by 4 ft. 6 in. wide will do. I advise the use of an extra, loose, cushion, of the shape in Fig. 2, hooked over the front couch head at night. See, for constructive details, papers on ottomans, etc., in back numbers.—J. S.

**Running Block Tin.**—J. McD. (*Glasgow*).—This querist asks how to make block tin run into brass moulds, and how to bring it to a very smooth surface. Well, I can only reply that you must melt the block tin in a ladle with a spout to it, and then pour it into the mould; and as to the smoothness of the surface, if the mould is smooth, the casting will also be smooth, and *vice versâ*. N.B.—In pouring metal into a mould, take care that the mould is free from damp or moisture.—R. A.

**Spherical Slide Rest.**—X. Y. (*Wandsworth*).—To describe a spherical slide rest fully would occupy three or four articles. I think, therefore, I must refer you to the fifth volume of Holtzapffel & Evans' work on ornamental turning.—J.

**Moulding.**—H. T. (*West Bromwich*).—The best cheap book is entitled "Practical Iron Founding," price 4s., published by Messrs. Whittaker. A more expensive book is "A Practical Treatise on Casting and Founding," price 18s., published by Spon. Two excellent books are "American Foundry Practice" (West), price 10s. 6d.: and "Moulders' Text-Book," by the same author, price 12s. 6d. They are both published in America by Wiley & Sons, New York, but are obtainable in England of Spon, Strand, E.C., or Trübner, Ludgate Hill, E.C.—J.

**Mending Incandescent Electric Lamp.**—W. B. (*Manchester*).—If you have some skill in soldering, and can manage a delicate job, the broken platinum wire can be repaired in the following manner: With a fine sharp file clear away a small portion of the glass around the end of the platinum wire, so as to expose about ⅛ in. of the wire. Get a piece of No. 24 copper wire, clean one end, and flatten it out into thin foil. Anneal this on a piece of red-hot iron, clean it with a scrap of fine emery cloth, and tin it as for soldering. This done, carefully trim it with a pair of sharp scissors, and bend it with a pair of small pliers to form a socket fitting tbe exposed end of the platinum wire. Give this a touch of the soldering flux or fluid, fit on the prepared socket, and solder it on with a small soldering bit, or a carefully directed blowpipe jet. After this is done, the copper wire can be cut off to the required length, and bent to form a loop.—G. E. B.

**Broken Mercury Column in Barometer.**—R. P. (*Islington, N.*).—The column of mercury in your barometer tube has been broken by a sudden jolting of the instrument when upside down, and thus some air has been shaken into the tube. This must be expelled either by shaking all the mercury into the upper part of the tube, or by heating the tube when upside down, and thus expelling the air from the mercury. Unscrew the clasps which hold the tube, take this out, and hold it upside down, so as to cause the mercury to run into the closed end. Gently tap the tube with the fingers, and thus try to shake the mercury into one unbroken column. If this fails, the tube must be warmed over a spirit lamp carefully, then heated at the closed end and upward, inch by inch, until all the air has been expelled. This done, cork the open end, turn the tube suddenly, withdraw the cork gradually, and thus allow the column to fall into its right position. This done, restore the tube to the frame.—G. E. B.

**Electric Belt.**—R. D.—Still they come! Inquiries about magnetic belts, galvanic belts, and electric belts, under several different names. Such belts and appliances differ only in name, and my reply concerning one is applicable to them all. If you wish to amuse yourself in making one, follow these instructions. Make a body belt of flannel, or of canvas, or of webbing. Get some pieces of sheet zinc and sheet copper, the size and shape of pennies. In the centre of each fix, by soldering or otherwise, a small brass screw long enough to just pass through the material of the belt and enter a screwed nut on the other side. Fix them in the belt just where you *fancy* they will do you most good. Coat the inside part of the belt with soft wash-leather, and stitch around the discs of copper and of zinc. Get some strips of thin brass, long enough

to connect one stud with another; drill holes in each end to pass over the screwed ends of the studs, and connect the studs as you would a battery—copper to zinc in series throughout the belt. The nuts employed to do this may be rounded at the edges and ornamented, if you like to see them look nice. You will now have a belt equal in value to one costing five guineas at the shops, as its value will depend upon the faith you have in such appliances. See my former replies on similar subjects. —G. E. B.

**Electric or Magnetic Appliances?**—F. J. S. (*Durham*).—As the magnet adheres to the so-called "Electric Soles" when these are placed in contact with a magnet, you have ample proof that they are made of iron or steel, not of zinc and copper. They may be made of magnetised steel, in which case they are not electric, but magnetic, appliances. Zinc plates will not attract nor be attracted by a magnet, nor can a belt containing zinc plates be magnetised. An electric belt, made up of alternate strips of zinc and copper, will not require being magnetised nor "electrified." It forms in itself an electric apparatus capable of generating a current of electricity when the flannel of the belt is moistened with vinegar or with the saline perspiration from the body of the wearer. The evidence of such a current may be obtained by connecting the two end plates (copper at one end and zinc at the other) with a delicate galvanometer, when the needle of the instrument will be deflected.—G. E. B.

**Old Oil Paintings.**—A. E. S. (*Wootton Bassett*). —This process requires great care and experience, especially where the picture is obscured by a coat of hard old varnish. This may be removed by spirits of wine and turpentine; but great care must be taken to stop their further action, when the varnish is dissolved, by using water freely, or they will attack the paint as well. Where the picture is merely obscured by dirt, wash with clean soft water, using a soft leather or a sponge. Then dry, or rather polish, with a silk handkerchief. When dry and bright, take a handful of medicated wool, and pour upon it two or three drops at a time of clear nut or linseed oil, rubbing well into the picture—the smallest quantity suffices; then polish dry with a silk handkerchief.—F. B.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Microphone.**—J. S. (*Enfield*) writes:—"Can anyone inform me where I can obtain a small quantity of the best oven-made coke?"

**Oval Bradawl Handles.**—C. C. E. (*Lincoln*) writes:—"These are beautifully made in soft wood, such as beech, and I shall be greatly obliged if any reader will tell me how they are turned or fashioned, and where their manufacture can be seen."

**Windmill.**—YOUNG writes:—"Would any reader kindly inform me, through 'Shop,' how to make a windmill to average about ½ horse-power, its probable cost, etc?"

**Inlaying.**—J. T. S. (*Sheffield*) writes:—"I am anxious to do some fret inlaying with my machine, but do not quite see my way. I should be glad if any reader would give me the benefit of his experience, and say how the holes, bored to put the saw through, are hidden afterwards? Is the wood cut at an angle to make the top piece fit the lower hole tightly? Any hints, or reference to a source of information, would greatly oblige."

**Mining.**—PUZZLED writes:—"Could any reader tell me of a good mining school in the Western States, U.S.A.? Any information on the subject would be gladly received."

**Varnish.**—J. M. P. (*Preston*) writes:—"Will any readers of WORK kindly give me a good receipt for making bookbinder's special varnish?"

**Rustic Woodwork.**—B. J. B. (*Boddington*) writes:—"Will any reader of WORK kindly give rough sketch of rustic bridge, and rustic arch for each end, with a few hints as to best plan of construction? Also I should be glad of rough plan for a timber storing shed, to be built of timber, and covered with galvanised iron."—[Much on rustic work has already appeared in WORK, Nos. 113, 115, 117, 119, 121, 123.]

**Fretwork Picture Frame.**—T. W. A. (*Stockton-on-Tees*) writes:—"Will any reader of WORK kindly tell me how to join a fretwork picture frame? It is 20 in. by 24 in. I should have to cut it in two parts. I should also be glad to know of any good book on fretwork."

**Mail-Cart Handles.**—ADIA writes:—"Can one of your numerous readers tell me where I could get some mail-cart handles, either in Birkenhead, Liverpool, or London? I want those that are bent."

**Bath, To Heat.**—ROUND O writes:—"Could any of the readers of WORK tell me how best to heat water for a bath having no connection with a boiler or fire, only cold water attached to it?"

**Indiarubber Mat.**—ROUND O writes:—"Our door-mat, which is of special design, is parting in two in the middle. I shall be glad to know what will repair it, and how it can be done."

**Pocket Boiler.**—W. M. (*Derby*) writes:—"I should like to know how to make a small pocket tin for boiling water, etc. Lamp—to fit inside when not in use—to burn paraffin or other common oil, and yet not deposit soot. Is this practicable? Would some form of Argand be suitable?"

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Copper Sheets.**—HUMPHREYS & ROSSITER (18, *Arthur Place, Camden Street, Birmingham*) write, in reply to ANXIOUS (see page 267, No. 121) to say that they supply copper sheets 4 in. by 2 in. by ⅛ in. thick.

**Fretwork Thin Lines.**—ROUND O writes, in reply to query by PUZZLED (see page 222, No. 118):—"If your wood is not too thick, it could be pierced with a machine needle fixed into a hand vice. You could get a needle as fine as any fret-saw, which would not mar the job. I have seen such lines cut in with a carving tool, which may answer better."

**Model Electric Lights.**—S. T. (*Horley*) writes, in answer to J. H. (*Wolverhampton*) (see page 254, No. 120):—"You can get carbon plates, dynamos, and electrical apparatus of every description, and cheap, of W. Wells, engineer, Toovies Worth, Crawley, Sussex. Send the size of articles you want, and he will quote the prices for same."

**Compound Engine.**—H. B. (*Disley*) writes, in reply to PUZZLED (see page 286, No. 122):—"The steam exhausted from the high-pressure cylinder *does* exert a back pressure almost equal to the pressure exerted upon the low-pressure piston. Whatever difference of pressure there is is due to condensation. The back pressure is amply compensated for by the increase of area upon which the steam acts in the L.-P. cylinder. The receiver will be quite large enough in the form of an ordinary cylindrical pipe of an area equal to the steam-ports in the L.-P. cylinder. A good rule is to make the port in the H.-P. cylinder = ¼th area of cylinder, and in the L.-P. cylinder ⅛th area of cylinder. Some of the best makers make the L.-P. cylinder twice the diameter of the H.-P. cylinder—*i.e.*, four times the area."

**Chair Seats.**—M. (*Bishop Auckland*) writes, in reply to W. J. B. (*Deptford*) (see page 270, No. 121):—"I have found the seats wear very well with fair usage. You can get them in two or more different thicknesses from the ironmongers. If you want to make them in one piece, use birch or beech, but they will cost more."

**Portable Furnace.**—H. B. S. (*No Address*) writes, in reply to H. B. (*East Hartlepool*) (see page 270, No. 121):—"You wish to have the dimensions, etc., of a portable furnace for melting about 12 lbs. of brass. Look up my answer to G. T. M (Vol. I., page 622). If you had stated in your query whether you wanted a wind furnace or blast furnace, it would have been much easier to answer you. In the reference I have given you above, I described both kinds. The dimensions required are about 2 ft. 6 in. high, 16 in. wide, and 16 in. deep. Perhaps your best plan will be to make it of sheet-iron, bound together by two bands up each side of hoop-iron riveted to the outer case, and to line it inside with fire-clay 1½ in. or 2 in. thick; the chimney may be of sheet-iron stove pipe, about 3 in. diameter, let in at the back. It will rapidly wear out near the furnace, and for about a couple of feet wrought-iron tube would be better, and sheet-iron above that. The top of the furnace may be made of sheet-iron, bent down about 2 in. all round in the form of a box, and filled up with fire-clay. Rivet a handle on to move it by. At the ground level in the front of the furnace cut out a hole, say, 6 in. by 3 in., and 9 in. above that cut another hole, 6 in. by 3 in. At a little below the level of the upper hole and inside rivet two angle irons both at back and front of furnace. These project through the fire-clay and support the fire-grate. The upper hole is for clinkering, and the lower hole for ashes, and to regulate the draught. The holes may be stopped with a brick, or tile, or a door attached to each. The furnace is stoked from the top, and the crucible inserted there also. To prevent the wind cooling down the bottom of the crucible, put a small round tile on the bars to stand the crucible on. During the first heating of the furnace, begin very gently with paper and wood, and allow to cool down, and fill up the cracks with fire-clay; then begin again, but increase the temperature, and fill cracks again. Whenever a crack appears fill it with fire-clay, and allow the furnace to die out of its own accord, so as to cool down slowly. I am afraid the length of pipe required would be very unsightly out of doors, and if you are in a crowded neighbourhood someone will knock it down for you, unless you carry it right up the side of the house as high as the chimney. The best plan would be to carry it into a chimney-stack, and block up the opening to the fire-place, so as to bring the draught right through the furnace."

### V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. P. & Co. (*East Greenwich*); W. B. (*Staffordshire*); J. H. (*Droitwich*); J. E. W. (*Farnworth*); T. F. (*Willington-on-Tyne*); J. W. T. (*Manchester*); J. H. (*Leigh*); J. S. (*Saltley*); A. B. (*Belfast*); A LOVER OF "WORK"; W. R. (*Manchester*); F. S. (*Wyke*); J. J. (*Wigton*); SCOT; D. W. A. (*Fallowfield*); WATCH JOBBER; T. B. (*Rochdale*); F. T. (*Dundee*); B. S. (*Kinsale*); CAMERA; J. H. (*Uxbridge*); G. C. B. (*Echuca, Victoria*); YARMOUTH; E. A. (*Ashford*); VERTICAL; C. McC. (*Bangor*); R. R. (*Dumbarton*); J. W. H. (*Brackley*); P. J. (*Devoran*); G. A. (*Fulham*); T. L. (*Bristol*); INNEK; W. E. M. (*Stawell, Victoria*); VERAX; J. D. (*London*); GREENHOUSE; J. G. (*Liverpool*); T. C. C. S. (*Liverpool*); J. M. P. (*Nottingham*); R. W. D (*Manchester*); A. E. (*Wandsworth*); S. E. (*Battersea*); J. W. H. (*Nottingham*); PEDAGOGUE; E. H. B. (*Manchester*); A READER OF "WORK"; A NEW SUBSCRIBER; SUBSCRIBER; R. W. J. L. (*Gorler, S. Australia*); J. C. (*Belfast*); H. N. (*Ipswich*); T. S. (*Amsterdam*); A. J. (*Faversham*); A. E. P. (*Hackney*); W. P. W. (*Newport, Mon.*); G. H. (*Shaftesbury*); NORFOLK; H. P. (*Ash-next-Sandwich*); E. F. B. (*Liverpool*); H. H. C. (*Yeovil*); APPRENTICE; H. A. H. (*Chatham*; W. G. (*Bradford*); P. W. (*Devonport*); S. R. W. (*Saltburn-by-the-Sea*); ELECTRO-MAGNET; J. H. (*West Bromwich*); C. W. N. (*Aldershot*); STUDENT; DRAKE; H. McM. (*Bootle*); ANGLO-CYMRO; THE VICTOR CYCLE CO.; A. B. (*Liverpool*); S. A. D. (*Lewisham*); A CONSTANT READER; T. C. W. (*Hull*); SNOB; H. B. (*Hulme*); J. F. (*Tipton*); BANJOIST; J. S. (*Leith*).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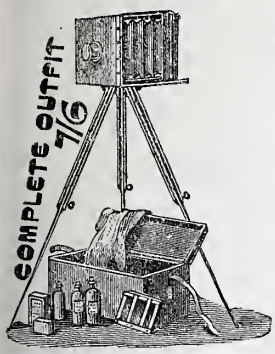


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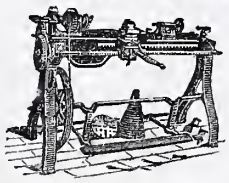

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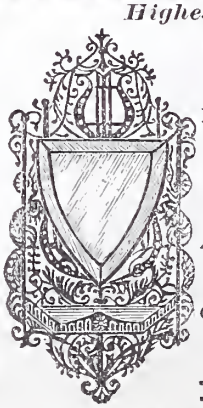

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# WORK

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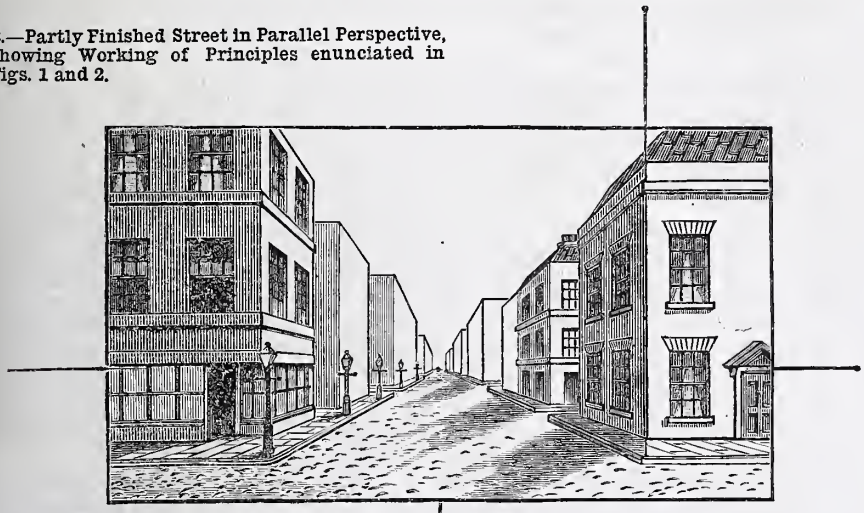
VOL. III.—No. 131.] SATURDAY, SEPTEMBER 19, 1891. [PRICE ONE PENNY.

Fig. 3.—Partly Finished Street in Parallel Perspective, showing Working of Principles enunciated in Figs. 1 and 2.



## STAGE PERSPECTIVE.

BY WILLIAM CORBOULD.

### PARALLEL PERSPECTIVE.

IT must be understood by the would-be scenic artist that it is indispensable that he should thoroughly understand the art of perspective. Although a rather dry study, a little patience and trouble will soon simplify the matter; by working out the rules here laid down a few times the student will find the subject prove easy enough. No drawing would be correct unless the principles now to be laid down, and which may be termed the Grammar of Art, be thoroughly mastered. Do not let these words frighten any beginner, because he will find the rules few and simple.

The most important point I wish to impress upon the learner is the names of the different lines, points, etc.; without their use no correct perspective could be obtained. No matter how well a scene may be painted, defective perspective would spoil the whole.

I now direct attention to the following points and lines, which are shown in Fig. 1:—A A′, the horizontal line; B, the point of sight, or vanishing point; C, D, measuring points; E, sight or station point. There are only two rules of perspective in straight lines—parallel oblique or angular—which I will now try to explain as easily as possible by the aid of diagrams.

Fig. 1.—This plate represents the horizontal line, point of sight and vanishing points, and points of measurement—that is to say, the only lines required to work out a scene

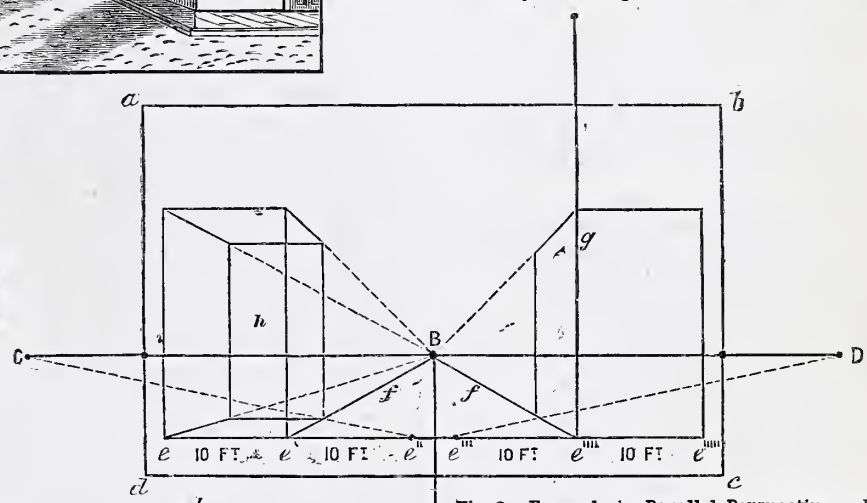



Fig. 2.—Example in Parallel Perspective—*a b c d*, Cloth; C D, Horizontal Line, C and D being also Measuring Points; B, Point of Sight; E, Station Point; *e e⁗′*, Base Line; *e′*, *e″*, *e‴*, *e⁗*, Points of Division; *f*, *f*, Lines to Vanishing Point, B; *g*, Corner Line of Block; *h*, Block.

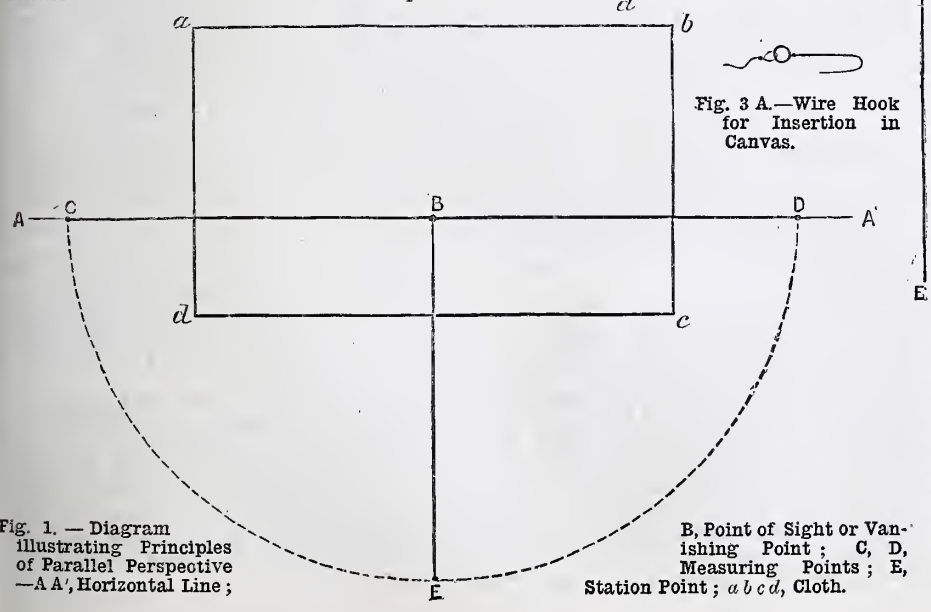



Fig. 1. — Diagram illustrating Principles of Parallel Perspective —A A′, Horizontal Line; B, Point of Sight or Vanishing Point; C, D, Measuring Points; E, Station Point; *a b c d*, Cloth.



Fig. 3 A.—Wire Hook for Insertion in Canvas.

in parallel perspective. The rectangle, *a b c d*, shows the size of the cloth or scene.

A A′ is the horizontal line. Supposing we were standing on the sea-shore: that line which divides the water from the sky is the horizontal line. If the student were to walk up from the shore to the top of some very high cliffs, this line would be found to rise with him, and still be opposite his eyes. We must bear this in mind, because in painting a seascape or a landscape, the horizontal line must rise according to the height of the foreground represented. If we were to go up in a balloon we should find the horizontal line still opposite our eyes, the balloon hanging, as it were, in a huge bowl. Supposing the scene was a mountain pass, three or four thousand feet above sea level, but we were looking out to

sea, the horizontal line would be two-thirds up the scene, or thereabouts. On the other hand, if the reader were painting a scene from the sea-shore, the line would hardly be more than a fourth.

It is always best in stage perspective to keep the horizontal line as low as possible, taking into consideration that some of the audience are sitting below as well as above the horizontal line.

The point of sight on this line would be the spot where all the lines receding from the eye would fall. In Fig. 1 this point is at B on the horizontal line, A A'. This constitutes the rule, "parallel or linear perspective." The points C and D would be the measuring points. All lines above and below the horizontal line must fall into the point of sight, B (Fig. 1).

We will suppose that Fig. 2 represents a road running straight up the plate, with blocks on each side which might represent buildings, such as a street: *a b c d* is the cloth or scene, C D the horizontal line, E showing how far the eye is supposed to be from the picture.

We may determine this by dividing the horizontal line in halves. One-half would be the distance to point E, or by striking a half-circle from E to the horizontal line it would intersect this line at C and D, which would be the points of measurement (Fig. 1).

The base line, *e e''''*, may be marked off into parts of, say, 10 ft. from the dots *e* to *e'*, *e'* to *e''*, etc.—that is, the blocks would be 10 ft. square. The front of the block would be parallel with the horizontal line. A line drawn from the next point, marking another 10 ft. to the points of measurement, C, D, would give the perspective size of the square where it crossed the ground-line of the building, *f f*. This is where the second perpendicular line would rise. *g* shows the block in perspective if it were framed and glazed.

Fig. 3 represents a partly finished street scene, to show the working out of the first and second figures, completing the first lesson in "parallel or linear perspective."

It will be seen here that the fronts of the houses facing the spectator—that is, the lines of the doors, windows, base, and tops of the houses, as well as the pavement—are parallel with the horizontal line. All lines of both sides of the street will be seen to fall into the point of sight, B (Fig. 2). The lamps come under the same rule, as will be seen if we take a line from the front lamp to the last. I hope this will be explicit enough for the beginner, who with a little practice will soon master this first rule in perspective.

We now come to the use of the horizontal and perpendicular lines (page 640, Vol. II., No. 92).

If one were going to draw a picture or scene on paper, the T-square and ruler would do for the purpose; but it is very different when drawing on a large scale, such as 15 ft., 30 ft., or more. It is obvious that lines would have to be used.

As I have explained before, one should have a plumb-bob attached to it for the perpendicular lines; the first one is represented at *g* (Fig. 2). If we hang this straight down, leaving the bob to steady itself when so hanging, dot here and there exactly behind the line; then take the straight-edge, and by connecting the dots make a straight line. All other perpendicular lines can be measured from this one, always having the line to correct from.

The other line should have a piece of stout wire bent as shown in Fig. 3A, the point to be sharp, so that the student may be able to insert it easily into the canvas. This would be the horizontal line.

When the height of the horizontal line is decided on, place a dot at each side of the cloth denoting the height; hook the horizontal line in at one dot; take a piece of charcoal and rub the line with it; cover the other dot with the line, and pull it tightly. With the other hand draw the line away from the cloth and let it go smartly back again: this will give the first or horizontal line—of course, to be covered with vandyke brown and dusted off.

## NEW COVERINGS FOR OLD BOOKS.

BY H. J. L. J. MASSÉ.

GLAZED LINEN AS COVERING—VEGETABLE PARCHMENT—ITS DISADVANTAGES—TREATMENT OF BOOK IN BOARDS—LOOSE PAGES—EDGES—CONCEALING ADVERTISEMENTS, ETC.—COVERING WITH PARCHMENT—END PAPERS—FINISHING COVER WITH RULED LINES, ETC.—COST OF HOME BINDING.

IN one of the earlier numbers of WORK I was much interested in reading about the home manufacture of portfolios for the preservation of loose papers and the like. For special purposes, no doubt fancy stuffs are very appropriate, but they require to be very carefully handled and affixed to the strawboard or cardboard foundation that is underneath. As a boy at school, I used to furbish up my school books when they became very shabby with a covering of brown holland pasted on with very strong paste, in which a small piece of glue had been dissolved. This plan had one very great disadvantage: viz., that the brown holland soon became very dirty, and I soon took to covering the sides with glazed lining. Somehow, I always used the green kind, as being neither too gaudy nor too dull, having previously covered the backs with very stiff glazed brown paper. Of course, the glaze on the lining partly disappeared after being pasted; but I used to varnish the cover with shellac dissolved in methylated spirits with good results.

Sometimes, in later years, I have used the material sold as vegetable parchment, but it is really more suitable for loose removable covers than for those that are meant to be permanent. It is a serviceable stuff for putting a strong back to songs and loose sheet music, and its dull colour can be easily varied by pasting a thin slip of coloured paper underneath. The coloured slip, if bright enough, will show through, and give a pleasing tint to the vegetable parchment; and by using different-coloured papers for the different classes of music a ready means of distinguishing between them is afforded. My only objection to the vegetable parchment is that it is rather intractable under the paste-brush, gets hard, and has a tendency to crack if kept in a dry place.

The other day, having a few spare moments at my disposal, I resolved to remove an eyesore from one of my bookshelves, in the shape of some "yellow backs," by covering them. They were standard novels, by the way, that had been picked up at odd times at half price, or less, at the bookstalls. Now, the binding of these cheap "yellow backs" varies very much. Sometimes the books come to pieces in the very first reading, while sometimes they endure a considerable amount of really heavy wear and tear—mine, luckily, were in good repair, with the exception of a corner or so and a couple of loose pages. The loose pages I secured with a stitch or two, and the corners were strengthened with a little gum. I will deal with one book as a type of the whole batch. One of the edges had been stamped "Reduced to 1s. 2d.," in the so-called indelible violet ink—I say "so-called," because its indelibility is not always to be trusted. By exposing the "indelible" inscription to the sunlight, it faded a little, and to remove it entirely, a gentle rubbing with No. 00 glass-paper was required, the book meanwhile being held in a hand-press, or clamp, made of two pieces of 1½ in. oak, each 16 in. by 8 in., with a ¾ in. hand-screw in each corner. Next, after blowing away the paper dust thus caused, I brushed the edges over with red aniline ink, taking care to squeeze the book extra tightly in the press, and to avoid leaving any excess of ink at the corners, and after an hour a second coat of ink gave the required depth of colour. When this ink was quite dry I cut a piece of demy paper, like that used by chemists for wrapping purposes, about 1 in. larger each way than the book, and pasting it thinly, covered the back and sides of the book, with the object of hiding the illustration and the advertisements of pills and other articles from view, and put the book, with two layers of clean blotting-paper inside and outside its two covers, into a copying-press to dry. A little practice will soon enable anyone to cover the corners neatly. I should advise everyone to try his hand first on a few waste strips of cardboard.

When the demy paper was quite dry, the book already looked quite respectable, with its clean white cover and brand-new red edges. Next I cut a piece of parchment a little larger than the white demy used above, and pasting it well backwards and forwards till it could absorb no more paste, and giving an extra brush along the edges to finish up with, I put the parchment over the white demy and put the book back in the press, with dry, clean blotting-paper as before. When this was *quite* dry—it must be quite dry, or the book would warp unpleasantly—I put in some suitable fancy end papers which I had got from the city house of Messrs. Marlborough, Pewtress & Co.

This finished the inside of the book. To finish the outside, I ruled a red ink line all round the front cover, about ⅛ in. from the edge, and double lines, about 1¼ in. apart, diagonally from the bottom left-hand corner to the top right-hand corner of the cover. This space was filled with the name of the book engrossed with red ink in Old English capitals, and the name was also written in the same style along the back.

The book, when finished, looked extremely well, especially considering the outlay—which was well under 4d.—and put its late companions to the blush.

Bookbinding technicalities have been avoided, as my wish was not to deter anybody who would like to furbish up any stray books without the expense of sending them to be bound, but who would be disheartened by any strange terms.

This article is written from no wish to deter those who seek to do better work in bookbinding from making a trial, but from a desire to show what can be done with very little expense, if only the attempt be honestly made and persevered with. Further, it is a pleasant and profitable way of using and utilising a little spare time.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### The Bed-plate—The Cross-head and Guides—The Fly-wheel.

The Four Surfaces of the Bed-plate, and how to bring them True—Screwing the Cylinder to the Bed—The Cross-head Pin, and how to Bore the Hole for it—Chucking the Cross-head—Securing the Piston-rod to Cross-head—Fitting the Cross-head and Guide-bars—How the Connecting-rod acts on the Guide—Making the Cross-head Pin and Boring the Oil Channels—Chucking the Fly-wheel, Boring it, and Slotting the Key-way.

Examine the bed-plate casting and the views of it (Figs. 4, 5, 8, pp. 260, 328), when it will be seen that there are four surfaces to get up true. First, the end surface (1) against which the cylinder is bolted; second, the large facing in the middle on which the slipper-guide works (2); third and fourth, the two smaller facings on which the crank-shaft bearings are bolted (3, 4). The three last mentioned are all in one plane, and, though not necessary, it will be most convenient to have them planed. In fitting or getting up these parts, we must attend to two things: first, it is essential that the first surface against which the cylinder beds should be absolutely at right angles to the other three, or the slipper-guide cannot work without bending the piston-rod, and the rod must point fairly down the middle of the bed; secondly, the recess into which the cylinder cover fits must place the cylinder at the correct height above the three last surfaces; this height is given in Fig. 8: $1\frac{3}{4}$ in. Probably the correct way to do this would be to mount the bed upon the saddle of a lathe, so that the line of the lathe centres shall coincide with the centre line of the cylinder, then a boring-bar would be used both to face the end surface and to bore out the hole in it. We will not, however, propose to make more cutters for our bar, since there is another way which will do very well. If the three level surfaces are not planed, these had better be filed up fairly true, first of all. Get a spirit-level, and, laying it on the three surfaces, pack up with slips of wood, tin, etc., under the bed-plate as it lies on the bench, until the three surfaces come as level as possible; now you can file them up, keeping them in one level plane by trying them alternately with level and surface-plate. The bed-plate had better be screwed down on your bench by wood screws passing through the three lugs. The three flat surfaces being filed or planed, we turn to the end surface, the hole in which requires to fit the cylinder cover. The diameter of the hole is to be $2\frac{1}{4}$ in., and the height of its centre above the plane surfaces, $1\frac{3}{4}$ in.; therefore, the height of its bottom edge above these surfaces will be $\frac{3}{4}$ in. Lay a scribing-block on the second surface, and set its point $\frac{5}{8}$ in. high.; now take a half-round file, and file away at the bottom of the hole till the application of the scribing-block shows it to be $\frac{5}{8}$ in. above the level surfaces. Now turn a short conical mandrel of hard wood (Fig. 38); make it small enough to go into the hole at the smallest end, and at the larger end make it the size the hole ought to be: it may be two or three inches long; rub it all over with chalk, and rub it gently in the hole; take out and file where the chalk appears; continue thus till the cone will go nearly up to the large end, touching also the bottom of the hole, when you file more carefully, and begin to try in the cylinder cover. By this means you can get the cover to fit, without looseness, at the proper height. Fig. 39 is turned in hard wood, and will enable us to file up the first surface at the end of the bed-plate. The neck of Fig. 39 is made $2\frac{1}{4}$ in. diameter, and should fit the hole without shake; the shoulder, A, is turned exactly square and flat; the long shaft is reduced for lightness' sake: it may be 1 in. in diameter, and about 1 ft. 3 in. long, and should be quite parallel. Chalk the surface, A, and put the pin through the hole in the bed-plate; rub A against the end by turning the wood in the hole, and note the direction of the long pin *vertically* and *horizontally*; take out the wood, and file the end surface accordingly. When the eye is satisfied with the direction taken by the pin, measure carefully from underneath the pin to surface 2 at both ends, to see whether the pin is quite level, and from the inner edges of surfaces 3 and 4 to the sides of the end of the pin, to see whether it points fairly down the middle of the bed, passing exactly between them. The surface-plate may be applied to finish the end surface; it need not be scraped, however, but left from a smooth file. We next apply the cylinder cover and cylinder, setting the screw-holes in correspondence while the valve-face is vertical; remove the cylinder without disturbing the cover, scribe through the holes in the cover on to the back of the bed, drill and tap these holes, and now we can screw the cylinder to the bed.

The slipper-guide, or cross-head, and the guide-plates seem to follow naturally, and we will take them next. First finish surface 2 on the bed-plate, on which the guide is to slide, scraping it up true with the help of the surface-plate, as before described. Take next the guide-plates between which the slipper moves; file these top and bottom, bringing them to the same thickness all over; scrape up their lower surfaces and draw-file their upper; square their outer edges and draw-file them; for the chamfered edges make a gauge by filing a notch in a bit of sheet metal with a smooth "three-square" file; use this notch to try the angle of the chamfer, filing to the gauge, and watching the width of the pieces so as to keep them parallel. This chamfered edge must be brought to a true surface by means of the surface-plate and the scraper. Drill three holes for screws in each piece in the positions shown in Fig. 5, and make and fit the four screws seen in the same view, which are used to push them forward into touch with the slipper, but do not bore in the bed the holes by means of which they are held down on to the bed till the slipper is made. Now take the slipper itself, and file up first the sole on which it slides, taking off just enough to make it $1\frac{3}{4}$ in. high to the centre of the bosses. The upper part of this slipper guide is called the cross-head, and the pin which goes through it, and is grasped by the small end of the connecting-rod, the cross-head pin; it is a very important part of the engine, and requires careful workmanship. Look at the view in Fig. 8, and consider what would be the effect on the working of the engine if that pin did not go through *quite* horizontally; look at the plan view in Fig. 5, and suppose for a moment that the hole for the cross-head pin was not *absolutely* at right angles with that for the end of the piston-rod. These points are worth some careful consideration; it is attention to just such points as these that makes the difference between good work and bad, and they are the very things an amateur is most tempted to overlook. The centre lines of the holes in the cross-head, for the piston-rod and for the cross-head pin, must be: first, at right angles; second, in the same plane; third, in a plane parallel to that of the sole of the slipper; fourth, the two planes are to be $1\frac{3}{4}$ in. apart. In the angle-plate we have the very thing to enable us to fulfil these conditions. Taking the fourth condition first: make a little template, like Fig. 40, of sheet iron; bore the hole $\frac{3}{8}$ in. to fit the piston-rod, and let the distance from the centre of this hole to the base be $1\frac{3}{4}$ in. Thread this template on to the piston-rod, and try whether it will touch the guide surface with equal pressure whether the rod be pushed in or drawn out: this will test your work, and show whether the cylinder is really true with surface 2. Now put the angle-plate on the face-plate chuck, drive a bit of wood into the hole in the mandrel, and turn it down to $\frac{3}{8}$ in.; put the template (Fig. 40) on this, and bring up the angle-plate till it touches the base of the template, and fix it there (see Fig. 41). Thus we shall have fixed the upper surface of the angle-plate at exactly the same distance from the lathe centres as the piston-rod of our engine is above surface on which the slipper works. Now remove the template and the bit of wood, and fix the cross-head upon the angle-plate, the dogs holding the sole or slipper down upon the plate, and the bosses for the cross-head pin being centred to run true. Fig. 42 will perhaps make this sufficiently plain. Now face up the boss and bore it through, when the hole will be, of necessity, true with the sole; do not, however, trust to a drill to make this hole straight; a half-round, or D-bit, would do it, but nothing else should be trusted; if, therefore, the workman does not possess a $\frac{3}{8}$ in. D-bit, let him bore with a $\frac{5}{16}$ in. drill, and true out the hole with a fixed tool in the slide-rest, leaving it rather less than $\frac{3}{8}$ in., since it must be cleaned out with a fluted reamer to fit the pin. Having bored this hole, turn a little rod about 4 in. long, or more, that will fit into the hole, being quite parallel its whole length; turn the cross-head one-quarter round upon the sole, and fix it so that the boss of the piston-rod runs true; thread the rod through the hole just bored, and measure very carefully from the ends of this rod to the face-plate chuck, altering the setting of the cross-head until these measurements show by being equal that the hole is parallel with the face of the chuck, and therefore exactly at right angles with the centre of revolution. Now face up the boss for the piston-rod, turning the outside as far as possible; then bore with a $\frac{5}{16}$ in. bit into the first hole, as seen in Fig. 5, and cone out this hole to $\frac{3}{8}$ in. with the fixed tool in the slide-rest, using a very sharp and rather pointed tool, and setting the cutting point at exactly the height of centres. By this method of procedure we ensure the accomplishment of the four conditions before stipulated, and the plan forms a good example, which is very likely to be of use on other occasions. Having prepared the hole for the end of the piston-rod, put the piston and its rod into the lathe once more, and turn the end of the rod to fit the hole, observing the dimensions written along the rod in Fig. 5; drive the cross-head on to the rod, drill a $\frac{1}{8}$ in. hole right through for a pin to hold it on, and put a slightly taper reamer in to enlarge the upper end of the hole.

In an ordinary way there would be a flat key to secure the piston-rod into the cross-head, but this would be a much more

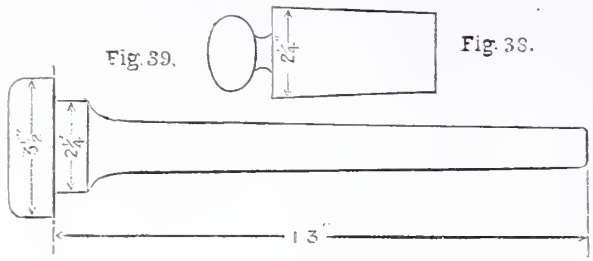
difficult job to accomplish; and, since the piston-rod is of ample strength, it will not pull in two even though half its cross section is cut away by the round pin. Moreover, the pin may be of good steel, hardened and spring-tempered; it will not then shear in two. Also it is quite easy to put a little "draft" on the pin, so as to make it tend to draw the rod into the cross-head; all that is required, after reaming out the hole and fitting the pin, is to put a small rat-tail file into the hole in the piston-rod, and file away a very little at B (Fig. 43), and into the cross-head, and file away a little at A, A—a very little will do it, and the plan often comes in handy.

Having put the cross-head on the rod, driven in the pin securely, and marked the rod so that it may be put in always the same way, rub some marking on the guide surface, and try the working of the cross-head by pulling it up and down whilst the piston and cylinder are in position. Notice whether the sole of the slipper bears all over on the guide surface, or whether the front or back edge is lifted; if so, take the cross-head off the rod and correct the sole with the scraper: it should not require much if our directions have been observed. We have now to file up the slanting edges of the slipper parallel with the piston-rod and with each other, and to the same angle as the guide-bars. Test your work as you proceed by laying the cross-head and two guide-bars in position upon a true surface, as in Fig. 44, and observing whether the guide-bars and piston-rod are all three parallel. (The piston should be taken off the rod, else it will be in the way.) When this is the case, finish filing up the cross-head, elongate the holes in the guide-bars, as shown in Fig. 44, place it and them in position on the guide surface, mark through the holes in the guide-bars on to bed, to give the positions of the six holding-down screws, drill and tap these holes, and put in the screws to hold down the guides and the four others used for advancing them sideways into contact. Now slide the cross-head and piston-rod up and down, the piston being removed and the rod passing through the stuffing-box. Watch whether the chamfered edges of the slipper are in perfect contact with the guide-bars, and correct them till they are. It will take some little time and trouble to do this properly, but it is worth the trouble. The red marking would be rubbed on the guide surface and inside the guide-bars; the cross-head would be rubbed up and down and then pulled out, the piston-rod coming out of the stuffing-box. Thus the chamfer of the slipper can be quickly tried, examined, and corrected, and then put in again. Don't say those fateful words, "It'll do," till the marking shows the chamfered edges and sole of the slipper really touch all over. Then put on the piston, and test once more.

Here it should be understood that the particular form of guide which has been described is suitable for an engine which will run chiefly, if not entirely, in one direction. Every reader who has studied the Introduction should know by looking at Fig. 4 in which direction the engine will run. The eccentric precedes the crank by a little more than a right angle, and therefore the engine wheel, as seen in Fig. 4, will turn round in the same direction as do the hands of a clock.

In the little diagram at Fig. 45, A B represents a piston-rod, B C a connecting-rod, C F a crank, and C D E a crank circle. Now, if the piston be driving forward the crank from C towards D, were there no guide at B for the cross-head, the tendency would be to bend the piston-rod downwards. It is this tendency which is resisted by the broad sole of the slipper-guide in the engine we are making. But let the motion of the crank be continued past D to E, and let the connecting-rod take up the position of the dotted line, B E; now the piston-rod is pulling the crank, yet the side pressure at B is still downwards, and not upwards, as one might have supposed. If, however, the direction in which the engine runs were to be reversed, then the pressure on the guide would be continually in an upward direction, and our guides would require to be modified. As it is, the pressure comes on the broad sole of the slipper, and is received by the solid metal of the bed, the guide-bars merely acting as safeguards.

We may now undertake the cross-head pin, as seen in Fig. 8. This is to be made of mild steel. Take a piece of Bessemer $\frac{5}{8}$ in. diameter, and about $2\frac{1}{4}$ in. long, and bore right through the centre a hole $\frac{3}{32}$ in. in diameter; this is for the oil or grease to pass. Countersink both ends of this hole to fit the lathe centres. The hole must afterwards be plugged up at both ends; or it might be bored not quite through, as shown at Fig. 8; at any rate, the piece must be a little too long at first, so as to allow for removing the countersunk part and squaring up the ends. Take a $\frac{3}{8}$ in. taper fluted reamer, and clean out with it the hole for the pin in the cross-head so that it can be driven in up to $\frac{5}{16}$ in. of the head. While in that position, bore the hole for the little $\frac{1}{8}$ in. set-screw, seen in Fig. 5, opposite the piston-rod, letting the point of the drill cut a little way into the cross-head pin. Take out the pin from the cross-head, tap this hole and fit the set-screw, then drive in the pin again, and fix it so with the set-screw, which must enter the little hole made for its point. Now bore the oil channels, as seen in Fig. 8; first bore with $\frac{3}{32}$ in. drill from the centre of the top of the cross-head right down through the cross-head pin and out at the sole; this will supply oil to the sole of the slipper. Then bore across the bottom of the hole from one side chamfer to the other, as seen in Fig. 8; bore also the two short holes from the top of the cross-head pin to the central hole, which will enable the lubricant to reach the two bearings at the forked end of the connecting-rod. The single lubricator screwed into the top of the vertical hole supplies lubrication to all these five surfaces.



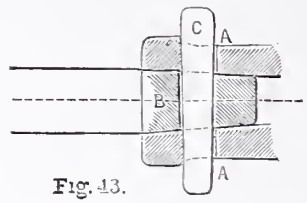




Fig. 43.

Fig. 40.

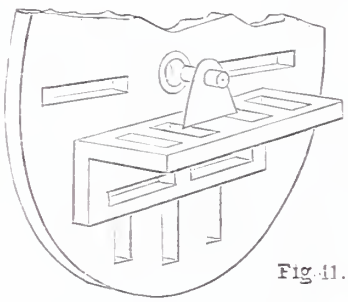


Fig. 41.

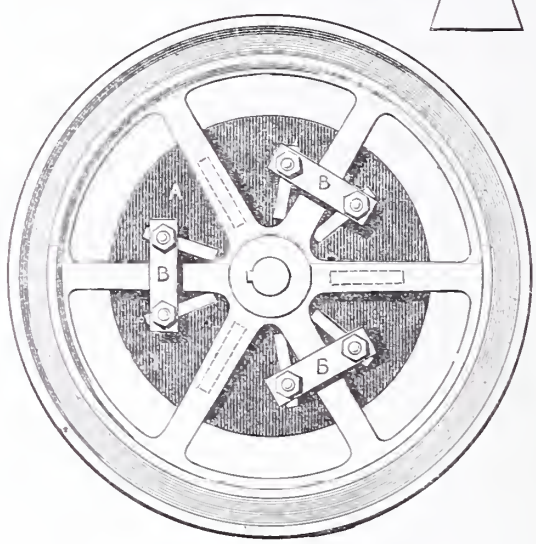



Fig. 46.

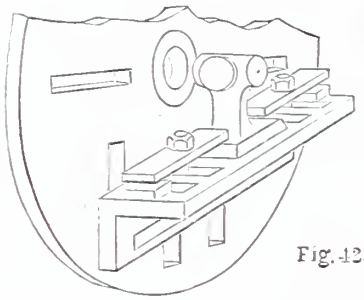


Fig. 42.

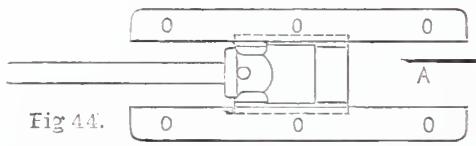



Fig. 44.

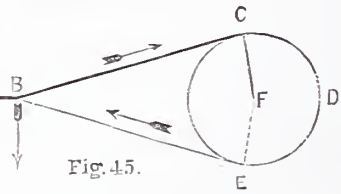



Fig. 45.

Fig. 38.—Wooden Plug for trying Hole in Bed-plate. Fig. 39.—Wooden Template for testing Bed-plate. Fig. 40.—Template. Fig. 41.—Mode of using Template to set Angle-plate to exact height. Fig. 42.—Mode of chucking Cross-head. Fig. 43.—Mode of securing Piston-rod into Cross-head. Fig. 44.—How Chamfers on Cross-head are tested for Parallelism. Fig. 45.—Diagram to explain Action of Connecting-rod on Guide. Fig. 46.—Mode of chucking the Fly-wheel.

Fig. 46 shows how the fly-wheel may be mounted on a 10 in. face-plate chuck for boring $\frac{7}{8}$ in. hole for crank-shaft. It is 16 in. in diameter, and if the gap in a 5 in. lathe were 3 in. deep, the wheel could be mounted as shown, the hole bored and slotted for the key, and the boss turned.

Possibly the rim might also be turned, but it would be with difficulty. It is not necessary to have it turned, though it does certainly improve the appearance of the engine, provided it be kept clean and bright. This rim, like the planing of the bed, might well be left to an engineer or to whoever supplies the castings. In Fig. 46, A is the face-plate; three of the arms are grasped by clamps of iron, B, B, B, and under each arm beneath these clamps are three pieces of hard wood which hold the boss of the wheel off the face-plate. When the wheel had been adjusted to run true and the clamp screws firmly fixed, the boss would be turned and the hole bored, first with a small drill, and then with larger ones, till nearly the right size, when it would be finished with a fixed tool in the slide-rest, using a sharp tool and a very light cut, and trying in the hole a bit of $\frac{7}{8}$ in. turned bar, to make quite sure it is turned parallel.

The key-way would be most easily made by slotting in the lathe—*i.e.*, fixing a slotting tool on the slide-rest, holding the work still, and moving the tool into the hole by working the saddle along by the rack. As, however, an amateur may not think it worth while to make a slotting tool for this key-way and that in the boss of the eccentric only, he may do the job by simply marking the position of the key-way by two lines drawn inside the hole by the point of the tool which was used in the slide-rest for finishing the hole. To do this, the work would be held still whilst the lines were drawn by moving the saddle along the bed by means of the rack. This method would ensure that the key-way should be marked out parallel with the hole of the wheel, and then the cutting could be done with the chisel and file. The key-way is not "sunk" in the shaft, as is usual, but bears simply upon a flat filed on the shaft, and therefore it should be rather larger than usual, since it is absolutely essential that it should fit well, and hold the wheel to the shaft without the slightest possibility of turning on it, for this would produce a knock at every stroke; and any slight looseness there might be at first would continually increase. Then make key-way $\frac{3}{8}$ in. wide and $\frac{3}{16}$ in. deep.

# NOTES ON HAND SAWS.

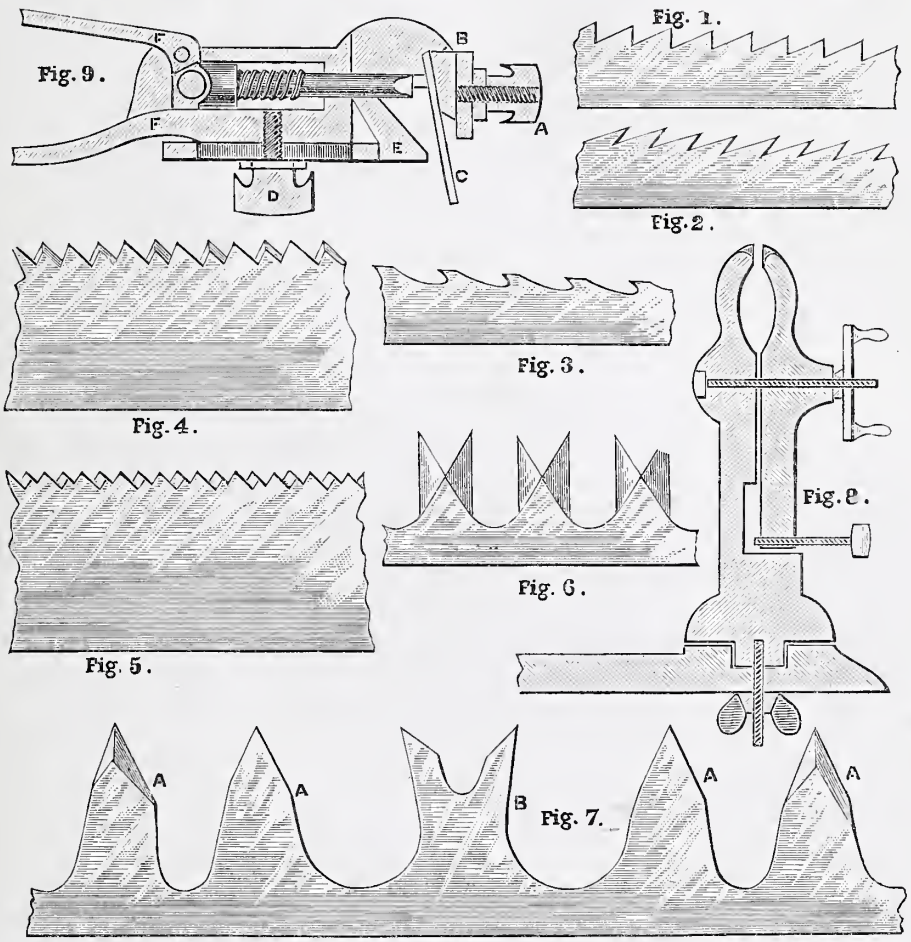
BY M. POWIS BALE, M.INST.M.E., A.M.INST.C.E.

*Author of "Woodworking Machinery," "Saw Mills: their Arrangement and Management," "A Handbook for Steam Users," etc.*

SELECTION OF A HAND SAW—SAW SHARPENING—VICE FOR BENCH—VICE VIBRATION—FORMS OF TEETH OF SAWS—ACTION OF RIP SAW—BEVELS OF TEETH—SETTING SAWS—SPRING-SETTING—HAMMER-SETTING.

On no point connected with wood conversion do opinions differ so much as in what is the best shape and cutting angle of saw teeth, and the proper method of sharpening them. This is, perhaps, more particularly the case with power-driven circular and mill-web saws, and is proved by the fact that there are at least one hundred varieties of teeth in use; but it applies, to a certain extent, to hand saws. The few notes given here, I trust, may be of some service, and I shall not be accused of egotism as I simply give an opinion and nothing more.

*Selection of a Hand Saw.*—In selecting a saw, for whatever purpose, do not be tempted by a low first cost, as this is no criterion as to its ultimate cheapness. What is required is a blade made of the very best quality of steel, combining, as far as may be, flexibility and toughness with a sufficient degree of hardness to allow of the steel carrying a good cutting edge. A saw bearing the name of a maker of repute should, and usually does, give satisfaction; but as a great number of very inferior ones are sold, some of the points to be desired in a good one, with a few hints on testing, may not be out of place. In selecting a saw, see first that the handle is comfortable to the grasp and made out of thoroughly seasoned wood. Beech handles, with countersunk rivets, are preferred by many. The blade of the saw should be of as thin a gauge and as narrow as the nature of the work it has to do will permit. A thin and narrow saw wastes less wood and will work with less friction than a thick and wide one, consequently it requires less power to drive it; at the same time, it will usually be found that the steel used in thin blades is of finer quality than in thick Care must be taken, however, that too thin a blade is not selected, and that the saw is stiff in work, as, should it "buckle," it may give a great deal of trouble. Bend the blade of the saw thoroughly, and see that it has a good flexible spring, and will fly back to its original position without marking or buckling the blade. Examine the blade carefully in a bright light, and see that it has been properly hammered and ground. See that it is carefully set and sharpened, and not too soft in temper, or it will rapidly dull and require frequent re-sharpening. If the saw has been "hammer"-set—in contradistinction to "spring"-set—without fracture to the teeth, it is a very fair test as to the quality of the steel. The blade should ring clearly when struck with the finger, and when sprung over by hand it should not jar in the handle. Finally, if possible, try the saw on a piece of difficult cutting wood, and see how it behaves: if it cuts fast and clean with a moderate expenditure of power, it is what you require. Increment teeth have of late come more into use—that is, the point of the saw is arranged with finer teeth than the heel—and are liked by many operators, as the fine teeth commence the cut smoothly, and the coarse teeth prevent the saw clogging.




Figs. 1, 2.—Saw Teeth that may be filed square across. Fig. 3.—Saw Teeth with Rounded Gullet. Fig. 4.—Cross-cut Teeth for Soft Wood. Fig. 5.—Ditto for Hard Wood. Fig. 6.—M-shaped Teeth. Fig. 7.—Saw for cross-cutting Logs. Fig. 8.—Bench Vice to hold Saw during Setting. Fig. 9.—Patent Saw set for bending Saw Teeth.

*Saw Sharpening.*—Having selected our saw, now comes the question of sharpening it. This is usually done with a three-sided saw-file. These are generally cut in three degrees of fineness. A second-cut or smooth-cut file is best for sharpening a hand saw. Select a file of the very best quality, about 10 in. long, and see that the teeth are cut perfectly even, and the colour of the file is uniform. If it is of a whitey-grey colour throughout, it shows that the temper is uniform; but if it is mottled, you may conclude that the temper is uneven.

To sharpen the saw, clamp it in a saw vice. The clamps should be of hard wood of about 3 in. deep by 1 in. in thickness. The upper edges of the wood should be chamfered off considerably, so as to allow of the file being held at an angle. The saw blade should project slightly above the top of the clamp, but not sufficiently far to allow of any vibration on it, or it will very soon strip the teeth of the file, and rapidly wear it out. The clamps and saw can be held between the jaws of the bench screw. Several excellent saw vices, well adapted for amateurs, are now made which spring the saw slightly, and so prevent vibration of the blade when filing. Vice vibration may be reduced considerably by fitting thick strips of indiarubber between the jaws.

Fig. 8 gives a sectional view of a very simple form of vice for fixing to work-table or bench. It is very handy, and will be found well adapted for amateur and general use. Its action will be readily understood from the illustration.

We will first consider briefly the sharpening of a hand rip saw. The forms of teeth most generally in use are shown in Figs. 1, 2, and 3. Fig. 1 is, perhaps, the most common, and, in my opinion, undoubtedly the worst form of the three; No. 2 a better form; and No. 3 by far the best, although the most troublesome to sharpen. In ripping with the grain of the wood, the saw teeth should act like a series of small chisels, producing minute chips or shavings instead of fine dust; if this latter is produced by a rip saw, it is grinding, not cutting. Correctly speaking, saw teeth should be adapted and modified in shape and set to suit the nature of the wood they have to cut; but as a hand rip saw has usually to do various kinds of duty, all that we can do is to select a tooth that can be used with tolerable success on a considerable variety of woods. The tooth shown in Figs. 1 and 2 is often filed square across, and this will answer fairly well for straight-grained wood; but as cross-grain is constantly met with, I prefer to file the teeth with a slight bevel. After the saw is set, some sharpeners give a bevel to the points of the teeth by holding the file at right angles to the saw. Owing to the rounded gullet, the teeth of Fig. 3 are much less liable to crack at the root than Figs. 1 and 2, which have an angular gullet. M-shaped teeth, similar to Fig. 6, are now largely used, chiefly in America. They have cutting edges both back and front, and will cut in both directions. They are usually bevelled and set alternately, and, if kept in good order, will cut rapidly.

The action of a saw when used for ripping or cutting with the fibres of the wood is entirely different from one used for cross-cutting or severing the fibres of the wood transversely. The shape of the teeth and the method of sharpening should, therefore, be entirely different. In the case of a ripping saw, the action of the saw is chiefly a splitting one,* the saw teeth acting like a series of small wedges or chisels driven into and separating the longitudinal fibres of the wood; whilst with cross-cutting saws, the fibre of the wood has to be severed across the grain, and is comparatively unyielding, and the teeth of the saw meet with much more resistance; it is therefore found necessary to make the teeth considerably more upright and more acute or lancet-shaped in their form than for cutting with the grain. Fig. 4 represents cross-cut teeth, adapted for soft wood, and Fig. 5 teeth for hard wood; the teeth for medium wood being at an angle about midway between the two. The faces of the teeth should be sharpened to a keen edge, so that in work they may have a direct cutting action similar to a series of knives. For soft wood the teeth should have a full set, and care should be taken that the teeth are made of sufficient depth to allow of an easy clearance for the sawdust. About eight or nine teeth to the inch can be recommended for general purposes. For hard wood there should be about ten teeth to the inch, and the back of the teeth filed square. Do not file all the teeth from one side, but file the front of all teeth set from you, and the back of those set towards you. Some sawyers recommend going over a saw several times to get the best results. The last teeth of cross-cut saws should be rounded at the points to prevent tearing when entering a cut.

One of the great difficulties found in hand sharpening is to get the bevels of the teeth exactly alike. A number of mechanical arrangements to guide the saw and effect this object have been tried with more or less success. In the best with which I am acquainted there is a circular casting, divided and indexed from its centre each way, giving bevels for each side of the saw, or square across. The file is fitted into a guide, and is held by a set-screw. The index shows the pitch at which the file is set, and a rod passes through holes in a graduating ring and guides the file. The frame upon which the ring is held slides in grooves cut on each side of the vice in which the saw is fixed; a table connected with the guide is arranged and indexed so as to give the required bevel and pitch for the kind of saw to be filed, and it is only necessary to set the ring for the bevel, and the indicator for the pitch, and the apparatus is ready for use. As the filing is proceeded with from tooth to tooth, the frame follows, giving the same bevel, pitch, and size to each tooth on one side of the saw the same as on the other, thus leaving the saw, when finished filing, with the teeth all uniform in size, pitch, and bevel, so that each tooth will do its share of cutting equally with the others, thus turning out more and better quality of work with a less expenditure of power.

After a saw has been sharpened, it should be carefully jointed, or, in other words, it should be laid flat on its side and the teeth rubbed down with a whetstone or smooth file to remove any feather edge that may be left by the file in sharpening. This gives a larger and better cutting edge to the saw. If the points of the teeth only are allowed to do the work, the action is a scratching and not a cutting one.

For cross-cutting logs with a double-hand saw, I can recommend a saw with teeth similar to Fig. 7, instead of ordinary cross-cut teeth, as it is much quicker and cleaner in cutting. These saws are of American origin, where they are now largely used. The cutting is done by the teeth marked A, and the tooth marked B acts as a clearer; this latter is filed about $\frac{1}{32}$ in. shorter than the scorer teeth. The teeth are often formed on both edges of the blade, and when one set are worn down, they are knocked off, and the other edge of the blade used. The saw is made slightly curved, and the handles reversible. Fourteen gauge steel is used. From experience I can say this form of saw is rapid and easy to work, and does not bind in the cut; at the same time comparatively little set is required. It will cut well both hard and soft wood.

*Setting Saws.*—After the saw is filed, and all the teeth made as uniform as possible in shape, length, and gullet, comes the important operation of setting the teeth so as to afford a ready clearance for the sawdust. This is apparently a simple operation; but to secure absolute uniformity in setting by the use of the common saw-set is not by any means easy, consequently greater power is required to work the saw. The longest teeth having the greatest set, are rapidly worn down, and the work turned out is scored and rough. At the same time, the saw will run from the line to the side of the saw on which there is most set. If a saw is properly and uniformly set, the teeth should form an angular groove one with the other when held up to the light and looked at from point to heel. The amount of set necessary to allow an easy motion to the saw without pinching it or allowing it to rattle will vary according to the nature of the wood—clinging and stringy fibred woods requiring more set than hard woods; but no more set should be given to a saw than is absolutely required, as the more the set the greater the power required to work, and the greater the loss of wood.

Two kinds of setting are used for hand saws—viz., spring-setting and hammer-setting. In the former the teeth are bent from the line by a saw set; in the latter they are set over by a blow from a hammer.

In using spring-set, it is necessary to slightly over-set the saw, to compensate for the tendency of the teeth, especially when worn and dull, to spring back to their original position. Several capital contrivances are now made for spring-setting, so arranged that all the teeth can be readily set to one line, and when the instrument is fixed it is impossible to overset a tooth; and should the saw be found to bind at any particular point, the teeth can, with this contrivance, be set into line, and any excessive friction reduced. I illustrate herewith such a set (patent) by Fig. 9, which is adapted for setting either hand, circular, mill, or band saws. Its operation will be readily understood from the sketch and the following directions for use: Hold the saw with the teeth upwards; adjust the die, B, by means of the screw, A, in the end of the set, so as to have the angle on the die, B, come near the base of the tooth on a fine saw; on a coarse saw, have the angle of the die strike the tooth about two-thirds down from the point. Set the guard, E, on the underside of the set forward to about $\frac{3}{16}$ in. from the die, B; then let the set hang loose on the saw. When thus held, the space between the tooth and the die shows the amount of set you will be giving the saw. To increase the set, move the guard, E, still closer to the die; to decrease the set, move the guard back.

Saws set by the blow of a hammer or punch are apt to be more irregular than spring-set saws; the operation should, therefore, be very carefully done, and the teeth constantly tried with a gauge or straight-edge, so that all the teeth should be exactly in line. Hammer or swage-set teeth will stand well up to their work in cross-grained and knotty wood, whilst spring-set teeth are more inclined to dodge the knots. I have seen saws working with part of the teeth spring-set and part hammer-set, but the difficulty of keeping them exactly uniform neutralises any advantages the plan may possess.

Before attempting to set and sharpen his own saws for actual work, the amateur should practise on an old saw which he cannot possibly spoil.

* See "Saw Mills: Their Arrangement and Management" (M. Powis Bale).

## MY FIDDLE-CASE: HOW I MADE IT.

BY O. B.

PROFESSIONAL AND AMATEUR WORK CONTRASTED—PATTERN OF CASE—MATERIAL—JOINING UP BOX—FORMATION OF LID—LOCK, HANDLE, ETC. FITTINGS—LINING.

IF I were asked to define man, I would say he is a creature sensible of increasing needs. No sooner has he satisfied a want than he feels possessed of a capacity all the larger for having accomplished his object. This is the basis of all human progress, and of this feeling all men are more or less conscious.

These reflections have been occasioned this wise. Having made a music-stand, I soon began to feel that I was sadly in want of a fiddle-box. It is true I had a box, but the more I looked at it the more I became dissatisfied; and for this reason. Nearly thirty years ago I became possessed of a very fine old instrument. I gave a cabinet-maker an order to measure the fiddle for a suit of mahogany and baize, which in due time came to hand with the "little bill;" but one may imagine my annoyance at finding that to reduce the size of the box he had actually shortened the bow to the extent of two inches.

And here I am reminded of a circumstance which came under my notice a little while ago. Being in a town at a distance from my residence, I was accosted by a stranger who had seen my name announced. He wanted to know if my name had not appeared in WORK, to which I pleaded guilty; whereupon a conversation ensued as to the merits of the paper. His opinion was that many of the articles were very amateurish—for example, one on a music-stand. I maintained that one advantage of WORK was that amateurs wrote for amateurs as well as professionals for professionals, and that having faced difficulties, they were better able to explain them than the professional workman, who, from his frequent repetitions and mechanical operations, had long since failed to notice the difficulties. And further: it must have been observed many times over that when a professional gives instruction in his art, either from stronger professional jealousy or otherwise, some essential—some pinch of salt—is left out, so that the explanation is much like that of a professional conjurer: "'You don't see exactly, you know." But, granted that an amateur does his work amateurish, what then? Do not professionals make blunders that an amateur would be ashamed of? What amateur would make a box to fit a fiddle and then cut a grand old bow to fit the box? Well, it was for this reason I discovered I needed a new one; for the young people had to carry the bow in paper when they went out with their fiddle; and besides, the box itself was of such a shape that some vulgar little boy cried out, "Heigh! see that lass: she has got a coffin!" and truly, it only needed the upper corners to be taken off to be the exact pattern of a box for "mortal remains;" but then, it was made by a professional, so there is *some* comfort in that.

The pattern and the material cost me some thought. There was the ordinary round-ended case, but to make a presentable one of this pattern, even if I availed myself of a Dutch cheese-box to provide the circular ends, did not seem very easy. Then there was the coffin pattern, but I could not contemplate that with any pleasure. There was only one that I could think of, known, I believe, as the French pattern. This seemed to be the best. Having a good stock of walnut-wood by me for fretwork, I considered this to be most suitable. Shooting one edge true, I measured and marked off two pieces for the sides (as Fig. 1), the long edge 2 ft. 8 in., short edge, 1 ft. 11 in., and 10 in. wide. These were carefully cleaned up. To make the ends the same angle, they were planed together, and then the ends reversed and planed up again. By this means the ends were got true. Two pieces, $10\frac{3}{4}$ in. by $4\frac{3}{4}$ in., for the ends; one piece, 24 in. by 5 in., for the top; and another, 29 in. by 5 in., for the bottom. The end pieces were made the same width, and one end of each squared off.

How should the box be joined up was a consideration. The wood was thin, so I decided on the following plan:—I cut a $\frac{1}{2}$ in. plank into $\frac{1}{2}$ in. strips, and glued and screwed a strip on the inside edges of the end pieces, which would be joined to the sides, being careful to use such screws as would not come through. When the glue was hard, I carefully squared up the edges. I now had a good $\frac{5}{8}$ in. surface to join the side to, which was done by glue, and three screws driven in from the outside. Before the glue set the work was tried, to see that it was true. The top and bottom of the end

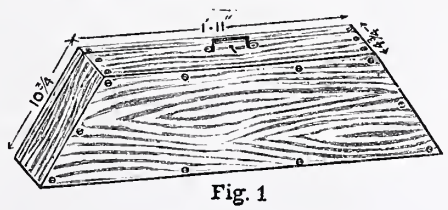



Fig. 1

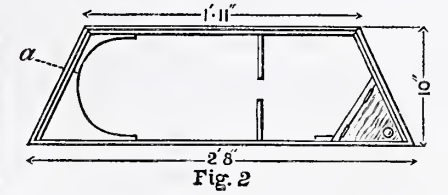



Fig. 2

Fig. 1.—Fiddle-case in Isometrical Perspective.
Fig. 2.—Plan of Case within.

pieces were now planed off level with the sides, and the inside edges of each were lined with strips, to increase the thickness all around. Then the edges were planed and squared up, and care taken that there was no winding on the edges. The top and bottom were now put on with glue and screws, precaution being taken that the screws were put at equal distance by measurement, else they would present an unsightly appearance when the case was completed.

The work was now put on one side to dry and harden, when the screws were withdrawn, and the whole surface was worked up as smooth as possible: first with a fine-set sharp plane, and then with glass-paper. The screw-holes were countersunk, and the screws replaced. The case was now cut in two, leaving a caddy-lid 1 in. deep. The edges were planed true, to make a close joint. On the inside of the deeper half along the top and ends a strip of wood was glued, projecting $\frac{1}{2}$ in., so as to form a rebate for the lid to close over (*a*, Fig. 2). This had to be taken down with a rebate plane, else the lid would be too tight. Blocks had to be glued on the inside of the bottom, to give a foundation to the screws holding the hinges, which, in my case, were ornamental ones fixed to the outside, and not as ordinary butts. A lock and handle were fitted in their place. The inside now received attention. Across one corner, as shown in Fig. 2, a piece of wood was secured by blocks, and a lid hinged, as a receptacle for strings, etc.

At the opposite end a piece of wood was cut with a fret-saw, to fit the end of the instrument. This was glued in its position, and secured with blocks. A piece of stout cardboard was then bent and fastened to the hollow wood with pins; this reached to the bottom. Measuring where the neck of the fiddle would come, a strip of wood was glued across the lower half, with a slot to take the neck. By this means the instrument is kept in its place. A packing-piece was secured from this division, slanting towards the tail, so that the instrument should bed firmly. On this, cotton wadding was laid. The sides and bottom were now lined with velvet. In the lid, on the longer side, two pieces of pine, 3 in. long, were glued, to hold the bow, which is kept in place by small brass buttons. The lid was also lined with velvet.

When the inside was lined, the outside was polished, after which the hinges and handle were replaced, and the case, thus completed, presents an elegant appearance. On the principle that the kitten can go through an opening large enough for the cat, I made my box deep enough to take the highest model fiddle I have, so that a flat model can be taken equally well.

## AN EARLY RISER'S FRIEND.

BY C. MAYNARD WALKER.

ADVANTAGES OF ALARUM—DIMENSIONS—CLOCK PARTS—CASE—PARTS OF APPARATUS—MAKING UP—THINGS THE ALARUM WILL DO—ALTERING CLOCK—MATCH-HOLDER AND AXLE—SPIRIT LAMP—HOLDER FOR STRIKING SURFACE—REFIXING CLOCK MOVEMENT.

How to make an alarum for early risers, which will strike a match, light a lamp, boil water, make tea or coffee, and awaken the sleeper at any required hour. The advantages to be derived from the habit of early rising, whether viewed from the points of obtaining or retaining health, or for the lesser objects of acquiring wealth by devoting more hours to labour, or of riding some particular hobby, are pretty generally admitted; and while it may be true that most persons living in the country practise from choice the laudable habit with a regularity that is perhaps hereditary, and also that thousands are compelled to rise early in order to follow their employment, whether they like it or not, it is equally true that a very respectable minority, who, while recognising the advantages of early rising, fail to acquire the habit, either from a want of strength of purpose, from natural sleepiness, or from some other reason equally powerful to keep them in bed, and who therefore usually "oversleep" themselves—unlike the late Duke of Wellington (the Iron Duke), who is reported to have uttered and acted upon the statement that "when a man turned over, it was time to turn out." The enormous trade in alarum clocks, carried on in this and other countries, is evidence that the class of persons referred to is a very large one; and as, doubtless, many of them are readers of this Magazine, and therefore anxious to carry out some of the excellent suggestions therein, will welcome the instructions here given, which, if carefully carried out, will put them in possession of a faithful servant, which will minister to their comfort by calling them at any desired hour,

and, further, getting the breakfast ready at the same time.

In these instructions it is to be understood that the parts are of such form and of such material as are best suited to be made up by persons capable of doing ordinary soldering with sheet metal, and without the use of expensive tools; therefore, such parts of the apparatus which could be much better made from castings and turned may be with advantage so altered. However that may be, the present plan will answer every purpose.

Fig. 1 represents the complete apparatus, the dimensions being: height, 8 in.; width, 5½ in.; depth, 5½ in. externally, and is taken from a photograph of one in use, and made by the writer. The outer part or case is made of tinplate. The internal fittings are of wire and tin of the simplest kind, so that anyone capable of "jobbing" tin work may undertake the work with every probability of success. The clock part is an ordinary alarum clock, known in the trade as a "Cottage Alarm," and can be bought through any clock dealer, or direct from Messrs. Meyer, Aldersgate Street, E.C., for about 3s. 6d. This will be found a serviceable article. When purchased, it will be in a wooden case, which will of course be dispensed with and put to some other use.

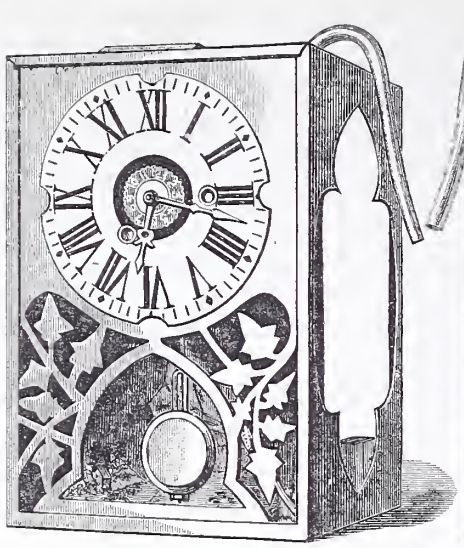


Fig. 1.—Apparatus complete.

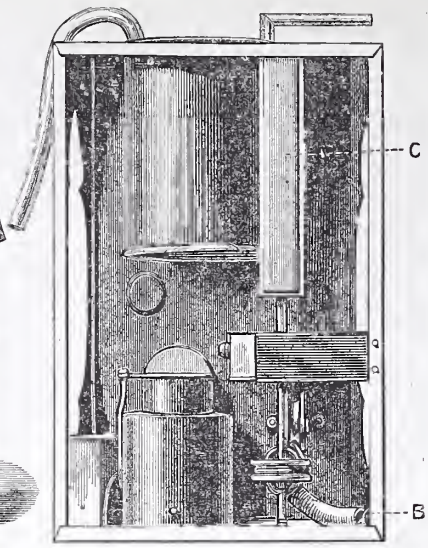



Fig. 2.—Back of ditto; B, Check Spring; C, Angle-piece.

We shall first require to make up the case (Fig. 3), which will need but little explanation beyond pointing out that the edges of the front are turned over on three sides only, the bottom being left to admit of the front sliding into its position; also that the device or cut out at the sides is simply to combine a little ornamentation while strengthening the side. The cutting should be made before the case is made up; also the hole, B, 3 in. in diameter, should be cut. The case is quite open at the back, and from the front a kind of inner case extends 2⅛ in. inside of tin, which will presently form the case proper of the clockwork. In the back of this inner case, at a point 1½ in. from the bottom and 1 in. from left-hand side, is cut an oblong hole, 1⅛ in. deep by ⅜ in. wide. This case should be very neatly made and its sides true to each other, or the finished work will present an awkward appearance. We have now to fit up the mechanism, and it will be best perhaps that, at this point, a description of the general idea should be given. We have an alarm clock, which, in its present form, simply sounds a bell at a given hour. We want to make the clock carry out our purpose, so that, in addition to being awakened, we shall be provided with tea or coffee, ready to hand when the alarm is given. In order to do this, we remove the spring of the alarm, and in its place attach a piece of catgut. Connect this to a piece of mechanism at the back of the case, which will carry and strike a match in such a position that the match will ignite a spirit lamp under a small boiler, the water of which will run out as soon as it boils into a tea or coffee pot, and at the same moment sound a shrill call with a whistle on the boiler. The writer has endeavoured to arrange the parts so that they occupy a comparatively small space, and that the case shall present a fairly ornamental appearance, the front (Fig. 1) being a design cut out of zinc with the fret-saw, and the dial of clock let in behind, the whole sliding up the groove referred to in case (Fig. 3).

The details of the various actions of the interior will now be described. Having made the outer case, we require to make the necessary alteration in the clock. Remove it from the case, and take out the wire holdfast on the alarm side, so as to be able to raise the plate. You can then, with a little care, take out the spring-wheel and spring, cutting the latter clear of the bar to which it is fastened to the clock. Having removed the spring from the wheel, punch out the rivet which held it in its place, and in lieu thereof pass one end of a length of catgut (14 in.) through the hole. Leave about ½ in. of the catgut out, tie a small knot, and restore the wheel to its position in the clock, and fasten up the plate as before. In front of the spring-wheel, at the winding-up pin, will be noticed a peculiar shaped piece of brass, which acts as a stop to the winder, and prevents the work being overwound. We shall require to readjust this later on.

Further down at the bottom of the works will be noticed an escapement in connection with the alarm, having a small weight on a piece of wire, which acts as a bell-hammer. Cut this off with wire-cutting pliers. Also notice attached to this two steel pellets, which, when the alarm runs down, alternately escape, and give the necessary intermittent action of striking the bell. We do not

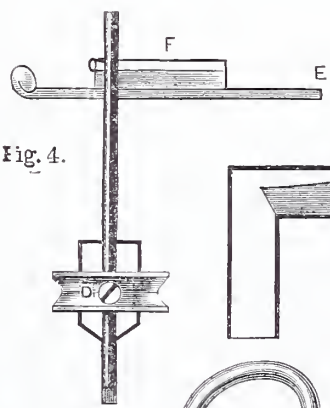



Fig. 4.

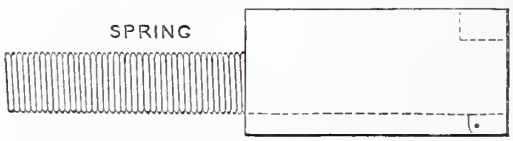



Fig. 7.

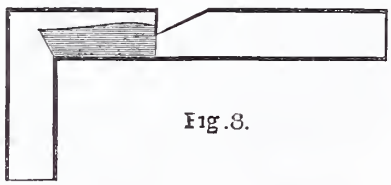


Fig. 8.

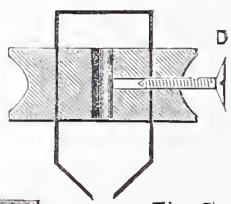



Fig. 5.

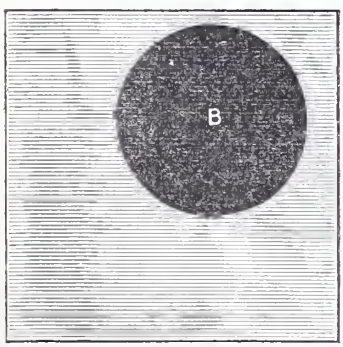



Fig. 3.

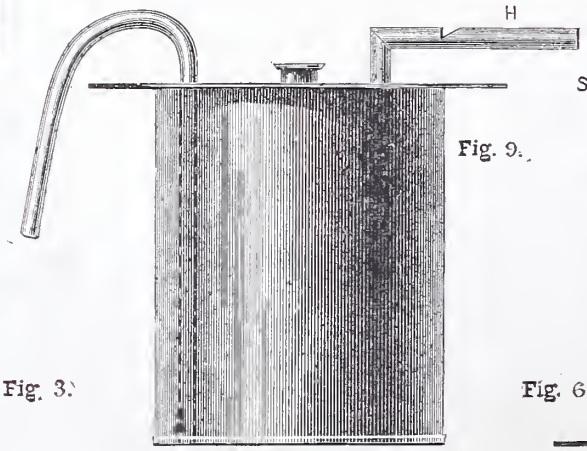



Fig. 9.

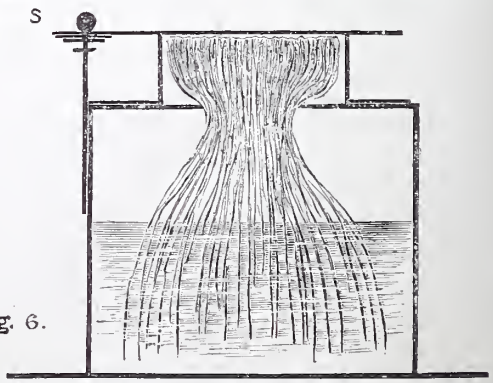



Fig. 6.

Fig. 3.—Plan of Top of Case. Fig. 4.—Match-holder and Support (half full size). Fig. 5.—Pulley-wheel (full size), with Wire and Screw. Fig. 6.—Section of Lamp with Sliding Cover pivoted at S. Fig. 7.—Carrier for Friction Surface (full size): the Dotted Lines show where Edge of Metal is turned up. Fig. 8.—Section of Steam Whistle (full size). Fig. 9.—Boiler Pipe and Whistle.

require an intermittent action, but a continuous run down. So take firm hold of the *lower* pellet, and break it off. Being hard steel, it will readily snap. Hold the other part firmly, so as not to break both off. Now set the clock aside for a time. Then make a bearing to connect the catgut at right angles, for which purpose we require a pulley-wheel (such as are used by venetian blind makers, and sold in London about sixpence per dozen). This is fitted in the slot in the back of case by passing a piece of wire through the wheel, and soldering to the case. As this has to bear a considerable strain, the ends of the wire should be bent over, and let into the case before soldering. This will ensure the necessary strength.

We now require to make the match-holder and axle (Fig. 4), which consists of an upright piece of wire, $\frac{1}{8}$ in. thick by $4\frac{1}{8}$ in. long, to which, at a point 1 in. from bottom, is fitted another pulley-wheel, of the same kind just described. This is readily fastened by first drilling a hole on each side of the centre, passing a piece of bent wire through, as shown in Fig. 5, and soldering to the upright. Bore another small hole, and insert a screw, D. This will later on be connected to the catgut. At the upper end of Fig. 4 will be seen the match-holder, which is simply a piece of tin or zinc, 1 in. long by 1 in. wide, bent over a piece of $\frac{1}{8}$ in. wire, and pinched in under the wire, leaving a kind of tube when the wire is withdrawn. This is soldered to the upright, 1 in. from the top, and at right angles to the screw, D. A piece of tinned or brass wire is bent, as E, with an eye $\frac{5}{8}$ in. from the holder, F, leaving $1\frac{3}{4}$ in. extending in the opposite direction. This is soldered to the holder and to the upright, neat and strong. The next operation is to provide bearings for this work. The lower one will consist of the bottom of the case. For the upper one we must make an angle-piece (C, Fig. 2)—a piece of stout brass or zinc, $\frac{3}{4}$ in. wide, $7\frac{1}{4}$ in. long, bent to a right angle, 4 in. by 3 in., and soldered, the longer end to top of case, the shorter end to back of case, at a point $1\frac{1}{4}$ in. from the right-hand outside of case. Before soldering up, however, a hole to admit the upright should be punched in the shorter piece, at a point $1\frac{1}{4}$ in. from the bend. Having soldered this up, make a corresponding hole in the bottom of case, exactly under the other, so that the match-holder action-work will be vertical—that is, as shown in Fig. 4. If the measurements have been correctly made, you should have about $\frac{1}{8}$ in. to spare of the upright wire at each hole; and you can now secure this into its place, so that while it is free to move round, it cannot move up or down, by soldering at each end a bead of solder slightly larger than the holes.

We now require a small spirit lamp (Fig. 6), which is easily made of sheet zinc. The lamp is circular, with a square base, $1\frac{3}{8}$ in. high to shoulder, the part which forms the burner extending $\frac{1}{2}$ in. higher, having a diameter of $1\frac{1}{4}$ in. A "hank" of ordinary white darning cotton cut into three and placed inside the lamp forms a capital wick. The latter should not project above the lamp when in use, or it will hinder the action of the slide-cover. This cover is connected with an upright wire soldered to side of lamp (Fig. 6), and at a point level with top of lamp. A ledge is soldered to the wire. A hole is made in the extended side of cover, and is passed over the wire. A bead of solder on top serves to secure it, while leaving it free to move. Across the cover is soldered a semi-circular piece of tin, against which the wire at the opposite end of match strikes and knocks it away.

We have now to make the holder for the striking surface (Fig. 7), which is given full size, and is simply a piece of tin with edge and corner turned over at dotted lines. This is attached to a piece of crinoline steel spring, and soldered at its other end to the right-hand upright of case. It is best before soldering to pierce the steel, and insert a portion of an ordinary pin—the head part, and as much as is wanted of the stem. The steel must be softened at the ends to enable this to be done, which is readily effected by holding the ends in a lamp-flame till slightly red, and letting it cool of itself. It can then be punched with the point of a centre-punch or bradawl. The spring, when in position, should be curved inwards, so that the eye of match-holder just clears it. Thus, when the projecting match is in the holder, it will strike with some force. I prefer to use safety matches—the large size, Bryant and May's—and in the striker I place a piece of their friction surfaces, which are sold at most Italian warehouses at twopence per packet. Each sheet cuts into three, and each of the three is used four times—that is, I turn a different corner to the path of the match each time. Thus, a twopenny packet will last about nine months, daily use. I keep the box of matches in the case at the left-hand of lamp, and solder a strip of tin upright, which serves as a holder for the match-box, and keeps the lamp in position. The latter is best made with a square bottom, and to fit easily into the space left of the floor of the case. The lamp, of course, should be under the hole in top of case which was provided for the boiler (Fig. 9), which is 4 in. deep by 3 in. wide. The top extends $\frac{3}{8}$ in. beyond, all round. A piece of compo. pipe, $\frac{1}{4}$ in. bore, is soldered into top, near edge, and reaches to nearly the bottom; or, what is better, cut the pipe on the "skew," so that the water can run easily. A brass screw-cap is used for the filling hole, and a brass whistle (H) is made in an elbow form. Take a piece of brass tube, $\frac{1}{4}$ in. bore, $2\frac{3}{4}$ in. long. Saw off $\frac{3}{4}$ in., so as to make a mitre, and on the longer piece, $\frac{3}{4}$ in. from mitre, file an angular cut (Fig. 8). Stop up the longer end with solder, and insert in the shorter end a piece of cane or hard wood, the exact size of the tube, having previously filed the top flat, about $\frac{1}{16}$ in., slightly more at the mitred end. Just try it, and if you like the tone, secure the wood in its place by drilling a very small hole, and pass a pin in and solder to tube. Now solder the shorter end to top of the boiler, having previously made a hole at the spot. Next take a piece of suitable ordinary "bell-check" steel spring. Fasten the loop end to a piece of wire, and having passed the wire through the base of clock case, at the right-hand corner extreme point, solder underneath, and bend the other end of spring wire over the screw, D, in Fig. 5, so that when at rest it pulls over the striker a little beyond its proper position of being over centre of lamp.

There remains now only to fix clock movement into position, and connect the catgut (through the opening of clock case back) with the striking work at the point D. This is easily done by giving the gut a turn over D, and tying it to the wire over wheel. The gut should be so fixed that it brings back the striker to its position to centre of lamp. It will be necessary, of course, to pass the gut round the wheel, and the point D should be in the position of right angles to the striker. Now, if you wind up the alarm, you will see the action of the brass stop, before referred to. Take it off and adjust it when you have wound the gut up far enough to bring the striker to the right-hand side of case, so as to be easily manipulated in fixing match, and taking out the same. Stop its further turning by putting the stop so that it can turn no further. Replace the pin. Try the work a few times, seeing that the alarm escapement frees itself readily, and the work runs down with a sudden run. This being found all right, paint the whole (except clock) with black japan, and, when dry, slide into position the clock face. Fix on the hands and pendulum, and all is ready for use. I find about half a pint of spirit is used in a fortnight. As spirit easily evaporates, the cover must be put back as soon as lamp is blown out. Do not put the match in holder until wound up. I use a small china tea-pot, set under the pipe of boiler, for tea, and a jug for coffee. The apparatus makes these or cocoa admirably, from the fact that the water is actually boiling over when it comes into contact with either.

## AN ASBESTOS LEAD JOINT RUNNER.

BY J. C. KING.

A PLUMBER is supposed to carry his kit of tools and melting pot, with some solder, with him, and do a job at joint soldering in a place which is sometimes almost out of sight and often difficult to reach.

Sometimes contriving an appliance to hold up the lead or solder to a joint to be wiped or scraped in the best manner, the awkward position admits of little chance of a clean job. The inventions of plumbers' tools have been slow, and differ but little year after year; yet the want of such handy appliances is felt alike by masters and workmen, especially at the away-from-shop jobs.

The invention now illustrated is by William Vanderman, 21, Church Street, Willimantic, Connecticut, U.S., and is intended to serve for running a joint for soil, water, or gas pipes, or bell pipes of any kind where a joint is poured with molten lead. It consists of a specially woven asbestos rope, with a safety chain down the centre, with tapering ferrules on the ends of the rope, fastened to the chain with a hook on one end and a coil spring and extension of chain on the other end, to draw round the pipe to get the rope in position below the joint that has to be run.

Asbestos Lead Joint Runner.

To operate it, make the lap on the top of the pipe with the tapered end under; draw tight, pass chain under pipe to opposite side, let the pull draw on the spring to take up any slack of the rope, and attach the hook to chain to keep all tight.

Be sure there is no space or opening except the space intended into which the lead is to be poured. If there is, press the joint runner up close against hub or lap. The

molten lead or solder will not injure the asbestos or bring any of it off to spoil a nice joint.

The usual plan of a putty or clay gasket, in some jobs stuck up like a swallow's nest, while the solder is baled with a spoon from a ladle and poured at a joint, is quite uncertain in results, as the clay or putty may be too hard or too soft, or get into the joint and spoil it.

No doubt this invention will lead to asbestos belting with chain inside for some forms of joint gaskets.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 61.—Messrs. Marris and Cooke's "Victor" Child's Carriage.

In Vol. II., page 142, of WORK, I had the pleasure of calling the attention of readers to

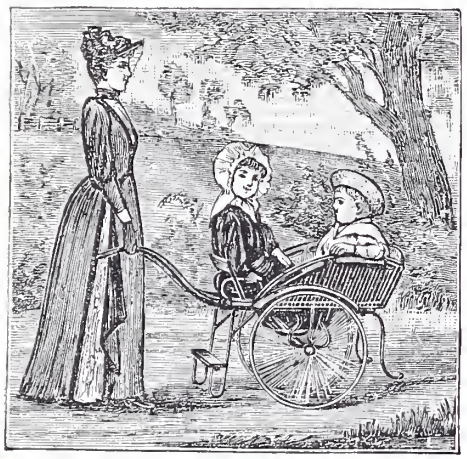


**Fig. 1.—Messrs. Marris and Cooke's "Victor" Child's Carriage.**

the original form of the "Victor" Child's Carriage, invented, patented, and manufactured by Messrs. Marris and Cooke, of Grimsby, who are also the proprietors of the Victor Bicycle advertised in these pages. The "Victor" Carriage in its earliest form was an excellent vehicle for children, and especially for children who were strong and active enough to take their turn in the shafts and draw one another; but its new development certainly has the merit of being more attractive in appearance, and is, in every way, more suitable and convenient as a child's carriage when mistress or maid is the motive power. This will be apparent to all who will take the trouble to compare the illustration given above with that in page 142 of Vol. II., over which it presents many decided advantages. Among these are the position and form of the shafts or handles, which are so contrived and affixed as to render it unnecessary for the tallest person to stoop when pushing it; and the carriage itself, which is level, or nearly so, when in transit, remains so when the shafts are relinquished by the driver, as when these are let down it rests on the irons which carry the front step; and, further, the irons attached to the back of the car prevent its being tilted up beyond a certain extent, and at the same time are not so long as to touch the ground when the carriage is being pushed along in a level position. The front seat is reversible, so that the child who occupies it may sit facing or with its back to the occupant of the back seat, the feet of both children being in the well of the car when the children are face to face. By means of two pieces of wood laid between the seats a bed is formed, on which an invalid child can recline with ease. It is well painted and nicely finished; it moves easily and without jolting on its springs; and its bicycle wheels are furnished with rubber tires, which render them absolutely noiseless, and

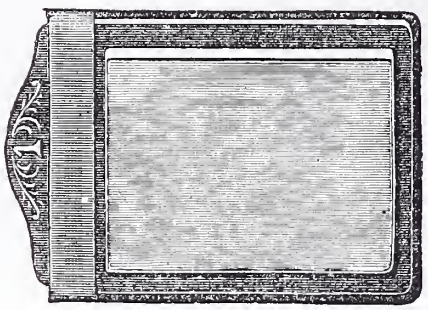


**Fig. 2.—Tylar's Single Metal Dark Slide: Shut.**

protected by broad mud-guards, which serve the double purpose of protecting the children from any mud that may be thrown up by the wheels, and also of preventing them from attempting to touch the wheels, which children are sometimes apt to do. The price, carriage paid to any part of the United Kingdom, is £2 5s. It compares favourably with, if it does not excel, any child's carriage of its kind, or any perambulator now in the market.

### 62.—Tylar's New Patent Single Metal Dark Slide.

This new invention of Mr. William Tylar, 57, High Street, Aston, Birmingham, and one of his most recent additions to his already large stock of photographic novelties, is specially designed for use in detective cameras, although there is nothing about it to prevent its use, generally speaking, in cameras so constructed as to admit of the use of dark slides. Its construction will be recognised from the accompanying illustrations, of which Fig. 2 represents it with the slide in or closed, and Fig. 3 with the slide withdrawn or open. To the back of the flat frame, which is shown in front, is attached a sheet of metal, moulded in the form of a shallow tray, and the slide or shutter works closely but not too tightly and stiffly in the groove, formed by the back of the frame and the upper surface of the margin of the back, rendering the dark slide absolutely light-proof. Below the groove, two projecting pieces of metal are attached to the sides of the

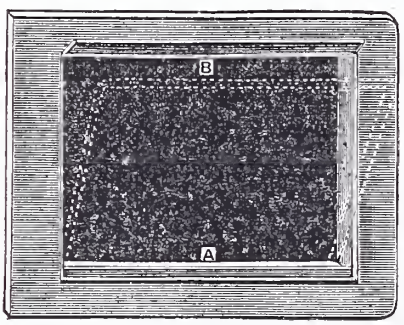



**Fig. 3.—Tylar's Single Metal Dark Slide: Open.**

rim of the so-called tray. That at A is fixed, and one side of the plate, which is dropped in from the front, as shown by the dotted lines in Fig. 3, is pushed under it. The slip at B lifts up, as shown in the illustration, and is closed down on the plate, thus holding it in position. Every slide and every shutter are interchangeable. They are supplied as ¼ plate slides, at 15s. per dozen: or at 20s. in a sling canvas case with focussing screen register. Mr. Tylar sends with this cheap and excellent machine-made slide a little finder for detective cameras, in the form of a small triangular box. The shorter sides are at right angles to one another, and are furnished, one with a lens and the other with a small ground glass plate, 1 in. by ⅞ in., on which the image of the object to be photographed is shown. It is fitted with perforated lugs for purposes of attachment, and is supplied at 2s. THE EDITOR.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

AMMONIA GAS ENGINES.—For very many years inventors have been endeavouring to devise a form of boiler in which ammonia can be profitably used in place of water. As, to give a pressure of 100 lbs. to the square inch, the latter must be heated to a temperature of 300°, while ammonia will give the same pressure when raised to 60° only, the enormous saving of fuel secured by using the latter is obvious. Unfortunately, however, ammonia is not so cheap as water by a long way, and its use can only be commercially successful if the gas evolved can be recondensed into a liquid so as to be again subjected to expansion by the application of heat. According to a New York journal, an American inventor has succeeded in fitting a condensing apparatus to his boiler, which goes a long way towards solving the problem. No one, however, has successfully tackled it on this side of the Atlantic as yet, and ingenious minds may find the hint useful. It is quite possible that the ammonia engine may, under certain circumstances, form the intermediate link between the steam engine and the electric motor.

MECHANICAL SHOE BLACKING.—Considering the millions of boots and shoes which require blacking daily, it seems strange that no one has thought of producing a handy little apparatus which would save time and trouble when performing this operation. Electricity has already been pressed into service to drive mechanical blackers in certain shops at Paris and some of the larger American cities, but they are fitted up rather to attract customers than to effect any economy. Moreover, the average British housekeeper has not, as yet, laid on electricity into his house for motor purposes. The field is still open for the production of a cheap, handy, and effective substitute for the brushes. It need hardly be said that the shine produced by rapidly revolving polishers is, as evidenced by the electrical polishers to which we refer, much superior to that appearing on the boot blacked in the ordinary way.

WELDING COPPER.—Amateurs often ask for some easily applied process for welding copper—*i.e.*, dispensing with the use of spelter, and the consequent yellow marks along the seam when the operation is completed. To such the following description of an effective process may be useful, but it must be premised that great care in its performance is necessary, and that a first attempt is liable to be unsuccessful. The edges to be welded should be brought to a dull red heat, and most carefully cleaned from scale or ash. Then take 124 parts boracic acid and 358 parts phosphate of soda; mix them thoroughly, and apply to the seam. Increase the heat until the metal becomes cherry-red, and then, using a *wooden* (not an iron) hammer, weld the edges together. Non-success sometimes arises from either the edges being imperfectly cleaned or from want of judgment as to the colour of the metal before commencing to weld. The result, however, when successful, is very neat.

GAS METER.—The recent case, in which a gentleman, dissatisfied with the record of his company's gas meter, fitted an extra one at his own expense, which indicated greater consumption than the official meter, shows the need of a *really* accurate meter. Inventive ingenuity should be directed towards devising an apparatus for providing uniform pressure of gas before it enters the indexing chambers. Gas companies usually have their meters tested under the same, or nearly the same, conditions, whereas, as every gas-burning resident knows, the pressure from the mains often differs widely on different days of the week.

# SHOP:

## A Corner for Those who Want to Talk It.

*** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letter from a Correspondent.

**Testing the Accuracy of Framework.**—J. C. K. (*London, N.W.*) writes:—"In Work, p. 326, I read a simple way of testing the accuracy of framework by two diagonal measurements, having seen a similar statement, almost, in Work, May 2, 1891, thus: 'And a final check on its accuracy taken by measuring it across diagonally from corner to corner, when, if both diagonals are equal, the board will be square.' Though I do not think anyone will be misled into testing for squareness by this erroneous plan, I venture to send a sketch of a trapezoid, which has, at Fig. 1, a base line and two lines nearly at right angles to it, forming ends or sides, each line exactly $4\frac{7}{12}$ in. long and 5 in. on the top or opposite parallel line or side of an assumed

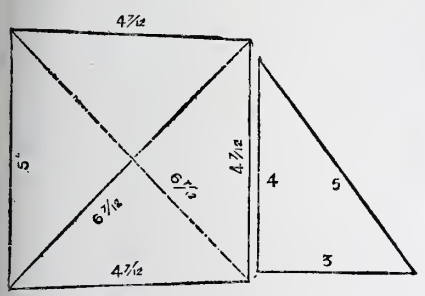



Fig. 1 Fig 2

Framework-testing Diagrams.

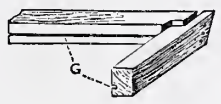
square. We will measure the two diagonal lines shown by the lines of dots. They are each exactly the same, $6\frac{7}{12}$ in., yet the sides are not square with the base line or top line, nor are the sides parallel with each other. There are several ways of ensuring accuracy of squareness to a frame, etc., by compasses or rule measure. One of the simplest and, perhaps, oldest known—practised by the slave workmen of Egypt and Greece thirty centuries ago—is to subtend a line from a base to a perpendicular, the base being as 4, the perpendicular 3, and the hypothenuse 5. This 3, 4, 5 is an immutable law of geometric proportion, and proves two sides are right-angled or square."

### II.—Questions Answered by Editor and Staff.

**Model Dynamo.**—A Novice.—Mr. Bottone, Wallington, Surrey, makes a small model Siemens dynamo capable of lighting a 5 c.-p. lamp, and sells this machine for 15s.; castings in the rough for the same machine at 5s. the set. He will also supply you with a 10 c.-p. machine for 30s., or a 20 c.-p. machine for 50s. If you care to get the castings and make the machine yourself, you will find full instructions in "Model Electric Lights," published in Work, No. 92, Vol. II., on December 20th, 1890. If you choose a 20 c.-p. machine, run it on two 10 c.-p. lamps, instead of one of 20 c.-p. You can get suitable lamps from the vendor of the machine. The machine will work best on a firm foundation, but, as it will have to be run at 3,000 revolutions per minute, it must not be in a shaky position. The lamp may be close up to the machine if so desired, but must not be subjected to severe jolting. If you will read carefully the series of articles on "Model Electric Lights," which appeared in Vol. II., I think you will obtain all necessary information on dynamos, lamps, etc. etc.—G. E. B.

**Carbon Plates.**—M. C. (*Lewisham, S.E.*).—Carbon plates may be made of powdered gas carbon (not powdered charcoal) mixed with treacle to a paste, compressed in iron moulds of the required shape, and baked in the moulds. Powdered charcoal mixed with resin or shellac will not do for the purpose even when baked in a mould, as the mixture would be too friable, and the plate be a bad conductor of electricity. As carbon plates are sold at a low price, it will not repay an amateur to make them himself. Gas carbon may be cut into plates by means of an old saw or a strip of sheet iron improvised as a saw, together with wet silver sand. An unlimited supply of elbow grease will also be required. As you can get carbon plates at a cheap rate from Messrs. Peppercorn, Broadway, Deptford; or from Bonney & Co., 19, Avenue Road, Lewisham, it will not pay you to cut them from gas carbon.—G. E. B.

**Bromide Enlargements.**—Water.—Procure your lengths of pitch pine wood 3 in. wide by 1 in. thick. Cut out a groove about ¼ in. deep, and 1 in. from one edge along the side of each piece—which, of course, must be of the proper length for the tray in question. The corners, instead of being mitred together, are best rebated. The preliminaries having been made ready, the grooves and corners should be well smeared with a mixture of ground red and white lead, made just thin enough, and no more, to work with gold size. Three sides of the frame being securely screwed together, a piece of stout glass is pushed into the groove, close up, leaving ¼ in. projecting to fit into the end piece, which is now carefully pressed on, and well screwed at the corners. Now we have a dish with wooden




sides and glass bottom, but not *sufficiently* watertight. Let this dry well in a warm current of air for a week, when we can set to work to render it absolutely waterproof with equal parts of pitch and paraffin wax *carefully* melted together, and well stirred during the operation. Having warmed the dish by the fire, and got it thoroughly dry, with a ladle pour some of the melted composition into all the corners, inside and out. If it happens to set too soon, get a hot spatula and rub it in. You will now have a thoroughly watertight dish, which had better be filled with water, and let stand one night, to dissolve anything prejudicial that may have been in the cement. Once more dry, and give the woodwork a coat inside and out with shellac dissolved in methylated spirits. When this is dry—which will be the case in a few hours—the dish is ready for use. Of course, small dishes may be made of lighter wood on the same principle. Pitch and paraffin wax is one of the best cements for this sort of dish. The accompanying diagram will show how the woodwork is put together.—D.

**School of Electrical Engineering.**—N. R. (*Carlisle*).—I think you are perfectly justified in making strict inquiries respecting the character of the school and its principal before parting with any money. Although I am not personally known to any of the gentlemen named in your letter, I should not doubt their good faith in recommending the school, as it cannot be of any personal interest to them to risk their characters by a false representation. The letters A.I.E.E. attached to a name represent that the owner is an Associate of the Institution of Electrical Engineers. On searching the members' list of this institution, I find the name among its associates. The school has been established several years, and is, I believe, doing good work.—G. E. B.

**Incandescent Gas Burners.**—C. B. V. (*Aldershot*).—If the pressure of the gas supply is weak, I think the light will not be improved by using incandescent gas burners, as my experience with these leads me to observe that they are useless when the pressure of gas is low. If the pressure of gas is fairly high, these burners give out a glowing, white, hot light, and they also give out considerable heat—more than an ordinary burner. They are useful where a room is to be lighted and heated with gas. I do not know the particular make mentioned in your letter, so cannot give the address of the maker. As you get such a bad light from gas, I recommend you to get some good oil lamps, as these give the next best light to good gas, and cost less than electric lights. If you have the power at hand to drive a small dynamo, then, as you have a good workshop and tools, why not make one, and lay down a small installation of electric light? You will find full instructions in "Model Electric Lights," published in Vol. II. of Work.—G. E. B.

**Motive Power for Dynamo.**—J. M. (*Hebburn-on-Tyne*).—Your idea, when worked out, should result in perpetual motion, if this were possible. If you could make a small dynamo to work a motor with part of its current, and then gear the motor to the dynamo, and thus work the same dynamo with its own current-driven motor, you would completely solve the question of perpetual motion. This equals the idea of a young friend of mine, who thought he could arrange a system of syphons to carry the tail water of a mill back into the mill-pond, and thus prevent waste of water. Suppose it takes, say, 100 units of power to drive a small dynamo 3,000 revolutions per minute. Part of this power will be used up in overcoming friction in the machine and belting, and part in heating the wires of the motor, still more in friction of the motor; so that we shall only get, at the best, about 70 units from the motor. As some of this will be lost in the friction of gearing with the dynamo, we shall only get about 50 units of power from the motor, or only half enough to drive the dynamo, even when the motor is supplied with *all* the current from the dynamo.—G. E. B.

**Water Engine.**—Water.—It is not possible to advise you without an inspection of the engine. Cannot you get a friend in your locality to look at it? Any working fitter could do so.—J.

**Bench Maker.**—J. O. H. (*Wandsworth*).—There is a cabinet bench maker in Old Street, St. Luke's, E.C., nearly opposite Pitfield Street, Hollis by name; but carpenters usually make their own benches.—B. A. B.

**Galvanometer.**—Galvanometer.—Take a needle, a little thicker than that fixed in the base-board, and fix at the eye end a piece of wood to form a handle, and using this in the same manner as a bradawl, work it carefully through between the coils of wire in the centre of bobbin, and when through, work it round to enlarge the hole, and slip it over the needle in the base-board. By using a little care, you can get the needle through without injuring the covering of the wire. Or you may fix a pin in the centre of bobbin before the wire is put on, and draw it out after the wire is wound on. You must be careful to fix the needle in the base perfectly square from the board, and at the proper height for the magnetic needle to be in the centre of the opening; also not to damage the point of the needle, and to make the conical hole in the brass very accurate, so that the needle will swing easily, as this will be more likely to impair the working of the instrument than if you should slightly abrade the covering of the wire.—M.

**Frosting Ornaments.**—A Would-be Decorator.—I have never heard of powdered mica, so cannot tell you where to buy it. As regards your difficulty, it is evident the acid has not sufficiently acted upon the mica; either it was not strong enough, or you did not boil it sufficiently long. Get the strongest acid and the thinnest sheets of mica, and try again, when you ought to succeed.—W. E. D., Jr.

**Chemical Apparatus.**—J. S. (*Little Horton*).—Put water into your flask, and suspend in it, by means of a string, a muslin bag containing your herbs. As the water distils over, it carries with it a little of the essential oil of the herb. Should any oil collect on the surface of the water, it can be drawn off. The oil which is dissolved in the water can be separated from it by saturating the liquid with common salt, when the oil rises to the surface.—F. B. C.

**Oil Painting on Silk.**—P. MacN. (*Shettlesworth*).—A preparation for this is sold by artists' colourmen, but the purpose will be served by dissolving a little isinglass in water, and sizing the silk with it. Take care to size it slightly *beyond* the future outline of the painting, or the oil will run.—S. W.

**Porcelain Studies.**—S. T. (*Amsterdam*).—As these are required *wholesale*, you are advised to apply direct to Messrs. Raphael Tuck & Sons, London.—S. W.

**Watch-Case Engraving.**—J. H. (*Ballina*).—Send your watch case to Messrs. Grimshaw & Co., 35, Goswell Road, Clerkenwell, or Haswell & Sons, 49 and 50, Spencer Street, Clerkenwell, either of whom will re-engrave or engine-turn it and repolish as new, the price being about 2s. or 3s., depending on being a double case or an open face.—A. B. C.

**White Pitch.**—W. W. (*Bristol*).—This is also called Burgundy pitch, and is obtained from pine resin or white resin. It is of a pale yellow colour, and is sold by most chemists; the price is, I believe, about 2d. per oz. If you cannot procure any, if you write me through our Editor, I can get you some. There are also Venice turpentine and Canada balsam, both of which are light-coloured gums, and which harden by exposure.—M.

**Answers in Work.**—J. W. H. (*Nottingham*).—While writing, why did you not repeat your queries?

**Medical Battery.**—Reader.—It is not enough to simply describe the battery as a "constant current battery." There are many types of constant current batteries. I must know the name of your battery before I can tell you how to re-charge it. If you cannot give me the name of the maker or of the type of battery, I must trouble you for a complete description of it; then I can give directions for re-charging the cells, and say nearly the probable cost. The address of Messrs. J. & A. Churchill is 11, New Burlington Street, London, W.—G. E. B.

**Low Voltage Incandescent Lamps.**—Lamps.—The lowest voltage lamps are those of one candle-power, having a voltage of from 3 to 8 volts. Then there are lamps of two and a half candle-power, having voltages ranging from 5 to 25 volts. If you will apply to Mr. Bottone, Wallington, Surrey, and tell him exactly what you wish to do, he will advise you as to the best lamps for the purpose of floral decoration, and supply you with all things necessary for the installation.—G. E. B.

**Electric Belt.**—J. A. R. (*Wandsworth*).—The current obtainable from such a belt, as proposed by you, would be very feeble. The pockets containing the zinc discs should be all on the inside, and the pockets containing the copper discs all on the outside, of the belt, opposite to each other, with only a thin partition of flannel between. The outside discs of copper should be connected to the inside discs of zinc in each alternate pair, and thus make a battery of the whole. I do not see how a belt of alternate pieces of copper and of German silver wire, connected "on the thermopile principle," can do any good. The heat from your body would not be sufficient to make such an arrangement a good thermopile. But, whatever arrangement you may determine upon, the effect upon your body will be in accordance with your faith in its efficacy. The curative action of all these electric belts is much increased by faith.—G. E. B.

**Copal Varnish for Floorcloth.**—H. F. (*Gateshead-on-Tyne*).—If the copal or oak varnish is evenly applied by a brush, and allowed a reasonable time to harden before being used, it would undoubtedly do much to preserve your floorcloth from wearing out so soon. At any rate, it will freshen up the appearance, though it will be well to bear in mind that the wear is on both sides, the underside being usually protected by a coat of paint. As you say your varnish dries in the open air, but not indoors, would it not be better to remove the whole outdoors some fine day and do it there, first taking the precaution of well washing it with some soda water (a handful of washing soda to a gallon of water), and wiping quite dry? If the varnish has thickened by keeping, it will be necessary to thin it down a little with turpentine—not naphtha, as you suggest—and the addition of a little japanners' gold size will assist its drying properties.—LIFEBOAT.

**Pin-hole Photography.**—JOHNNY GILPIN.—The number of WORK in which the article appeared is No. 17. The plates used, and the development of the same, are precisely the same as for other photographic work. The only difference between pin-hole photography and that with ordinary lenses is that the pin-hole image is *never* absolutely sharp, but that the focus is always the right one, no matter at what distance the objects may be from the camera. The exposure is always very prolonged, so much so, that pin-hole photography is useless for ordinary work or dark subjects. The exposure is regulated by the square of the distance between the pin-hole and plate, and also the size of the picture by the distance between them. The size of the plate is quite immaterial, as, at a proper distance, *any* sized plate can be covered; but with very large sizes the loss of light is so considerable as to render photography impracticable.—D.

**Oak Stain.**—READER OF "WORK."—You would have done well had you told us for what particular purpose you required the stain. Do you wish to stain common white wood in imitation of oak? or do you wish to make light oak darker? Had you given us these particulars, your question could have been answered more fully and to the point; as it is, we can only answer in a general way. To stain common white wood in imitation of oak by the aid of spirit stains and varnishes is a rather ticklish job for an amateur; to stain the colour of oak is a comparatively easy matter. It can be done by giving one or more coats of asphaltum dissolved in turpentine or coal tar naphtha (¼ lb. crushed asphaltum to a pint of turps); or you may thin down brunswick black with turps. The former is the most cleanly to use. Both must be used alone, not mixed with varnish; and both can be varnished over with spirit varnish, after first allowing a reasonable time to elapse for them to dry. If it is light oak that needs to be made darker, the asphaltum stain is a useful one, though the correct and most cleanly way is by means of fumigation, particulars of which you will find in "Shop," under the heading of "Stain" (p. 219, June 20th, 1891). If, on the other hand, it is cheap furniture you wish to do, you might do worse than read a reply given in "Shop" on "Graining Cheap Furniture," that appeared in the issue of June 6th, 1891 (p. 187). You will find there some useful hints. You say you have tried umber and spirits, but it does not suit. This would have been all right had you given the work a coat of patent size or varnish first, that had been stained by the addition of a little yellow ochre or lemon chrome—so forming a yellow ground to work on. The umber stain should be mixed with three parts spirits, one part polishor varnish (not all spirits). If, when this is applied, and while still wet, a grainer's steel comb is drawn over it, a passable imitation of oak will be the result. Finish by giving a coat of clear varnish. I append a couple of recipes for brown oak stains: (1) Mix together 2 oz. of pearlash and 2 oz. American potash in a quart of warm water, and apply to the parts to be stained. (2) 2 oz. vandyke brown, ½ pint liquid ammonia, ½ oz. bichromate of potash. A tinge of red in the polish or varnish will improve these. If stained varnishes are used, care should be taken to carefully strain through fine muslin before using; and you will be more likely to gain an even surface if the work has been previously sized over.—LIFEBOAT.

**Looking-Glass.**—F. L. (*West Cowes*).—Any glass merchant or furniture dealer will supply you with the above at about 3s. per foot super. But if you want such a quantity as would repay you for the cost of carriage, I should advise you to write to one or two large firms in London or Manchester for special quotations.—E. D.

**Lathe Making.**—LATHE-STRUCK.—It is well to be enthusiastic about the charming and useful art of turning, if your enthusiasm leads to patient and persevering work rather than trying to jump to the top of the tree at a single bound! Pray don't attempt to *make* a lathe till you know how to *use* one. Can't you get some workman friend to let you use his in the evening, when he has done work? You say you have no lathe, nor access to any; yet you write from a town where there must be a great many, and if you can't pay for the use of a lathe, you can, perhaps, earn the loan of one by working for its owner. Offer to go errands, etc., for some turner, for instance. If he will let you try your hand, make yourself useful to him, help him in any way you can *in his work*, and let him see you want to learn; and when you have worked at the lathe some two or three years, and can turn wood and metal, use files, chisels, tags, and dies; make and use drills; forge slide-rest tools; and, in short, when you have mastered the *a*, *b*, *c*, then you may think of making a lathe. Don't let your enthusiasm tempt you to try to do impossibilities, but rein it in, and make it keep you to the practicable.—F. A. M.

**Paint.**—H. E. R. (*York*).—If you had stated in what way the wall was damp, and from what cause, I might have been able to have given you a remedy far preferable to paint. Write to the Damp-proof Paint Co., Cannon Street, London, for particulars of their paint, and if you are not successful with it, let me know more about the damp, and no doubt we can get over the difficulty.—E. D.

**Waterproof Glue.**—F. B. (*Aldershot*).—If your two letters to the Glue Company had no fuller address than the one you sent us—which is quoted above—it is no wonder that you have received no answer to your communications. When you write a letter, you should add your full name and address.

**Printers' Roller Composition.**—POTASH.—A "compo." which is an improvement on the old glue and treacle, is said to be made of glycerine and gum; but instead of making, POTASH will be far wiser to buy his compo. ready mixed, as he can do from any printers' broker at from 1s. to 1s. 6d. per lb. The Durable Patent Roller Composition is sold only by the company so named (57, Shoe Lane, London, E.C.) and their agents.—S. W.

**Fixing Carbon.**—NO NAME.—Le Page's glue, or any bicycle cement, will fasten a piece of carbon to ferrotype or wood. These cements are very useful for all such purposes.—W. D.

**Safe Locks.**—J. A. (*Walsall*).—I cannot do better, in answer to your query, than quote Mr. Chatwood, the eminent safe maker. "In an ordinary lever lock, the bolt has fixed upon it, at right angles, a projection called the main stump, and each of the levers has a passage or gating, which, in a well-made lock, should be no wider than is absolutely necessary for the stumps to pass through. In unlocking the lock, all these levers have to be raised, each exactly to its right position, before the bolt can be withdrawn. If anyone of them should be raised too high, or not raised sufficiently, the stump is blocked, and therefore the bolt cannot be withdrawn. At the first glance it would appear impossible to pick such a lock, if the number of levers be considerable. The key has a number of steps, each of which—except the bottom one—lifts one of the levers. The bottom step then engages with the bolt, and draws it back. To pick such a lock, pressure is applied to the bolt, so as to cause the main stump to press against the face of the levers; then, by raising each lever in turn, the position of the gating is easily ascertained by the difference between the friction on the lever when pressed by the main stump and when in position and no longer pressed by the main stump. In a lock with many levers, special appliances are necessary for these purposes. The apparatus used in picking lever locks consists of a tubular key having one step upon it, and a solid key fitting inside it, and also having one step upon it, having an ordinary key bow with a lever arm carrying a small weight. These can be operated quite independently of one another. The step in the solid key engages with the talon of the bolt, and the weight on the lever arm attached to it causes the stump to be forced with suitable pressure against the faces of the levers. By means of the step on the tubular key, the levers are raised in turn to feel for their gatings, and as each is found, extra pressure necessary to retain them in position is provided by moving the weight along the lever arm. When all the levers have been thus arranged, the bolt is withdrawn." Lever locks with patented improvements, such as are now manufactured by Messrs. Hobbs, Hart & Co., and Messrs. Chubb, are practically unpickable.—T. W.

**Distemper Lines.**—J. B. (*Manchester*).—Lines of colour may be run with lining-fitch and straight-edge upon paper, distemper, or such-like absorbent surface either as "size colour" or "turps colour." For the former, mix *best* venetian red powder with water to a stiff paste, then thin for use with strong jelly size. This must be kept warm in using, as you may surmise. For turps colour, use japan gold size to make the dry pigment into "batter" consistency, then thin for use with turps. Both of these should work well and stand sizing. The simplest plan for blocking marble is a red or black pencil drawn round a wooden frame of block size.—F. P.

**Smooth Surface for Decoration.**—G. S. R. (*Tewkesbury*).—When a wall is badly plastered, no subsequent rubbing or smoothing will remedy the mischief. The best that can be done is either to prepare it in distemper, or to line it. After removing the old paper, and washing down the walls thoroughly to remove the old paste, etc., make some distemper (see Index, Vol. II.), but with *double* the quantity of *size*. Give the wall a good coat of this, used just warm, which will fill a lot of cracks, etc. Stop holes, etc., with plaster, and when all is dry, rub down with "coarse 2" glass-paper. It can now be treated with alabastine direct, or—a much better job—give it first a thin coat of oily paint. *Lining* the wall—viz., covering it with a stout white lining-paper—requires a paper-hanger's skill; and the wall must be also well prepared. The first is the easiest and dirtiest, and the latter the quickest and dearest, plan.—F. P.

**Japanese Leather Papers.**—F. R. E. (*Darlington*).—For Japanese leather goods, etc., *wholesale* and in large quantities, write Messrs. Rottman, Strome & Co., St. Mary Axe, London, who are makers, having factories at Yokohama, Japan. Maw & Co., Farringdon Road, City, E.C., are also large importers of all oriental goods. For odd yards and remnants, write Liberty & Co., Regent Street, W.—F. P.

**Gilding on Varnish.**—F. R. E. (*Darlington*).—For this class of gilding oil gold size is used. The surface of varnish scarcely ever being free from sufficient "tackiness" to hold gold leaf, it is first necessary to coat the work all over with albumen of one egg blown into half a pint of luke warm water. Twist it into a froth with the brush, and brush on the froth. Use the gold size very barely. When gilded (see recent article), wash off the egg size with hot water and soft sponge, which removes also all superfluous gold leaf.—F. P.

**Battery for Electric Light.**—F. G. (*Paddington, W.*).—Get four glass pickle jars or marmalade jars 7 in. by 4 in. The mouths of these should be from 2½ in. to 3 in. in diameter. Get for each bottle two carbon plates 7 in. by 2 in. by ¼ in., and one zinc plate 7 in. by 2 in. by ¼ in. Also get a binding screw clamp to fit each zinc plate, and a similar clamp with jaws 1 in. deep and 1½ in. apart, to clamp the carbon and zinc plates together in each jar. Amalgamate the zinc plates with mercury. Put the zinc clamps on the tops of the zinc plates, ½ in. at one side of the centre. Cut two strips from a cigar-box cover 3 in. by ⅝ in. for each zinc plate, place them along the top of each zinc plate on each side, place a carbon plate on each side of these, and clamp the whole together. The strips of wood will keep the carbon plates from touching the zinc plate, and the deep-jawed clamps will connect the two carbons. If you do not care to go to the expense of brass clamps, place a strip of sheet copper between the top of the zinc and the wood, and two strips between the carbon plates and the wood on each side to form connections. Separate the zincs and carbons at the bottom by two similar pieces of wood, and bind the whole together with indiarubber bands. This is a cheap makeshift. Battery plates thus put together can be easily taken apart to be cleaned. Charge each cell with a solution of chromic acid and sulphuric acid in water, 3 oz. of each to each pint of water, and allow the solution to cool before using. You should get 8-volt lamps to use with a battery of four such cells. Place the battery in a box in a cupboard or in the cellar, and lead No. 18 copper wires from the battery to the lamp-holders on the piano. Each lamp must be covered with a conical shade to screen the eyes from the glare of the light, and throw this down on the music-book. A switch should be provided to throw the lamps in or out of action at pleasure.—G. E. B.

**Faulty Induction Coil.**—NEMO.—Although four medium size Leclanché cells placed in series do not furnish a battery strong enough to work an induction coil 9 in. by 5 in., the current from such a battery will magnetise the core, and cause the hammer to vibrate, if the coil has been properly made, and the connections are all right. If you can get a current from this battery "through the machine" without "any magnetic effect whatever on the core," then there must be a serious leakage across the primary, such as connection between the first turn of the first layer and the last turn of the last layer, or the both ends in contact with the core, foot of break spring, or similar good conductor. If I could see it, I could tell you in a few minutes where the fault lies. Without seeing it, I can only suggest the above as being the most likely fault. If the coil is properly made, it should take the current from six bichromate or chromic acid cells.—G. E. B.

**Electro-Magnetic Apparatus.**—F. H. (*Drayton Park*).—To work the apparatus described by you, it will be necessary to have a horseshoe magnet with cores 3 in. by ½ in. fitted with bobbins 1½ in. in diameter, wound to the full with No. 22 silk-covered copper wire. The weight to be lifted must be attached to an armature of soft iron, ½ in. by ½ in., and long enough to span the poles of the magnet. The current should be furnished by three medium size Leclanché cells in series. Connect the cells to the clock and to the electro-magnet with No. 18 wire; then you need not fear any serious decrease in power whether the machine is placed twenty or forty yards from the clock. A stud must be placed on the clock face, and a spring contact fitted to the hour hand to sweep over the stud each hour and keep in contact with it for five seconds. Used thus, if properly fitted up, the battery would probably retain its power and keep in working order for several months, perhaps a year.—G. E. B.

**Measuring Instrument.**—POLYGON.—The instrument about which you inquire is a sector, by the aid of which all questions in proportion may be solved; lines may be divided either equally or unequally into any number of parts that may be desired; the angular functions, viz., chords, sines, tangents, etc., may be set off or measured to any radius whatever; plans and drawings may be reduced or enlarged in any required proportions, and, in short, every operation in geometrical drawing may be performed by the aid of this instrument and the compasses only. I suppose yours is the ordinary six-inch sector, which, when opened, forms a rule of twelve inches; and this circumstance is taken advantage of by filling up the space not occupied by the sectoral lines with such lines as it is the most important to lay down upon a greater length than the six-inch plain scale will admit. Among these the most usual are (1) the lines of logarithmic numbers, sines, and tangents;

(2) a scale of twelve inches, in which each inch is divided into ten equal parts; and (3) a foot divided into ten equal primary divisions, each of which is sub-divided into ten equal parts, so that the whole is divided into one hundred equal parts. This last is called the decimal scale, and is placed on the edge of the instrument. The "sectoral lines" proceed in pairs from the centre, one line of each pair on either leg, and are, upon one face of the instrument, a pair of scales of equal parts, called the "line of lines," and marked L; a pair of lines of chords, marked C; a pair of lines of secants, marked S; and a pair of lines of polygons, marked POL. Upon the other face the sectoral lines are: a pair of lines of sines, marked S; a pair of lines of tangents up to 45°, marked T; and a second line of tangents to a lesser radius, extending from 45° to 75°. Each pair of sectoral lines, except the lines of polygons, should be so adjusted as to make equal angles at the centre, so that the distance from the centre to the corresponding divisions of any pairs of lines, and the transverse distance between these divisions, may always form similar triangles. On many instruments, however, the pairs of lines of secants and of tangents from 45° to 75° make angles at the centre equal to one another, but unequal to the angle made by all other pairs of lines. The divisions of each sectoral line are contained within three parallel lines, *the innermost* being the line on which the points of the compass are to be placed, because this is the only line of the three which goes to the centre, and is, therefore, the sectoral line. The line of polygons is chiefly used for the ready division of the circumference of a circle into any number of equal parts from 4 to 12—that is, as a ready means to inscribe regular polygons of any given number of sides from 4 to 12 within a given circle. To do which, set off the radius of the given circle (which is always equal to the side of an inscribed hexagon) as the transverse distance of 6 and 6 upon the line of polygons. Then the transverse distance of 4 and 4 will be the side of a square; the transverse distance between 5 and 5 the side of a pentagon; between 7 and 7, the side of a heptagon; and so on. If it be required to form a polygon upon a given straight line, set off the extent of the given line as a transverse distance between the points upon the line of polygons answering to the number of sides of which the polygon is to consist; as for a pentagon between 5 and 5; or for an octagon between 8 and 8; then the transverse distance between 6 and 6 will be the radius of a circle whose circumference would be divided by the given line into the number of sides required. All regular polygons, whose number of sides will exactly divide 360 (the number of degrees into which all circles are supposed to be divided) without a remainder, may likewise be set off upon the circumference of the circle by the *line of chords*. Thus, take the radius of the circle between the compasses, and open the sector till that extent becomes the transverse distance between 60 and 60 upon the line of chords; then, having divided 360 by the required number of sides, the transverse distance between the numbers of the quotient will be the side of the polygon required. Thus, for an octagon, take the distance between 45 $\left(\frac{360}{8}\right)$ and 45; and for a polygon of 36 sides take the distance between 10 and 10.—F. B. C.

**Varnish for Walking Sticks.** — C. BROS. (*Leeds*).—These, when done in large quantities, are generally finished by drying in a hot room or drying stove. Suitable varnishes are sold by most varnish makers, amongst whom, in your neighbourhood, you might write to or call upon Mr. H. O. Milnes, Leeds Road Varnish Works, Bradford, stating your requirements; he will, I think, be able to suit you. Also with a black varnish suitable for dipping your iron wire in. If, however, you have no drying stove, or large quantity of sticks to do, what are known as spirit varnishes are most suitable. Foremost among these is that known as brown hard spirit varnish, made as follows:—Gum sandarach, 4 ozs.; seed lac, 2 ozs.; gum elemi, 1 oz.; methylated spirits, 1½ pints; when dissolved, add Venice turpentine, 2 ozs. Another:—Rectified naphtha, 1½ pints; gum sandarach, 2 ozs.; best amber resin, 2 ozs.; gum benzoin, 4 ozs. Both must be carefully strained before using, then applied with a camel's-hair brush. If required harder, this can be done by adding one-third part of French polish, made by dissolving 6 or 8 oz. of best orange shellac in 1 pint of rectified naphtha.—LIFEBOAT.

**Cleaning Old Gilt Frames.**—A. E. S. (*Wootton Bassett*).—The only way, save re-gilding, of improving the appearance of old gilt frames is to wash off the dirt and fly marks contained in the coat of size which covers all gold framework. This may be done by using a small sponge barely moistened with hot spirits of wine or oil of turpentine; *do not wipe* afterwards, but leave to dry. This process requires great care.—F. B.

**Alloy.**—ALLOY.—This querist asks to be informed of a metal nearest in strength to iron, which will not rust, and which can be melted on an ordinary fire. I think the metal or alloy which complies nearest with these conditions is brass. This may be melted on a close range fire under favourable conditions, and though greatly below iron in strength, yet it comes nearest to it to comply with the other two conditions — viz., non-rusting and fusibility.—R. A.

**Pewterers' Flux.**—A. E. (*Langton*).—The flux generally used by pewterers for soldering pewter counters, pots, etc., is Gallipoli oil. It is an inferior kind of olive oil, of a greenish tint. I have not tried it, but should think ordinary flask olive oil would do as well. As regards the composition of Baker's fluid, I believe it is simply distilled and diluted chloride of zinc.—R. A.

**Melting Brass.**—NO NAME.—Figs. 1 to 4 illustrate the standard type of brass-melting furnace. Fig. 1 is a vertical section, through one of the furnaces and the chimney. Fig. 2 is, on the right-hand side, a section through the right-hand furnace (× × in Fig. 3, and Z Z in Fig. 1); and, on the left-hand side, a view in front of the left-hand furnace, seen from the ash-pit (Y Y in Fig. 3). Fig. 3 is a general plan; Fig. 4 a view of the cover. In these figures, A, A, are the melting holes or furnaces, measuring from 12 in. to 18 in. square, according to the amount of metal that requires to be melted. A 14 in. or 15 in. hole will take a pot with a melting capacity of 50 lbs. or 60 lbs. The depth of the furnaces will range from 2 ft. to 2 ft. 6 in. It is essential to give ample depth, in order that the crucible shall be entirely enclosed in the fuel. The reason why furnaces are built in twos or threes, is to get sufficient melting capacity for heavy casts; or even where that is not the case, to be able to use one furnace while the other may be undergoing repairs. Still, if you are an amateur, and intend only to melt brass for your own use, a single furnace will suffice. Underneath the furnace is the ash-pit (B) and the opening (B') through which the ashes are raked into the front area (C). In Figs. 1 and 2, the line D D represents the level of the stone or brick floor, into which the furnaces are built. The ash-

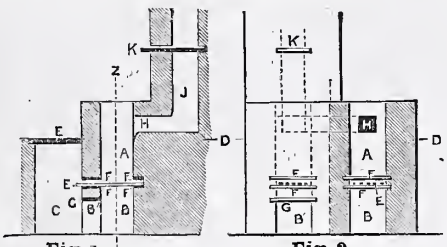


Fig. 1



Fig. 2

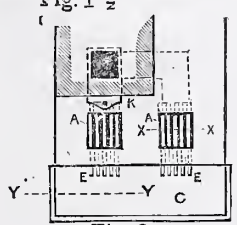


Fig. 3

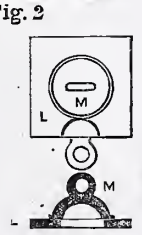


Fig. 4

Brass-melting Furnace.

pit (C), therefore, lies entirely beneath the floor level, and is covered over with a cast-iron grating (E). The object of this arrangement is to allow the attendant standing on the grating to be well over the furnaces, and so be able to exercise all his strength in lifting the pots of molten metal out of the furnaces. To clear the ashes out from underneath, it is necessary to remove the plate (E) and get down into the pit (C). E, E, in the figures are the fire-bars, upon which the fire is built; they are simply bars of wrought iron about 1 in. square, laid loosely across the bottom of the furnace. It is necessary to make them easily removable, so that the attendant, getting down into the ash-pit, C, may draw them out endwise, and let the cinders drop into the ash-pit, B. Replacing the bars, the fire can be rebuilt. In order that the constant removal and replacing of the bars shall not break away the brickwork, plates of iron (F, F) are built into the brickwork immediately above and below the bars. A similar plate (G) is built in to carry the brickwork over the opening B'. Both furnaces lead, by the openings H, into a common chimney (J); and the height of this chimney should not be less than from 12 ft. to 15 ft. A short chimney will not create sufficient draught to melt the metal quickly and properly, and artificial blast is not used for brass furnaces. The draught is regulated by means of the damper (K), placed in the chimney, and all the air necessary for combustion passes down through the perforated cast-iron plate (E). Fig. 4 shows a cover used for the mouths of the furnaces (A). L is a square cast-iron plate, having an eye cast in for sliding it on and off the furnace mouths. This plate is left in position during melting, but a light cast-iron top (M) is removed from time to time, for the purpose of watching the progress of the melting, and to throw in fresh fuel, if necessary. The furnace is built of fire-bricks, built with fire-clay joints, the clay being mixed with water to about the consistence of thick cream. Either gas coke or furnace coke can be used for melting brass, but the latter is more satisfactory, because of its heat-giving power. After the fire has been built, it is allowed to burn up, and then the crucible, with its charge of metal, is set about midway in the furnace, and covered over with fresh coke; the cover (L) and tile (M) are then put on, and the melting proceeds for an hour or more. You can purchase crucibles of the Morgan Crucible Company, Battersea; they will cost a trifle over one penny per pound of capacity. Now, in reference to the last part of your query, I am afraid I must refer you for the present to treatises written on the subject. The subject of moulding, to include that of the brass foundry, will be treated of in WORK by-and-by, and if so it will possess more practical value than any book I can recommend you. There is a book by Graham, price 2s., published by Crosby Lockwood & Co.; and there is another by Larkin, price 10s. 6d., which, I believe, is published by Spon. There is also Spretson's work, which contains a chapter on the brass foundry, one on fine-art work, and one on bell founding.—J.

**Re-tinning Rusty Spots.**—R. H. (*Notting Hill*).—In answer to your first query, I must say that I have seen a good many churns repaired, and also repaired many myself; but I never knew anyone "take on" the job of re-tinning the rusty patches—that is, unless there was a hole there, and a piece of tin had to be put on it. In this case, of course, the usual method of scraping or filing must be adopted to keep it clean, and then use spirits of salts and a soldering iron and solder to "tin" it preparatory to soldering on the piece. This is the usual, and, in fact, the only, way to get over it. If, as you say, you cannot get on with spirits of salts or resin (resin is no use for rusty tin), there must be something wrong, either with your materials or your method of procedure. (2) How to keep tools from turning rusty in a few hours after cleaning. You are quite right in supposing that this is caused mainly by the fumes of the spirits—this is one of the ills that tools are heir to in a tinman's shop. I will, however, offer a few suggestions that will help you to minimise the evil. In the first place, I would ask, Why do you want your tools bright? There are only a few tools that it is absolutely necessary to keep polished, such as the anvil, a few heads, and a few hammers. The anvil you should make a tin cover for, and grease the face of the anvil; for the hammer and head you can have wash-leather bags or caps to tie on over the faces, and keep them in a drawer when not in use, and clean them once a week whether they need it or not. The ordinary tools that lie about in constant use it is almost impossible to keep clean without constant looking after; but I find that, after they have got to a certain degree of tarnish, if they are rubbed occasionally with an oily rag, and then well rubbed dry, that they will scarcely be affected. Of course, faces of hammers and of tools will need to be rubbed up now and again. In conclusion, never keep any unkilled spirits of salts in the workshop, and cover your spirit jar when not in use, and I think you will go a great way to get over your little difficulty.—R. A.

**Patent Lock.**—A. M. (*Willenhall*).—If the patent for the lock still exists, you certainly must not make any imitation of it. Your best plan will be to consult a respectable patent agent, or approach the maker of the lock, and see if he will buy your improvement.—T. W.

**Relief Scraps on Screen.**—J. W. (*Morley*).—I know of nothing better than a stiff glue paste, such as that used for hanging Japanese "leather," and other heavy embossed papers. First dissolve the glue by boiling, and to prevent its burning to the bottom of the saucepan, wrap it in rag and tie it to the lid; then stir in the flour and boil. The paste should have time to soak into thick paper or card before fixing.—S. W.

**Prescription.**—SHEF.—We do not undertake to answer in WORK any questions appertaining to medical matters.

**Lime.**—E. F. B. (*No Address*).—You may mix the lime with coarse sand, fine gravel, coke breeze, crushed spar, or granite. The material should be screened through a mesh of the required size, and also screened a second time through a smaller mesh to remove the fine dust. You may put two parts to one of stone lime, and if chalk lime, rather less, unless the lime is very strong. You must not exceed this, or it will not set hard. You might try on a small quantity first. If you had said for what purpose, or how you mean to use it, I might have been able to give you more definite information. If you want it to set quickly, you could mix a little Portland cement or plaster of Paris with the lime. If this is not exactly what you require, if you write again, giving more particulars, I shall be glad to give you any further information.—M.

**Polish for Bookcase.**—H. A. W. (*Blyth*).—All dirt, grease, and furniture paste must be first removed by careful washing with soda and water and powdered pumice-stone or Bath brick (common washing soda the size of a walnut to a pint of warm water). It can then be French polished, if you like, but I cannot advise you to make your maiden efforts at polishing on anything with carvings and mouldings, etc., such as your clock case would be likely to have. Far better practice on some flat surfaces first, reading carefully the articles on French polishing appearing in the present volume of WORK. For the present, a decidedly fresher and more satisfactory appearance will be given by the application of one or two coats of brown hard spirit varnish, such as can be bought at any respectable oil and colour merchant's, to be applied carefully with a camel's-hair brush.—LIFEBOAT.

**Phonograph Cylinders.**—J. P. A. (*Walthamstow*).—I do not think it would be worth your while to try to make the above from your waste product. The demand at present does not seem to be very large. I could not undertake the trouble of inspecting one.—W. D.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Ink for Poster.**—C. B. (*Highbury*) writes:—"I shall be very much obliged to M. D. C. (*Liverpool*) if he will tell me how to mix a good red ink or paint for poster-writing. The stink of the benzine and oil paint recommended by SMILING SMUDGER is horrible. It also runs a little. Gum water is not of much use."

**Crimson Dye.**—G. B. (*London, W.*) writes:—"I should be much obliged for the ingredients for a good crimson dye, which would be economical and fast—for cloth."

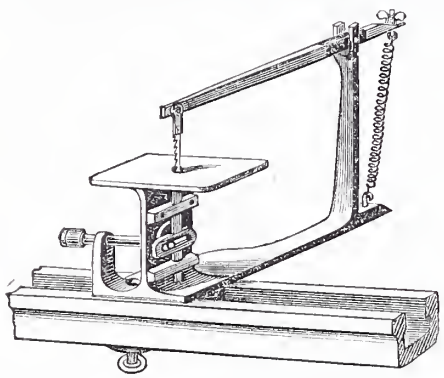
**Nets.**—C. C. (*Dartmouth*) asks:—"Could some correspondent kindly give in 'Shop' instructions, with drawings, as to how to make a trawl net for a 10 ft. beam? I should also be glad for notes concerning other nets."

**Upholstery.**—QUEEN'S ISLAND writes:—"Will any reader tell me how to cut the cloth to cover a couch so that it will be free of wrinkles, as those I have as yet covered do not look very well?"

**Cotton Band Machine.**—E. W. (*Halifax*) writes:—"Will any reader kindly inform me of the best and cheapest method of making a *small cotton band machine* to make lengths, say, from 1½ yd. to 2 yds. long?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

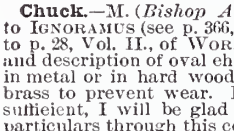
**Mandrel for Lathes.**—J. A. M. (*Stamford Hill, N.*) writes, in reply to J. T. (*Walworth*) (see page 159, Vol. II.):—"For jobbing engineering work I can recommend A. W. Salter, 15, Brunswick Street,



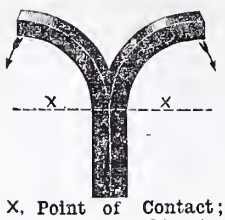
Hackney Road. He has done a good deal for me, and has forge, steam power, and almost every needful appliance at hand. Above is a drawing of a fret-saw attachment for my lathe which he has just made, and which will, I think, prove a serviceable tool."

**Chuck.**—M. (*Bishop Auckland*) writes, in reply to IGNORAMUS (see p. 366, No. 127):—"If you refer to p. 28, Vol. II., of WORK, you will find sketches and description of oval chuck, which you can make in metal or in hard wood, facing the V slides with brass to prevent wear. If the information is not sufficient, I will be glad to give you any further particulars through this column, if you write again. I can get you the castings, if you send me your address."

**Galvanometer.**—F. S. (*Normanton*) writes, in reply to GALVANIC (see page 206, No. 117):—"I will tell how I made a cheap and simple galvanometer. If, like me, GALVANIC is hard up, it will be just the thing he wants, as it cost me but a trifle, and any amateur could make it. First, I made a box like a linesman's detector; that is, two halves hinged together, 5 in. by 3¾ in. by 2½ in. Before putting on the front, I cut a hole 3 in. in diameter, and into this fitted a glass, which I got off an old bicycle lamp, and thus had glass and rim complete. I made the dial by taking a thin piece of wood, just large enough to fit inside the front half, and pasted on a sheet of white paper. Then on the side on which the paper was pasted I fixed my needle, which I made out of an old coil spring, and made it 1½ in. long for the support. I took a piece of brass shaped as in diagram, A being needle and axle, B piece of thin brass clamped between dial and angle brass, and C being angle brass. The needle simply rested on pivots, the bottom being slightly heavier to keep in the centre of the dial. I must not forget to say that the needle was magnetised. At the back of the dial I fixed a bobbin of wire (six layers No. 24 s.c.) lengthways across the dial, and connected the ends to terminals at the top of the box. On sending a current round the coils of wire, the needle was deflected to either side, according to which way the current was sent. To give the dial a finished appearance, I drew two half circles round the top of the needle which represented the graduations. If GALVANIC liked, he could fix a horseshoe electro-magnet to the back of the box, with the poles pressing against the back of the dial, but this would not be so good as a coil, as he would have to find which way to send the current to repel the needle; but perhaps some other reader could describe a better galvanometer, as this would be of no use for a professional electrician."




**Joining Vulcanite, Steel Etching, Rubber Stamps, etc.**—H. B. (*Sheffield*) writes:—"I have gone through the Indexes of Vols. I. and II. of WORK, but cannot find the description of a method to fasten together two pieces of polished vulcanite. I shall be greatly obliged if any of your correspondents can inform me what composition to use without heat or need for repolishing to securely fasten together two flat surfaces, say, ⅜ in. square, at bottom of strips 4 in. long by ½ in. wide, to resist a strain of 1 lb., as shown on enclosed sketch, and also to withstand the action of water. Some years ago a patented process was shown in Sheffield to etch upon steel direct from a rubber stamp in conjunction with certain acid salts, and was called 'E. Menstacta's New Direct Etching Process'; it is now, I believe, impossible to procure in this country the particular mixture of salts used. Could you inform me, through the medium of WORK, what ingredients to use which, in a plastic state, would contain sufficient power to light etch into steel direct from a rubber stamp a word moulded from 'nonpareil condensed type,' which, as you will probably be aware, does not carry a great body of ink in printing?"




X, Point of Contact; + Direction of Strain.

**Lace Frame.**—C. E. M. (*Birkenhead*) writes, in reply to MART (see page 14, No. 105): "Here is a description of a simple macramé lace frame, which I have found quite as convenient as any of more elaborate construction. Smooth a piece of pine, 28 in. by 8 in. by ⅜ in. thick; at each end of this screw on a piece 8 in. by 1½ in. high, and ⅜ in. thick. The screws must be put in from the back, three to each piece. On the outside of each of these insert a row of about twelve round-headed screws, ½ in. apart. Those on the right-hand end should be put in at an angle of 45°, points down. (Fig. 1.) The reason for this

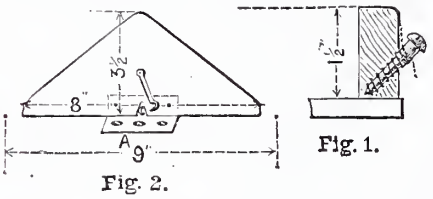



Fig. 2.



Fig. 1.

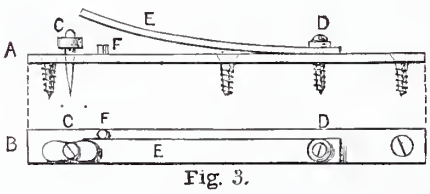



Fig. 3.

Lace Frame. Fig. 1.—Section of Right-hand End; Dotted Line, Foundation Cord. Fig. 2.—Flap—A, Hinge and Notch in Wood to allow for Eye. Fig. 3.—Brass Attachment—A, Side View (open); B, Top View (closed); C, C, Button; D, D, Pivot Screw and Washer; E, E, Spring; F, F, Small Brass Stud, to prevent Displacement of Spring.

is that, when a foundation cord is stretched across the board, it only requires one turn round the screw to secure it tight. The secret of making good macramé lace lies in having the foundation cords strained as tight as possible. A couple of flaps are hinged on to the back of the board, about 4 in. from each end. When the board is in use it rests on these, which are held in position by hook and eye. (Fig. 2.) At the left-hand side of my board I have screwed a brass attachment, for gripping the lace when a long piece is being worked. It consists of a brass plate 8 in. by ⅝ in. by 1/16 in., to which is attached a piece of spring-brass, one end turning on a pivot, while the other is placed under a brass button when in use, and kept in place by a small stud. (Fig. 3.)"

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—D. S. (*Glasgow*); W. M. (*Dundee*); A. G. (*Dublin*); LISFARREN; F. R. (*Salford*); T. W. (*Bolton*); J. B. (*Stoke Newington*); E. J. (*Yeovil*); DENIS; JACK PLANE; J. O. H. (*Nottingham Road*); R. J. H. (*Penzance*); E. B. (*Dorsetshire*); W. P. (*Scarborough*); F. W. & SON (*Billingshurst*); YOUNG CHIPS; H. N. (*Ballycanew*); M. & C. (*Grimsby*); CHOPSTICK; W. D. (*Belfast*); E. H. (*Warrington*); S. B. (*Nottingham*); J. H. S. (*Romsey*); D. A. (*Glasgow*); SHEF; W. D. (*Wigston-Magna*); J. P. (*Manchester*); A. L. (*Belfast*); R. J. L. O. (*Bangor*); H. T. M. (*Kentish Town*); J. E. B. (*Epworth*); QUÆSITOR; RAWTENSTALL; VENTRO; R. C. J. (*Cheadle*); POKER; WYNBERG; A. T. (*Canonbury*); CONSTANT READER; J. J. (*Morriston*); W. R. (*Cressington*) HÆREO; C. H. D. (*Guernsey*); F. D. (*Devonport*); E. C. (*Norfolk*); E. G. (*Salford*); C. F. T. (*Taunton*); W. N. (*Longfield*); EBONY; W. B. (*York*); PLUMBER; G. F. B. (*Notting Hill*); E. MCN. (*Gateshead*); W. H. (*Blyth*); J. H. B. (*Norton*); GANITE; T. H. B. (*Sowood*); W. E. B. (*Bowden*); C. C. (*Clapham*); W. J. H. T. (*Birmingham*); AURORA; G. P. (*Chester*); J. G. B. (*Clapham*).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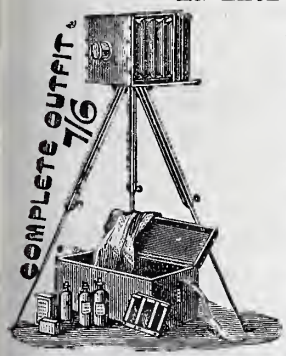


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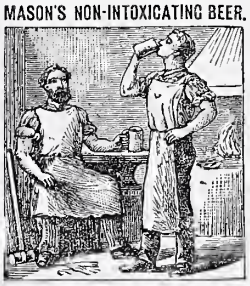

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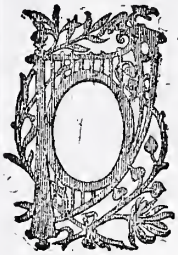

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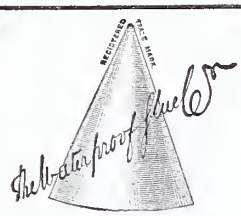


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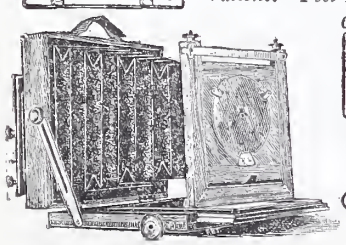

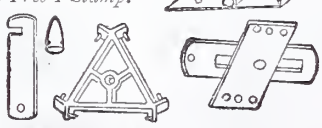

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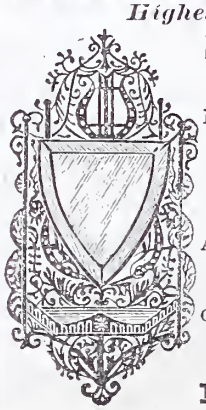

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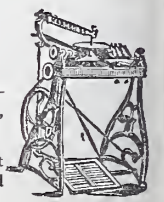

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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### A CABINET FOR OLD CHINA.

BY F. JERMAN.

INTRODUCTION — SIZES OF MATERIAL — WOOD — CONSTRUCTION—DOORS AND FITTINGS—PAINTING—CONCLUSION.

MOST of the readers of WORK, I daresay, have hobbies. Some go in for collecting stamps or birds' eggs, or in making collections of rare objects from the mineral and vegetable kingdoms. Perhaps a few are collectors of old china, and naturally want a cabinet in which they can show the fruit of their labours to the best advantage; and at the same time stow them away safe from the ravages of the domestic servant, who, under the pretence of "dusting," would gladly smash everything destructible in a house: the most valuable articles being, of course, the first to be destroyed. The article shown in the accompanying design may at first sight appear too complicated for the amateur carpenter to make, but on a close study of the drawings and reading the following directions these difficulties will vanish. The design is of a cabinet that I have just completed myself, and I think that any other amateur can "go and do likewise" if he has a well-stored chest of good tools. In execution it looks very well, although the small moulds around the panels are all stock patterns. This cabinet can be made into an excellent bookcase, being much preferable to a few open shelves, the glazed front effectually keeping out the dust; and the cupboard beneath would then be a good place to keep unbound magazines and journals.

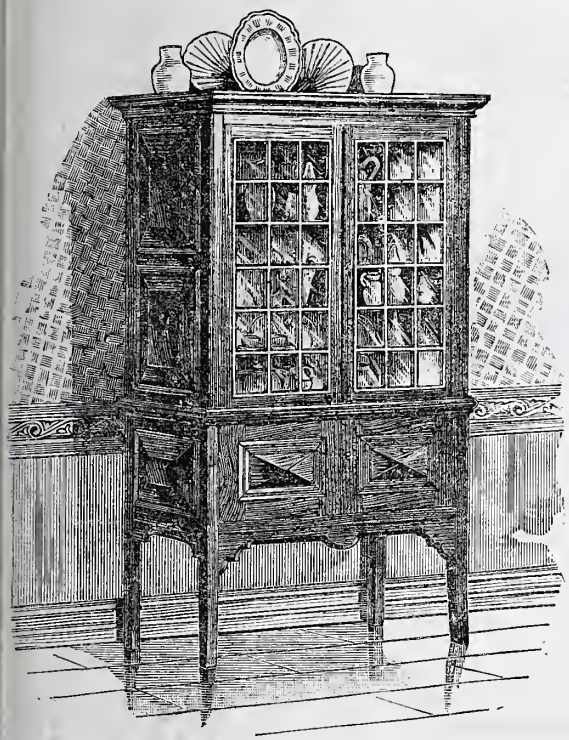


Fig. 1.—Perspective View of Cabinet for Old China.

The following are the measurements and lengths of wood required:—

1¾ in. square in four corner posts, 22 ft. run; 1¾ in. square stuff elsewhere, 22½ ft. run; ⅜ in. back, 11 ft. 8 in. super.; 1½ in. top, A, 4 ft. 3 in. super.; 1¼ in. shelf, B, 4 ft. 3 in. super.; 1¼ in. shelf at C, 3 ft. 6 in. super.; ¾ in. four shelves in cabinet, 13 ft. 4 in. super.; 1 in. mould round sides, 15 ft. 8 in. run; 2 in. bolection mould in front panels, 8 ft. 4 in. run. The glazed frames in front are formed of 1 in. by ⅞ in. stuff, with ½ in. bars. The

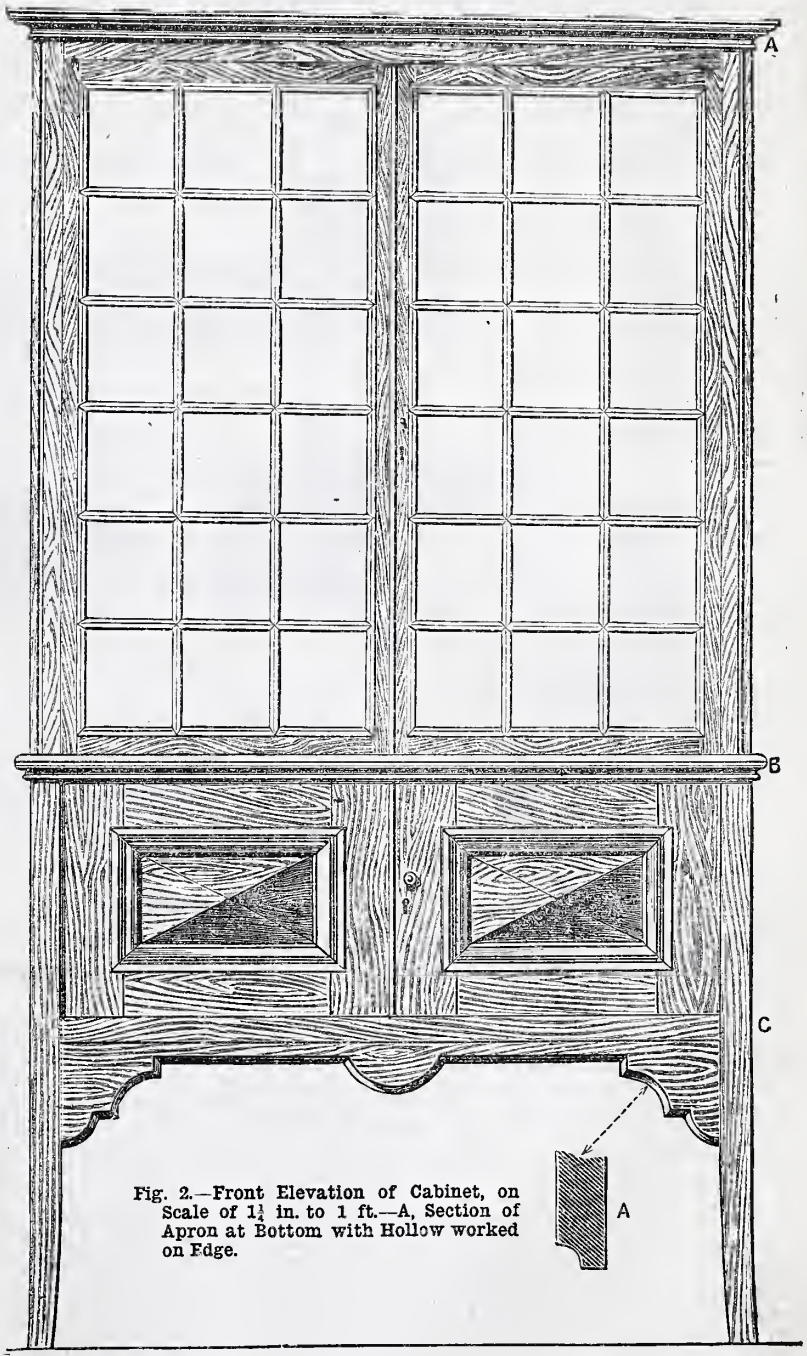



Fig. 2.—Front Elevation of Cabinet, on Scale of 1¼ in. to 1 ft.—A, Section of Apron at Bottom with Hollow worked on Edge.

frames to lower doors are 3 in. by $\frac{7}{8}$ in., with $\frac{5}{8}$ in. bevelled panels. The panels at the side are of 1 in. stuff, also bevelled. The size of the cabinet when finished is 5 ft. 6 in. high, 3 ft. broad, and 1 ft. 3 in. deep, outside measurements.

If an inexpensive cabinet is desired, the wood used may be red or yellow deal.

The angle uprights should be first cut out, the two in front to diminish at the bottom. Between A and B (Fig. 2) a bead is worked on the angles, and a groove is made for the side panels. The front uprights must be rebated $\frac{1}{4}$ in. for the glazed doors, and the two back uprights rebated $\frac{1}{2}$ in., as shown. The horizontal pieces grooved similarly for the panels must now be tenoned into these uprights, the panels being got ready and fitted into the grooves at the same time, similar to the manner in which a panel door is made. The moulds are then mitred properly and bradded on. The ornamental apron at the bottom is cut out of 11 in. by $\frac{1}{2}$ in. stuff, and tongued into the uprights, etc. A hollow is worked on the edge, as shown at A (Fig. 2). On each of the sides of the cabinet four strips of 2 in. by $\frac{3}{4}$ in. stuff are tenoned into the uprights to take the shelves. The shelf, B, is $1\frac{1}{4}$ in. thick, with 1 in. projection; a mould is worked on the outer edge, and the square holes for the front uprights are chiselled out carefully, and holes are cut also for the back ones. This method of keeping the shelf in one piece necessitates more care and time than if the mould is merely planted on; but, on the other hand, it adds to its good appearance, and makes a better job. This shelf and the top, A, are firmly secured to the horizontal pieces. The shelf, C, is $1\frac{1}{4}$ in. thick, rebated and screwed to the horizontal pieces all round, and cut out where the angle studs occur. The four intermediate shelves, three in the glazed front and one in the cupboard underneath, of $\frac{3}{4}$ in. stuff, are now screwed to the pieces mentioned above for the purpose. As an appearance of lightness and elegance is required in a cabinet of this description, the moulding at A is purposely made of very little height. It is worked on the top piece $1\frac{1}{2}$ in. thick, thus dispensing with the heavy cornice which is usually fixed on sideboards, wardrobes, etc. The back can now be placed in the rebates, care being taken to fix the pieces firmly together, with triangular strips nailed round to keep them in close.

Everything is now in position except the doors. The glazed doors are each 2 ft. 10 in. high and 1 ft. $4\frac{1}{2}$ in. in breadth, with frames and bars as before mentioned and rebated meeting styles. The glass is 21 oz. best sheet, care being taken to choose it without flaws and bubbles. Fit the panes with beads inside, bradded on instead of puttying. The doors are hung with small brass butts. A couple of small bolts are required in one leaf, and a small china handle and lock and key on the other. The frames of the two lower doors to cupboard are tenoned together, and a 2 in. mould run round panel. The hinges and fastenings are similar to those in the glazed front.

An excellent method of treating the cabinet is to paint it three coats, leaving the panels a sage green, the frames a blue green (called, I believe, "French" green), and the mouldings picked out in dark green and black, and afterwards varnishing the whole.

The sketch in Fig. 1 gives an idea of how the work will look when completed, and I think the above description will make everything clear. If there is anything that any reader may not understand, I shall be pleased to correspond with him through the columns of "Shop." I do not, however, think that any woodworker of average capacity and skill will find much that is difficult in the construction of the cabinet. The parts that will prove most troublesome are the glazed doors, but it is recommended that the style shown in Figs. 1 and 2 should be adhered to, as it is thoroughly in harmony with the other parts.

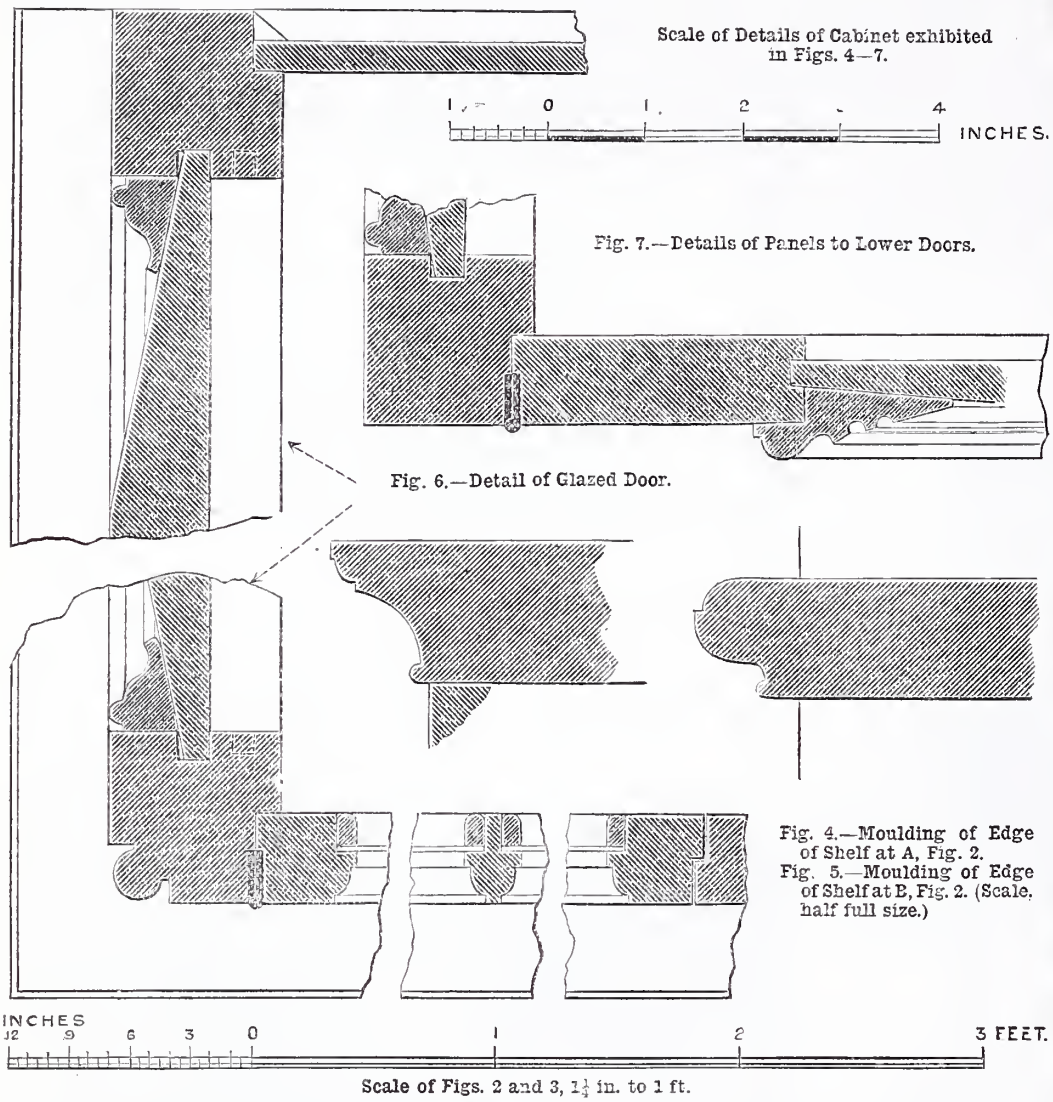



Fig. 7.—Details of Panels to Lower Doors.

Fig. 6.—Detail of Glazed Door.

Fig. 4.—Moulding of Edge of Shelf at A, Fig. 2.
Fig. 5.—Moulding of Edge of Shelf at B, Fig. 2. (Scale, half full size.)

Scale of Figs. 2 and 3, $1\frac{1}{4}$ in. to 1 ft.

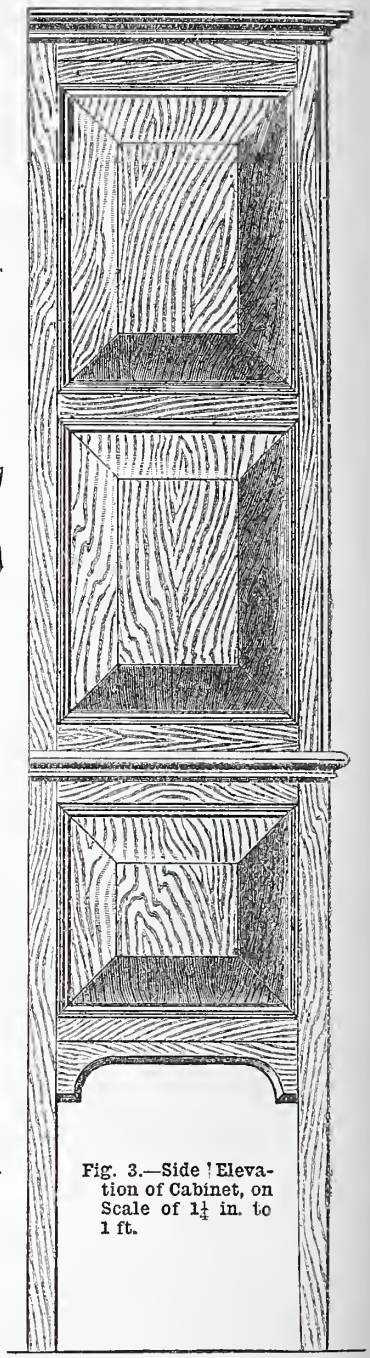


Fig. 3.—Side Elevation of Cabinet, on Scale of $1\frac{1}{4}$ in. to 1 ft.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

FRAME READY FOR THE FITTINGS—MAKING AND BENDING L-PIN—BRAKE-WORK—BRAKE LEVER—LAMP BRACKET—MUD-GUARDS—ADJUSTING PINS—DRIVING AXLE AND CHAIN WHEEL—CRANKS AND PEDALS—FOOT-RESTS AND STEP—SADDLE AND SPRING.

WE left our frame brazed up and finished ready for the various fittings, such as brake-work, mud-guard, L-pin, etc., and we have the frame with these parts in place in the annexed illustration (Fig. 29). The other figures accompanying this chapter are Fig. 30, L-pin; Fig. 31, A, B, brake lever; Fig. 32, A, B, brake spoon; Fig. 33, A, B, adjusting ring with lamp bracket; Fig. 34, brake-spoon hingeing-pin (full size); Fig. 35, adjustable brake-rod complete: A, the $\frac{3}{8}$ in. tube; B, the rod; C, the lower fork for attaching to spoon back; D, the upper fork for attaching to brake lever (Fig. 31); E, adjusting piece with set-screw (Fig. 38) fixed on upper end of tube, A; Fig. 36, ends of mud-guard stay-rods that fit on to axles (full size); Fig. 37, A, B, spring bracket for L-pin.

We will now proceed to the making and fitting of these parts, and first of all the L-pin (Fig. 30). It is made from a bit of round steel bar turned to $\frac{5}{8}$ in. exactly; it takes 13 in. of stuff to make. After being turned and smoothed ready for the final polishing, it is bent to a right angle, the two arms being equal lengths. The bending may be easily done as follows: heat up to a bright red in the centre; cool both ends in water, leaving $1\frac{1}{2}$ in. in the centre red; then grip in a vice and slip a piece of tube on the other end to act as a lever, and the bar will be easily bent to the required angle. Of course, the whole thing has to be done pretty smartly in order not to lose the heat. After bending, the L-pin has to be finished for nickel-plating by polishing on the emery-wheels, or, in the absence of wheels, with fine files, emery-cloth, and oil. In draw-filing with fine files it is an improvement to chalk the file. All cross file marks must be removed by draw-filing before the work is ready for emery-cloth.

Before finishing L-pin see that it moves freely in the vertical socket in the frame, and that the spring bracket (Fig. 37) also moves freely on it. The ends of the L-pin should be nicely rounded, and after the whole is polished with the finest emery-cloth it is ready for the plater.

We next take in hand the brake-work. The spoon (Fig. 32) is a stamping or casting; A is the upper side, B the side view. The end C is that which receives the hingeing-pin (Fig. 34). This part of the spoon is as long as fits in between the fork sides; it is bored right through for the pin $\frac{5}{16}$ in.; its face within the fork sides is $\frac{1}{2}$ in. clear of the wheel rubber. A hole is bored through each of the fork sides to receive the pin, that on the one side being the full size of the pin, that on the other somewhat less, and tapped for the screwed end of the pin. When the pin is in place the ends should be flush with the outer surface of the fork; the head end of the pin has a slot for turning with screwdriver, as shown in the figure. The spoon should move freely on the pin and have no side movement, else it will give a disagreeable rattle on the road. The spoon, after being fitted on its pin, is taken off and finished up, not for plating but for enamelling. On the back of the spoon (fig. 32, B) will be seen a pin to attach the lower fork end of brake-rod. The fork end, C, is neatly fitted to this pin, and a $\frac{1}{4}$ in. hole bored for a small bolt. The tubular portion of the brake-rod has already been noticed in the brazing process. It has only to be finished up for enamelling like the spoon. The solid rod, B (Fig. 35), is finished $\frac{1}{4}$ in. thick, and should fit neatly and slide freely in the tube, A. It is 9 in. long, including the forked head. This part is bought as a rough stamping, and has got to be finished for nickel-plating. The forked end has got to be fitted to the end of brake lever (A, B, Fig. 31). The fork is first filed with a flat file to receive the lever; the lever is then filed down to fit in tightly meantime. When fitted in, a $\frac{1}{4}$ in. hole is bored through both fork sides and lever to receive a bolt and nut, same as at spoon back. These bolts are bought for the purpose with neat hexagon heads and nuts. When the hole is bored as above, a piece of wire is driven into it and the fork part and lever filed up and finished together, which makes a neat tradesmanlike job. The set screw at E fixes the rod, B, at any desired height within the tube when adjusting the handle-bar.

We now tackle the brake lever (Fig. 31). This is 15 in. long and $\frac{7}{8}$ in. broad at the broadest part—namely, where it hinges to the lever lug (Fig. 26, page 356). It is about $\frac{1}{4}$ in. thick throughout its length, but at the right-hand end in the figure it is flattened out in the edge direction into a shallow spoon form, as a grip for the hand. When bought, the lever is a straight bar, and has got to be set. The end, A, B, has a double bend. This is necessary to bring it out in front of the steering-post, the lever being hinged directly under the handle-bar. At C the lever has to be bent to the same set as the handle-bar, so that the spoon part will be immediately under the handle, in the best position for gripping. This lever being fitted into the lug, D (shown full size, Fig. 26), has to be bored for $\frac{1}{4}$ in. bolt, as before described.

The spoon end of the lever is set downwards, as shown in A (Fig. 31), and this being done, this part—namely, the brake lever—is finished by grinding and polishing, or by filing, to be nickel-plated.

Fig. 33, A, B, is the lamp bracket and set-screw collar combined. This part may be neatly fitted to the top of the steering-tube. It is a steel stamping, and has to be finished up for plating, so it is not brazed, but fixed to the tube with two small flush screws. As will be seen from B, Fig. 33, a hole is bored through the bracket through which the brake-rod passes. The back part of this bracket is bored $\frac{5}{16}$ in. and tapped $\frac{3}{8}$ in. for the set-screw.

The adjusting cone ring, C (Fig. 8, page 168), here shown full size (Fig. 38, in section), is fitted on to the steering-tube before the lamp bracket at top; it also has a set-screw flush with a slit for a screwdriver. This part is turned and finished in the lathe, and is plated.

Now, having completed that part of our work, we will attend to the mud-guards.

The mud-guards are made of very thin steel, and are rolled to fit any size of wheel required, and in section like Fig. 39. The rear mud-guard is about a half circle, that for the front wheel being somewhat less than one-fourth of a circle. The front guard is fixed by a screw at its upper end hard under the fork crown, where a hole has been previously tapped and the screw fitted; it should at this part be an inch clear of the tire. The lower end is supported by stays (see Fig. 36). These stays may be round, flat, or half-round iron. I have shown them of half-round iron, as in section A. The ends have to be doubled in forging to get stuff enough to form an eye with a $\frac{7}{16}$ in. or $\frac{1}{2}$ in. hold, as the hub axle may require. The manner of forging these is clearly shown in the figure. This stay is made long enough to form the pair; it is simply bent in the middle to go round the *outside* of the mud-guard, and should be made of a length to stay the guard one inch from the tire, as at the upper end, as the neatness of a machine depends very much upon having the mud-guards concentric with the wheel tires.

The rear mud-guard is fastened to the frame at two points: first at the bottom bracket by a small screw to the tube; second, to the rear of the socket at upper end of the bent tube, D (Fig. 1, page 33). It is also stayed at two points by stays made exactly as the front guard stays. The inner ends of the stays are slipped on to the ends of the axles, and the whole tightened up with the outside nuts. This mud-guard should also be an inch clear of the tire throughout its whole length. The fact of the rear axle being adjustable by sliding in the slots does not affect the position of the mud-guard seriously, as the wheel being moved backwards or forwards in the slots carries the mud-guard with it, the stays being on the axle ends. The stays, where they pass round the mud-guards, are riveted by at least two small $\frac{1}{4}$ in. rivets, and filed off flush on the outside. The rivet holes should therefore be countersunk before riveting.

Fig. 40 is one of the adjusting pins of the rear wheel, full size (see Fig. 6, page 168, where it is seen in place half size). It is 2 in. long and $\frac{5}{16}$ in. thick. Its outer end presses against the axle ends where they are supported in the slots. When the pins are screwed to push the axle outwards, the slack of the chain is taken up, so as the chain wears and requires taking up these screws are brought into requisition. When, however, the axle has travelled out to near the end of the slots, a link must be taken out of the chain and the two screws wound back for readjustment.

I previously described the fitting of the bottom bracket bearings by bolting through the knuckle joints. They should now be fitted in together with the axle and its chain wheel: without the key, however, as yet. Now the rear driving-wheel is put in its place and adjusted to run in the centre of the fork tubes, otherwise to run in line with the bent tube in front of it. This being done, the chain wheel has got to be set exactly in line with the hub cog-wheel. This may be done by using a straight-edge or a taut string, or even a good eye. When the two wheels are got into line, the chain wheel is marked in its place on the axle, and the latter being removed from the bearings, the wheel is firmly keyed on.

It takes about 4 ft. of chain for one machine. This chain is provided with a small bolt and nut. This bolt fits the holes in every link, so that wherever the chain may be cut the bolt fits for joining. To fit a chain on a new machine, the rear wheel axle should be pulled in to the inner ends of the fork slots; when the chain is placed over the wheels and the ends placed alongside each other, it will be seen at once which link to remove. To cut the chain, both the rivet ends of the same link are filed down level, then punched out, and the bolt will fit the rivet-holes. The chain will hang loose, and has got to be pulled up by the

adjustment screws above referred to. It must be observed that for use the chain should not be pulled tight; the bottom half of the chain should hang a little curved when the upper side is taut, as when driving the machine.

If the cranks are bought in the rough, they are first bored to fit the axle ends, which should come through flush, and no more. I have shown in detail the two prevailing forms of cranks (Figs. 17 and 18, page 308). The cheaper crank is Fig. 17, keyed on; so it will remain a matter of choice which of the two sorts is adopted. The most approved length of cranks is from 6½ to 7 in. The outer ends of the cranks have a slot some 1½ in. long, to allow of varying the stroke of the pedals. The inner ends of the pedal pins slide in the slots, and are fixed at any desired place by a ½ in. nut with a washer behind it.

The pedals are generally bought ready-made and plated, and they may be plain or ball, according to the depth of the pocket of the buyer.

Pedals may be made up from the parts, however, as all the parts are sold by the dealers. In preparing the cranks for the pedals the slots must be filed out till the flattened end of the pedal pin enters, when it should move freely along the slot without shake. Then the cranks are finished up for plating or for enamelling, according to choice, although they are, as a rule, plated.

The foot-rests on the front fork may be plain pins fixed into the fork sides, and clothed with rubber, the pin having a small nut on the outer end to prevent rubber from coming off; or if the rubbers have close ends, they are cemented on to the pins with tire cement. The adjustable foot-rest is much preferred by many, as it may be placed on the fork side at any desired height. It is made of a steel strip about ½ in. broad, bent double and widened to clutch the fork side, where it is fixed at the back by a small bolt passing through both ends. The upper edges are serrated to prevent the foot slipping. They are nickel-plated, and sold in pairs at about 1s. 6d.

The step (Fig. 7, page 168) is fitted by screwing the tenon ⅜ in. and tapping the extension on the left rear fork; it should be screwed in tightly and filed off flush on the inside, as a nut might interfere with the hub.

If a rubber step is preferred, a plain ⅜ in. pin some 2½ in. long, with the outer end reduced and screwed for a ¼ in. nut, a piece of pedal rubber, or a foot-rest rubber, is placed on the pin, and a small washer and nut keep it secure.

Another kind of step is the loop, which is hung on to the end of the axle, hangs down about 2 in., then turns upwards, and has a round flat button for the foot to mount by.

We have now gone over nearly every part of our machine, with the exception of the saddle and spring. We have in the market the saddle and spring separately and the saddle and spring in combination.

When the saddle and spring are separate I use what is called a three-coil spring; the saddle is mounted on top of this, and it is in conjunction with this spring that the bracket (Fig. 37) is used. In the combination the saddle is stretched on a spring frame, having the bracket for the L-pin as

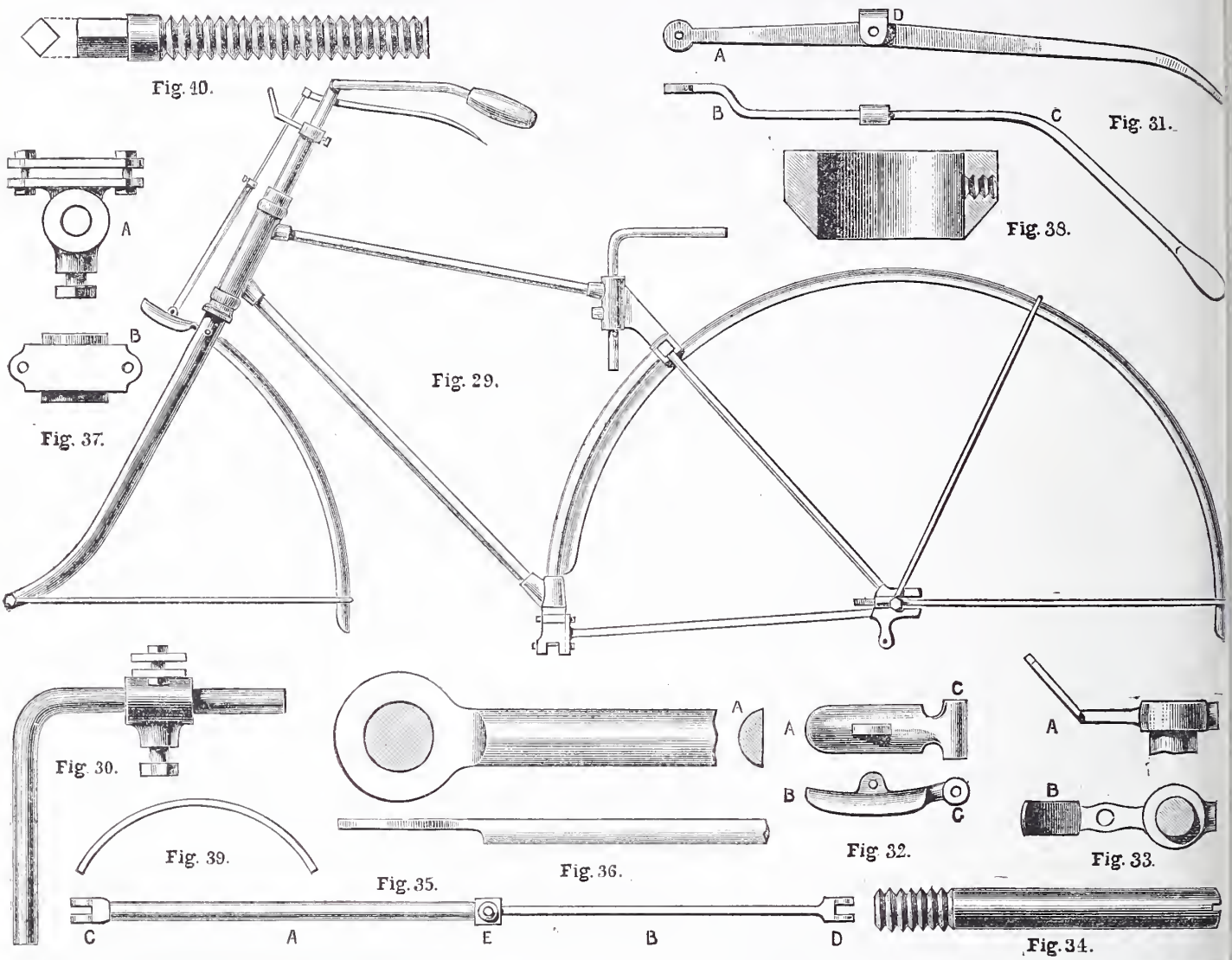



Fig. 29.—The Frame minus the Wheels (⅛ full size). Fig. 30.—L-Pin and Bracket. Fig. 31.—Brake Lever. Fig. 32.—Spoon. Fig. 33.—Lamp Bracket. Fig. 34.—Spoon Hinging-pin. Fig. 35.—Brake-rod. Fig. 36.—Mud-guard Stay Ends. Fig. 37.—Spring Bracket. Fig. 38.—Adjusting Collar. Fig. 39.—Section of Mud-guard. Fig. 40.—Screw for adjusting Chain. Figs. 30, 31, 32, 33, 35, 37 are ¼ full size. Figs. 34, 36, 38, 39, 40 are full size.

part of the under side of the frame, as in Fig. 1 (page 33). This combination is considerably dearer than the other, the cheapest being about 7s. 6d.

Having completed all the fitting, our next work will be the choosing and fitting the rubber tires, which I will leave over for the next article, which will be devoted to the consideration of the enamelling and the plating of the bright parts of the machine, as well as that portion of our subject already mentioned. Nothing will then remain to demand our attention except the final fitting up of the entire machine and the last touches necessary for its final preparation to take the road as a machine completed and ready for daily use.

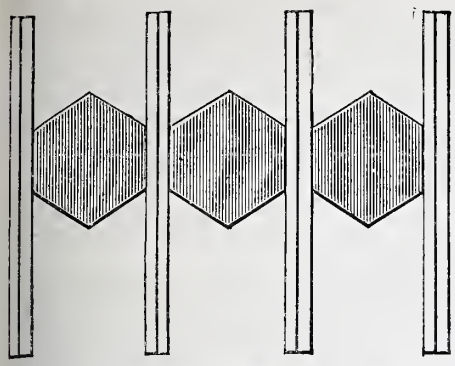


Fig. 84.—Laying out of Wires to be turned as in Fig. 83.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Peg Latticing—Hexagonal Mesh.

Every day one meets with fencing along palisades, in front of poultry pens, along garden walks, etc., of the description represented in Fig. 83. This pattern is one of the commonest made use of, but it is being greatly superseded by the diamond crimped mesh. However, the hexagonal mesh is a very useful and strong description of work, and deserves the patronage it has received.

The hand method of working it is comparatively simple. The process is delineated in the progressive diagrams (Figs. 84, 85, 86, and 87). A number of hard wood or iron pegs, corresponding in number to the number of clear holes required in the work, are inserted across the bench, as shown in Fig. 88, in a straight line with one another, each peg being separated from the other each side by about the space two or three thicknesses of the wire would occupy, and each being hexagonal in shape, as represented in Fig. 89. The pegs must be the same size as the mesh required to be made.

An even number of wires of the proper gauge are laid, as in Fig. 84, on the bench. One pair will be on the outside of the end peg at one side of the bench, and another pair on the outside of the peg at the opposite extreme; while the remainder will be disposed of in pairs between the rest of the

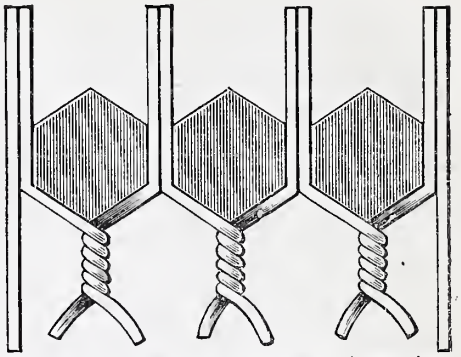


Fig. 85.—Progressive Continuation of Twisting: First Stage.

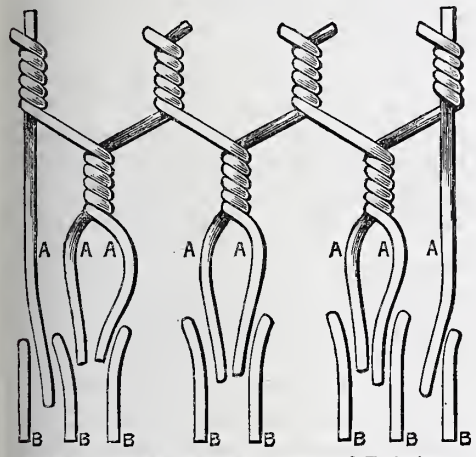



Fig. 86.—Progressive Continuation of Twisting: Second Stage.

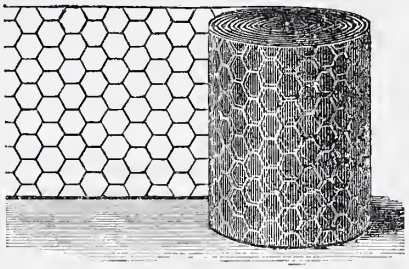


Fig. 83.—Roll of Peg Latticing or Hexagonal Mesh.

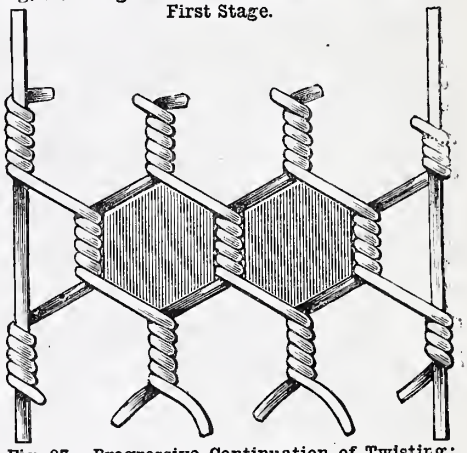


Fig. 87.—Progressive Continuation of Twisting: Third Stage.

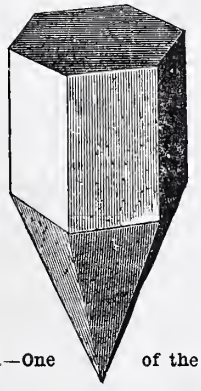


Fig. 89.—One of the Pegs.

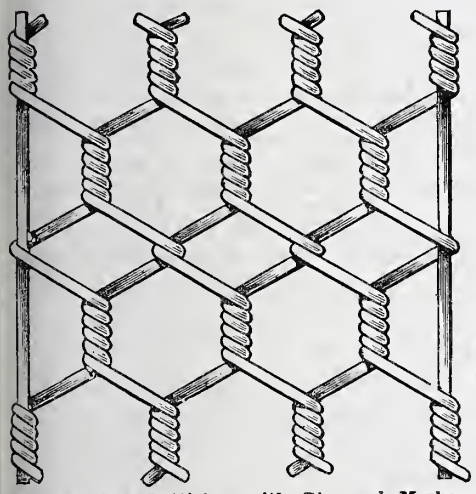
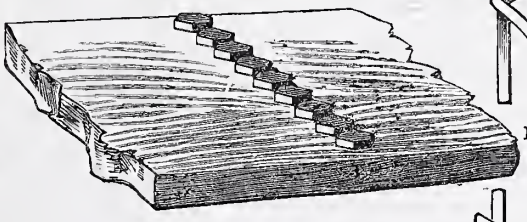


Fig. 90.—Peg Latticing with Diamond Meshes intervening.

Fig. 88.—Perspective View of Pegs round which Wires are twisted.



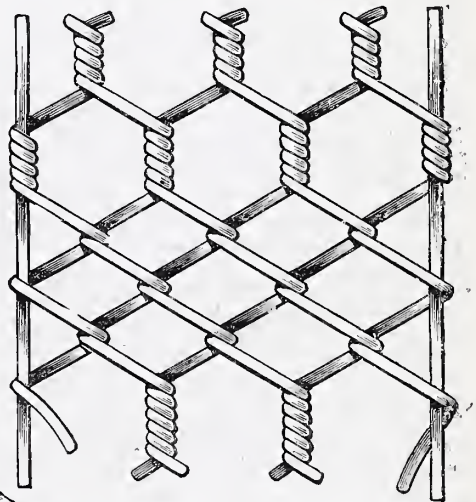


Fig. 91.—Another Form of Peg Latticing with Diamond Meshes intervening.

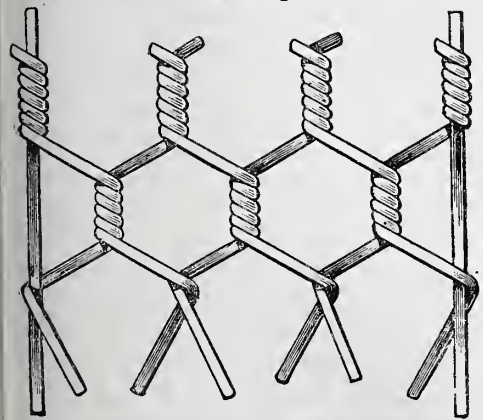


Fig. 92.—Diagram showing how Wires are crossed to obtain Diamond Meshes.

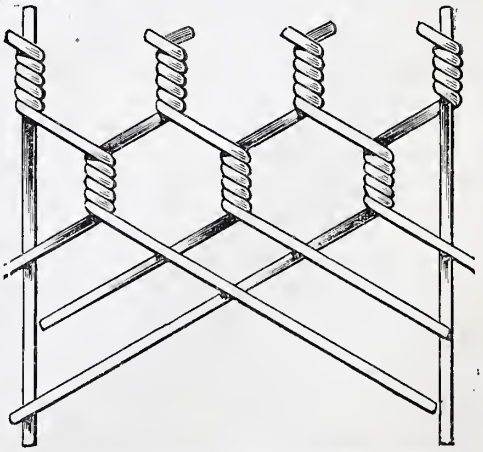


Fig. 93.—Another Mode of crossing Wires to obtain Diamond Meshes.

pegs. I have only used three imaginary pegs in my illustrations, for the purpose of economising the space at my disposal.

A wire bound round the bench can secure the wires temporarily by the latter being hooked on to it; or small staples can be driven into the bench, on to which the wires may be attached; or, in lieu of these means, the ends of them can be turned and driven into the bench. The object for thus temporarily securing them will be understood as I progress with my description.

The inner wire at one side, and the one nearest to it of the adjacent pair, are twisted by the hands or pliers, according to the toughness of the work, until the twisted section is in length equal to one side of the hexagon (Fig. 89); then the remaining single wire of the second pair is twisted in a similar manner in connection with the wire nearest to it of the third pair. So the operation is proceeded with until they assume the appearance shown in Fig. 85. The two outside wires will always remain in a straight line—*i.e.*, they will not follow a hexagonal shape, but merely be twisted round the others where necessary. The ends which have until now been secured to the bench must be twisted, and will appear as in Fig. 86. At this stage the work is placed over the pegs, as in Fig. 87, a half mesh remaining outside the pegs at each end. It will be found necessary to remove one of the pegs occasionally to permit this to be accomplished.

When in the position last mentioned, the same process is followed as described above, a wire in each pair being twisted around the wire nearest to it in the pair close by. Every time they are twisted the same number of turns must be given them to bring all twisted sections to the same length as each other. By following these means, any length of netting or latticing can be made; the finished portion being rolled when it becomes a source of inconvenience. It will be necessary to use a weight to keep the work steady.

When the ends of the wires are reached, they can be joined on to others in order to continue the length. We will suppose that the ends are shown in Fig. 86 (A). The ends of the wires to be continued with these are indicated by B (Fig. 86). Each separate wire of B is twisted around the wire facing it in A for a certain distance, which certain distance must be just so far as will allow the sides of the mesh, when the pegging is continued, to be of clear wire as the remainder is composed of.

There are other variations of the same method, the results of which present a very different aspect—at any rate, in some opinions. I am of this opinion, for I should most decidedly say that the meshes shown in Figs. 90 and 91 are each different in appearance to the other, and both present a different aspect to the one we have just previously given attention to.

We will take Fig. 90 for our present consideration. In this mesh a single row of diamonds is introduced between every two, three, or more rows of hexagonals. The hexagonal pegs will serve for this description of work every bit as well as for that of merely hexagonal ones. To effect the difference, it is only necessary to allow the plain wires to cross one another, as in Fig. 93, when a row of hexagonals is finished, instead of placing them in a continuous straight line as is done in Fig. 85. The wires, where they at first cross one another, are then twisted with two turns, again coming straight, as shown in Fig. 86. Here they are proceeded with in the same manner as at the start of the work; each pair where they cross being twisted, as in Fig. 92.

Dealing with the mesh in which there are two rows of diamonds, it is quite suffieient to say that the method of working will only differ from the others noticed in that the wires are again crossed when one row of diamonds have been completed, and are treated in exactly the same manner by being twisted twice, and then continued in a hexagonal mesh.

There are other varieties of this mesh. Sometimes the twisted sides of the hexagon are lengthened to twice the distance occupied by the plain sides; but those which I have endeavoured to make clear to the reader will convey an idea of their construction.

Very many workmen were in the habit of using but one peg to make this kind of netting. It is true that "experience teaches;" and that is the reason why they could twist the wires to form a hole, take them off the peg, make more holes, and thus finish the work.

I may in a future paper describe the peg latticing machine, but I do not absolutely promise to do so. There is a gentleman in Norwich who, I am given to understand, enjoys what might reasonably be termed a monopoly of the manufacture of peg latticing—at least, he supplies wire-workers all over the kingdom with this description of goods, the majority of warehouses or workshops preferring to purchase it from him to manufacturing it themselves.

## PORTABLE BOOKCASES.

BY H. J. L. J. MASSÉ.

ADVANTAGES OF PORTABLE BOOKCASES—OXFORD BOOK-BOX FOR READING MEN—WRITER'S BOX-BOOKCASE—TWO-SHELVED BOOKCASE—ALTERNATIVE METHOD OF CONSTRUCTION—HANGING SHELVES.

THOUGH a portable bookcase is to many persons quite unnecessary (and they may pass over what I have to say on the subject), still, on the other hand, there are many people who, when away from home, cannot, from the nature of their calling, manage to be absolutely without a few books on some special subject or other, or a few books of reference. Many persons are deterred from transporting books with them on their travels because of the damage often done in transit to their mute but trusty friends, and also because of the difficulty of placing them conveniently for use and of securing them from over-inquisitive eyes.

In my own undergraduate days at Oxford a favourite plan for reading men was to have a box with the inside fitted with movable and easily adjustable shelves. This book-box being made of deal as a rule, or pine, fitted with a lid sliding in a groove, could be fastened with a till lock or one or two screws and sent home or to one's destination during vacation, reading parties, or what not, by goods train.

This form of bookcase is, in my opinion, the best for actual travelling, though others may be considered more portable, and can be put together by anyone who is at all clever with his head and fingers at a very small cost. While I am writing I have by me a mahogany box which I use as a book-box. It measures 16 in. by 9¼ in. by 6 in., and will hold about thirteen or fourteen books of average thickness not exceeding the size known as post octavo. It is a cigar box with a sliding lid, and was bought long ago from a tobacconist when I was a boy and delighted in having a box to keep my treasures in. After its partial covering of gaudy paper had been removed by soaking, it was French polished, and finally I fitted it with an American window-sash lock. These locks, by the way, slightly resemble the well-known Yale locks in the shape of their keys and general construction. The box can easily be carried by means of a luggage-strap or brass drawer handle.

This form of box-bookcase can naturally be varied in size to suit the wants of any person who may desire to make or possess one. I have seen them 3 ft. square by 8 or 9 in. in depth, and the quantity of books they held was surprising. Larger sizes than this are made, but they are apt to be rather cumbersome, and require to be structurally heavier.

Another kind can be made by anybody skilled in turnery, or could be made by using up banister rails. The mode of construction is as follows:—After choosing and preparing the pieces of wood for the shelves—the size must be left to the maker of the case—and settling on the distance to be allowed between the shelves, two narrow strips of wood, say 2 in. wide and ½ in. in thickness, are to be screwed on at the back of the shelves: about 6 in. from the ends of the shelves is a good distance to fix them. These two strips or slips will serve to keep the shelves rigidly in position (if the shelves are cut out to receive them so much the better), and being serewed in can be removed in a few moments. For the front of this bookcase small columns can be turned and fitted with the two-ended screws used in fixing the ends to curtain poles. These screws will of course pass through holes in the shelves; at the lower end of the columns they may be screwed into knobs which will serve for front feet if the bookcase be designed for standing on a table; at the top ends the knobs may be made slightly more elaborate.

So far I have described the construction of a two-shelved bookcase—*i.e.*, one which will hold only one row of books—but the principle may be extended, and an upper tier for smaller books added as occasion may require. There is scope, too, for design in the shape of the shelves, which may range from the severely rectangular to the what I may call lodging-house mantelboard pattern.

Yet another way of knocking together a small bookcase would be to make the slips for the back slightly stouter, and hinge the shelves on them in such a way that they shut down closely on to the slips for travelling. The front columns would fit in as described above, and would take up very little space in any box or bag.

There is a way of suspending a shelf or set of shelves from the wall with strings or cords, the shelves being adjusted in their places by means of knots. These shelves are certainly portable, but they are often unsightly and untidy because they hang, as they are made, crooked, it being not the easiest thing in the world for anyone new to the work to make a firm knot at a given point in a string or cord. A good way in making them is to use chain, strong in proportion to the weight to be carried, remembering that a chain is in no part stronger than its weakest link. The distance between the various shelves may be regulated by neat little pins of stout wire passing through the links just under the shelves to be supported by them.

It is advisable, whether cord or chain be used, to fix a thin strip of wood at right angles to the shelf where the holes for the cord or chain are made.

## MEANS, MODES, AND METHODS.

### An Excellent Brown Stain.

A brown stain, which can be used on all kinds of wood, and made a lighter shade if desired simply by the addition of water, can be made in the following way:—Take vandyke brown ½ lb., a pennyworth of burnt sienna, and 1 lb. of washing soda. Add two quarts of water, and boil for twenty minutes. This stain only costs sixpence for two quarts, is very strong, and will stain floors light oak, dark oak, and walnut colour; and is, in fact, about the most useful stain we can possibly have. H. H.

### Springs for Gluing Purposes.

Very useful articles can be made from old sofa or chair springs by simply cutting them off in rings, by which means we shall get large and small sizes, suitable for all jobs.

Fig. 1. Fig. 2.

Fig. 1.—Spring. Fig. 2.—Method of using Spring.

The method of using them is exceedingly simple. Take, for example, a thin slip of hard wood is to be glued on to a rail, as in the case of drawer work. After rubbing out the glue, pull on a few springs, taking care not to open them too much (but just letting them spring on, as it were), and it will be found they will hold the joint close while the glue sets. A little thought will discover lots of jobs (where glue is used) that the springs will be of great use for. Fig. 1 shows a spring cut off, and Fig. 2 the method of using the spring. H. H.

## HOW TO MAKE AN INEXPENSIVE GLASS DOOR-PLATE.

BY FRED JOINT.

Whilst looking over the pages of Work, men of limited means have, as a rule, first to consider the cost, or probable cost, of articles in the making. No doubt there are many that have fancy articles in their minds, only waiting for the "necessary" to come to hand to commence operations.

Those who had the good fortune to visit the Work Exhibition, doubtless, carefully examined the "Waste Product" department. In essays exhibited by me was one on the treatment of broken china ware for window-boxes, plant-holders, etc.; and another, cork dust (the packing from grape barrels), for gardens, ferneries, etc.; and now, to complete effects, I herewith give an artistic glass door name-plate, at a trifling cost to make.

First get a piece of glass cut a little under the size of plate required, and then draw your name (or the name you wish) on a piece of transparent paper. This must be drawn neatly and well to ensure good results, so if, however, you are not skilful in lettering, I advise the study and practise of articles in back numbers of Work on the subject, otherwise procure a copy of Vere Foster's Printing Book, which is sold by or can be got from any stationer, and gives several forms of lettering. When this is mastered, paste the edges to the glass, taking care to put the paper on the top, name upwards. Also be careful to see that it is placed even and straight with the centre.

With a fine camel-hair brush and some brunswick black, follow out all parts *not to show*. When this is dry, trim off any surplus black with any sharp-pointed instrument, and clean the glass with a fine rag, then with gum or glycerine cover the name part left, and again leave to dry or get "tacky." Now cover over with gold leaf, carefully laying it down even and straight, so that when the paper is removed from the front you find the name appearing boldly in gold with a relief of deep black. Varnish the back to prevent damp getting to the gold, and frame in the usual way, staining the frame to match your door.

A more elaborate method is to shade your printing with white and blue, or white and brown, giving the whole a bordering of about ¼ in. in gold.

Cost of materials, complete, about one shilling.

## A COMBINATION COAL-BOX AND MUSIC-STAND.

BY W. NEWTON.

Novelty and Utility of Design—Parts and Measurements — Fixing Sides — Bottom Board—Top Board—Brackets—Front—Uprights — Cross-rails — Music-stand — Its Construction—False Base—Coal-box and Receiver—Drop-handle—Quadrant Stay—Finishing.

This piece of furniture I introduce to amateur carpenters as a novel design concerning the combination of the coal-box and music-stand. The plan on which the former is made is not new, though I believe the manner of fixing the coal-receiver and the front is not common, and more simple than hanging the coal-box to the sides by means of swivels or swing joints. However, this does not much concern the amateur, providing he can get a design that can be worked out with comparatively little difficulty.

This particular piece of furniture is very easy to make, and yet, if carefully put together and nicely finished, is a very creditable article for either dining or drawing-room—in fact, anywhere where the piano may happen to be, as it naturally would be in a room where there is also a fireplace. One is apt to connect the piano with music when speaking generally, though, of course, it is not necessary to have a piano to have music; but this is drifting away from my subject, and I will call my readers' attention to Fig. 1, which shows a general view of the furniture in question.

The measurements are as follows:—Bottom board, 18 in. long by 14 in. deep, of ⅝ in. or ¾ in. wood. Sides of box, 2 ft. high by 12 in. wide, ¾ in. thick; the top board 21 in. long, 13 in. wide, ¾ in. thick. The wood used would possibly be one of the following:—oak, mahogany, walnut, pine, or ordinary deal. Personally, I don't aspire to either of the first three-mentioned, as a rule; first, because of the expense, and secondly, because I am not a good French polisher. Nor do I think, from my own experience, that many amateurs are; and such woods to look really well, and to repay for the cost, require polishing, so I generally stick to yellow pine when I want a natural coloured wood, and varnish it well; or common deal when the article is to be painted or enamelled, and so think the question of the material to be used must be left open, to suit the taste and pocket of the amateur.

The sides are fixed to the bottom by screws from underneath, and should have a clear space of 13½ in. between them, and also leave a margin of 2 in. of the bottom board in front. This will bring the sides flush with the bottom board at the back, the idea of the margin in front being to prevent the possibility of the furniture tilting forward when the coal-receiver is pulled out for use (see Fig. 2), to which I will refer again later on. The top board, A, is screwed on to the sides in like manner, overlapping them in front 1 in., and each side about 3 in. Four fancy brackets, 4 in. by 3 in., as shown supporting the top board, are more for finish, so need not be fixed very firmly; ½ in. wood being used for these. The front of box must be of substantial thickness—certainly not less than ¾ in., as it will have to stand the weight of the coal-receiver, and should be "made up:" by which I mean, not cut out of a single board, but having two uprights and two cross-rails. The uprights are 4 in. wide; the cross-rails 6½ in. This will leave an open space in the centre, measuring 11½ in. by 5½ in., to be filled in according to fancy. A good plan is to get a hand-painted tile, 12 in. by 6 in., or two 6 in. fancy tiles of some delicate tints, letting them into a rebate at the back ½ in. deep, the space admitting of a ¼ in. margin on all sides.

The uprights and cross-rails are, I need hardly mention, mortised and tenoned; and every amateur will know how to set about this who knows anything at all about carpentering, so there is no occasion to go more into details. And in making the front, or door, as I shall call it, it is as well to let it be full large, so that when fixed together it can more easily be squared up and fitted into its place, two thin fillets being screwed to the sides of the box for the door to shut against. Two strong brass hinges, 2½ in. long, are next let into the bottom edge of the door, so that they are flush with the surface when shut together (the knuckle edge being outwards); then screw them on to the bottom board, and this must be done before the back is fixed on. The back is of ⅜ in. wood, the grain running horizontally, and screwed on to the sides at back. Referring again to the door, the width of the uprights and cross-rails if left plain would sink the centre panel into insignificance, so I found a fancy moulding, 1 in. wide, mitred at the corners, and fixed on about 2 in. from the sides, and 3 in. from the top and bottom, greatly relieved the flat appearance, the moulding being fixed on with thin glue and needle points.

So much for the coal-box; but before proceeding to explain the music-stand I offer a suggestion for a false base, should the amateur consider the furniture not high enough, as it will not be higher (as shown) than about 3 ft. 9 in. In Fig. 3 I give a plan for a false base, which can be made up as follows, after the sides have been fixed to the bottom board:—Prepare three pieces of wood 4 in. wide, one piece ¾ in. thick, two pieces 1 in. thick, of sufficient length to form the front and two sides; and as the corners are mitred, this must be allowed for when cutting out the pieces. In Fig. 4 I give a section, showing how the base is made up. First, a piece (A) ¾ in. thick, with the front edge rounded, is screwed on to the

bottom board; B is 1 in. thick, with front edge hollowed and screwed to A; C, 1 in. thick, front edge rounded and screwed on to B. All screw-holes to be well countersunk, so that each piece screws flat against the other, having the appearance of a solid moulding, and all corners to be mitred. By referring to Fig. 4, it will be seen that the base projects slightly beyond the bottom board of coal-box. I have recently fixed a base of this sort to mine, and am pleased with the result, so that I think others may feel inclined to do likewise. The lining for the coal-box or coal-receiver I will refer to further on, and proceed now to explain the top part for the music-stand; and in so doing I must refer my readers to Fig. 5, which shows the uprights, that are the main and sole supports for the shelves and side pieces. The uprights are 1 ft. 9 in. long, of $\frac{3}{4}$ in. stuff, $1\frac{1}{4}$ in. wide, the front edges being beaded, and a groove, $\frac{5}{16}$ in. wide, $\frac{1}{4}$ in. or $\frac{3}{8}$ in. deep, cut down the centre. This is done by the aid of the "plough;" but in the event of the amateur not possessing this particular plane, a simple method is to get a marking-gauge, and set it so that when marking from both edges of the wood it will leave a space of $\frac{5}{16}$ in. wide in the centre. Then lengthen the marker, and by filing it flat, like the head of a spear, it will form a cutter sufficiently good to cut in the required depth; then, of course, a $\frac{1}{4}$ in. chisel will take out the centre. The uprights should then be screwed to the *back* of the top board, A (Fig. 1), 1 in. from either end; but, before fixing them, grooves should be cut in the top board to correspond with those on the uprights, and in a line with the same, for the side pieces, B, to fit into; and should be 9 in. in length. These grooves can more readily be cut out with a chisel, as they are "cross-grain." The shelves and side pieces should next be cut out, the former being of $\frac{3}{4}$ in. wood, the latter $\frac{3}{8}$ in. thick. Shelf E, the lower one, is 21 in. long, 10 in. wide; shelf D, the top one, 1 in. less in width. These are grooved on both sides, to take the side pieces. The grooves underneath shelf E are 9 in. long; the grooves between the shelves that hold the side pieces, C, are 8 in. long; and those on the top shelf, for the side pieces, H, are 7 in. long; all grooves, of course, being in a line with those on the uprights. The side pieces, B, are 8 in. high, when fitted, so should be cut $8\frac{1}{2}$ in. by $9\frac{1}{4}$ in. long, to allow for letting in; and those marked C are 7 in. high and 8 in. long when fitted, taking care that the grain of the wood is vertical. The top side pieces, H, are cut out to match the four brackets under the top board, A, and the height of them can better be judged after the shelves and other side pieces are fixed, the latter being glued into the grooves; and the former, in addition, should be strengthened by screws through the back of the uprights. The back, G, only extends down as far as the top shelf, and can be of thin wood, say, $\frac{3}{8}$ in., which is screwed on to the uprights at back, the top corners being level with the tops of the uprights, the points in the centre about 3 in. higher. A moulding or beading, $\frac{3}{4}$ in. wide and $\frac{1}{3}$ in. thick, makes a finish for the back, and is fixed on by screws from the back. The knobs on the top of the uprights can be of wood or metal; but should the amateur not possess a lathe, he can get some very effective brass knobs, such as are used at the ends of picture-rods. And, in conclusion, I would suggest that all edges showing which are drawn as square should have a beading on them, which is easily done with the "bead-router" so much advertised. The beading helps to relieve the appearance where the wood is required to be thick—such as the shelves, for instance—for, being intended for sheet or bound music, they have to stand a good weight if full. To prevent the music slipping through at the back, three laths, 1 in. wide and $\frac{1}{2}$ in. thick, should be screwed to the shelves and top board, A, at the back; and they also help to strengthen the stand.

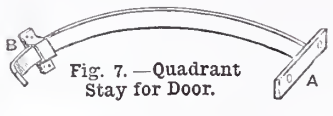


Fig. 7.—Quadrant Stay for Door.

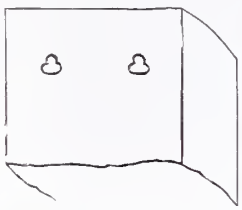


Fig. 6.—Holes in Front of Coal-receiver.

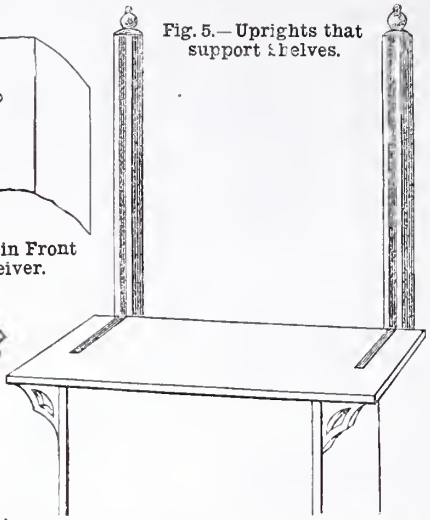


Fig. 5.—Uprights that support Shelves.

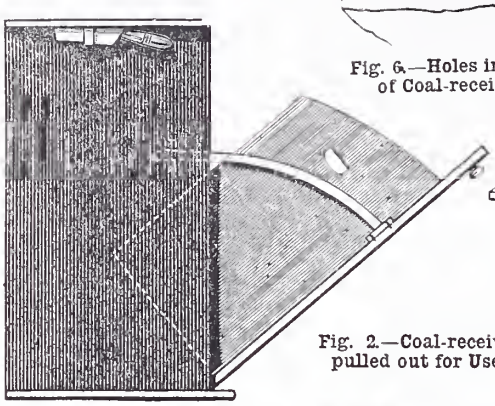


Fig. 2.—Coal-receiver pulled out for Use.

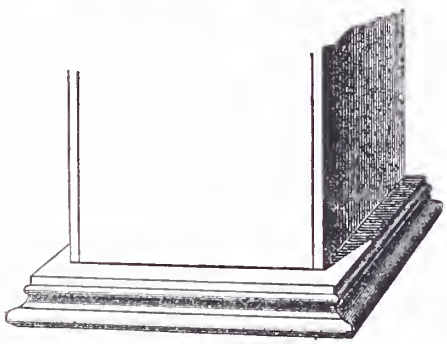


Fig. 3.—Plan for False Base.

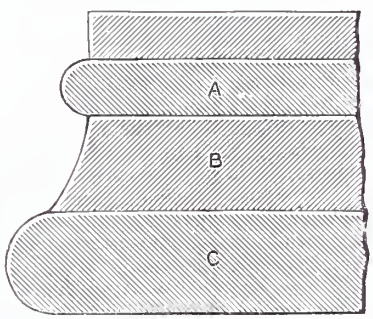


Fig. 4.—Section showing how Base is made up.

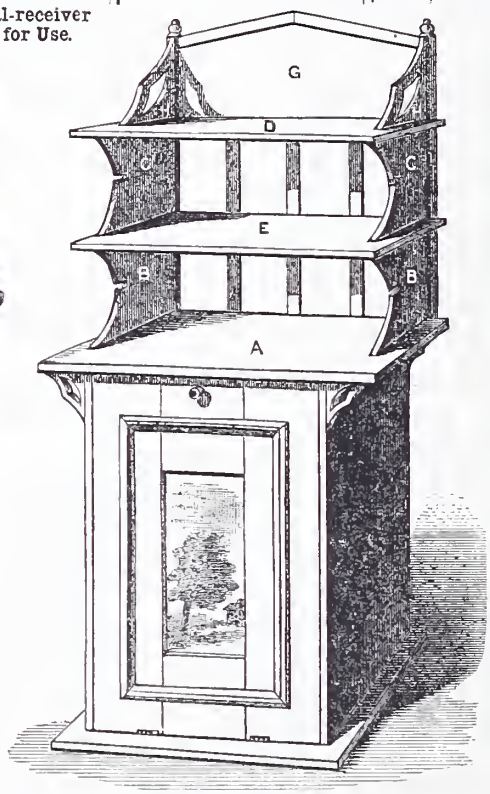


Fig. 1.—General View of Coal-box and Music-stand.

I now refer the amateur to Fig. 2, which is a section of the coal-box, and shows position of the coal receiver when pulled out for use. The receiver should be of the following size (strictly *outside* measurements):—Height at front, 18 in.; ditto at back, 15 in.; width, $11\frac{1}{2}$ in.; back to front, 10 in. This, of course, can be made of wood, but I would strongly advise the amateur to get one made in galvanised iron, as there is no fear of rust through wet coal; and an iron one will last a dozen wooden ones. It is hung on to the door, and should have two holes cut in the front, as shown in Fig. 6, the same shape as mirror-plates, so that it can be easily taken out, if required, for filling. Two drop-handles of iron wire should be fixed on the sides, either in or outside, for the purpose of lifting. Two stout round-headed screws, 1 in. long, are fitted in the door as far as they will go without appearing through, and the receiver hung on these. To hold the door in a proper position when opened to get the coal out, what is known as a quadrant stay should be fixed on one or both sides, if necessary. I endeavour to explain what I mean in Fig. 7, and the amateur will probably have to get it made either in brass or iron. The plate A is a fixture on the stay, and is screwed to the door; the plate B is a guide for the stay, and is screwed to the side of the coal-box. The end of the stay is turned up slightly to form a stop, and this coming against the plate B will prevent the receiver from coming out too far. So

in case of two stays being used, they must be handed—*i.e.*, one right and one left hand. A small piece will have to be cut out of the fillets on the sides, to allow for the stay moving in and out; and there is a space of 1 in. allowed either side, between the receiver and side of coal-box, for the stays. A strap of brass or hoop-iron screwed inside to the top board will hold the coal-scoop; and this, I think, completes the handy piece of furniture, with the exception of a small brass knob to open the door with. The weight of the receiver and its contents will be sufficient to keep the door closed. However, a small spring catch could be fixed on the top edge, if thought necessary. As to the finish, this will entirely depend upon the kind of wood used, and also upon the taste of the amateur; but I offer two suggestions. If made of yellow pine, which can be obtained nearly or entirely free from knots, a good way is to size the wood, and when dry, sand-paper it well, being careful to remove any roughness; then put on a coat of best copal varnish (dark oak), and when it is hard, sand-paper again, and apply a second coat. This will have the desired effect of giving a fine bright surface, and will show up the grain of the wood. I have done this with other pieces of furniture that I have made, with good results. I don't recommend spirit varnishes at all; they are cheaper, but not lasting. If ordinary deal has been used, the best plan is to enamel the furniture, but first it should be primed with a coating of white lead, turps, and a little red lead to harden it. This soon dries, and should then be sand-papered, and a coat of ordinary paint put on, consisting of white lead, turps, boiled oil, and a little driers. If the amateur mixes his own paint, he should always strain it through some fine netting or similar material; otherwise, it will not leave a smooth surface. On this the enamel can be put, the colour of which I leave to the maker.

Some of our readers may not care to have the coal-box surmounted by a music-stand, being unable to play. Under such circumstances a small revolving bookcase, or set of bookshelves that can be turned to suit the need of the owner, might be substituted for the music-stand, being extremely simple in construction and easily made, or the top might be finished to form a box-table, after the manner of the pretty little box-table described in a recent number of Work. If these are not liked a newspaper rack could be placed above the coal-stand, or the pedestal may form a stand for a bust, or be utilised as a jardiniere.

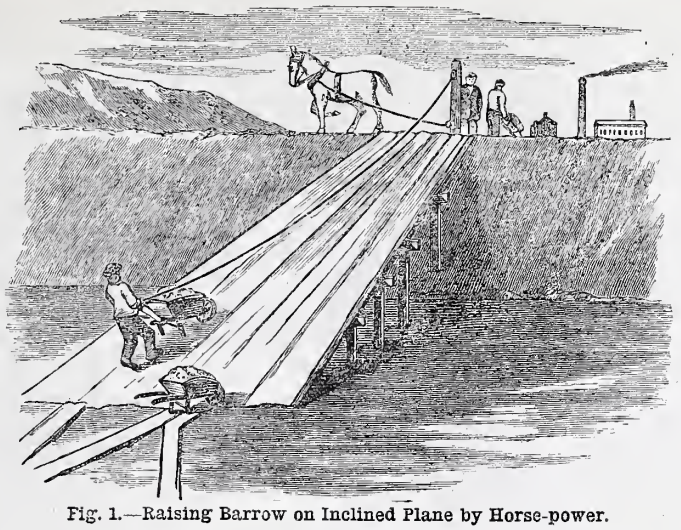


Fig. 1.—Raising Barrow on Inclined Plane by Horse-power.

## LABOUR-SAVING APPLIANCES ON THE MANCHESTER SHIP CANAL.

BY P. B. H.

Most of the readers of this paper will have come across descriptions of, if they have not seen, the large American diggers, which, with two scoopsful, load a contractor's waggon, or the powerful steam excavators, both German and French, which are incessantly at work on the above vast undertaking, now happily nearing completion, and which save such a vast amount of manual labour. In fact, they save so much that it would have been impossible to have constructed it without their aid. These great machines have been described so often and at such length in so many papers that I shall make no reference to them here. There are, however, in odd nooks and corners various labour-saving devices of a smaller kind, employed where the larger machine could not work, and which I will here endeavour to describe.

One of the first devices I saw, and which I have illustrated, is shown in Fig. 1, where a docile horse pulls the loaded barrow and man up an inclined plane formed of boards laid on temporary staging, the incline from the bottom of the canal to the top of the bank being too great for a man alone to wheel the loaded barrow up it.

One man attends to the incline, the full barrows being brought to him and the empties taken away below, while, on the bank, the full ones are removed and the empties brought to the top. Suppose a loaded one is below; the man slips over the handles a board perforated with two holes for that purpose, and to the centre of which the end of the hauling rope is fastened. The man now lifts the barrow in the ordinary way, but, instead of pushing it, he has only to hang on and guide it while both are drawn up by the horse, which starts at the word of command, and stops when it feels the tension on the rope diminish by the load reaching the top; it then turns round and walks back to the starting-point ready for the next load. The man now removes the board and hauling rope to one of the empties and proceeds, generally by sliding to the bottom of the incline. Should his velocity increase beyond safety pitch, the boy at the top puts the brake on the rope, which passes from the barrow over the pulley in the top of the post, then down to a swinging pulley near the ground, and then to the horse. It is really wonderful to see how expeditiously the work is done.

In certain cases hand-carts were used instead of barrows on these inclines; the proceedings were otherwise the same as in the preceding case.

A somewhat similar plan is used for raising the building materials for some arches in course of construction which had almost attained the necessary height of some seventy feet above the surface of the canal. In this case the rise is vertical, the rope passing from the horse round the swinging pulley at the bottom of the scaffolding, up over the pulley on derrick, and down to the floor, where it is fixed on the barrow, which the horse, at a word of command, immediately hauls up to the top. The man on the building seizes hold of it and draws it inwards as the horse backs a few paces to allow the load to descend. The horse now quietly turns round and proceeds to its starting-point. It may here be noted that in all cases where the horse is used the feeding-trough is placed across its path to mark its limit, but even with this they seem almost human from the manner in which they obey the word of command, starting, stopping, backing, turning, and walking back to the starting-point with the utmost precision.

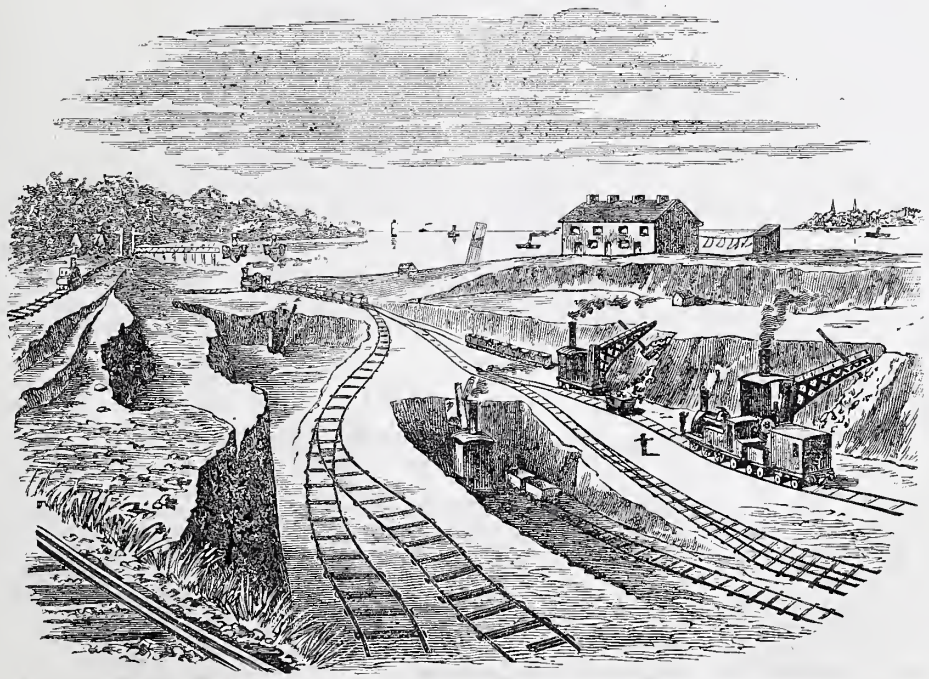


Fig. 2.—Mode adopted in excavating the Site of the present Eastham Locks.

Near some of the arches under construction there was a locomotive steam crane employed for lifting the blocks of granite for the masons. This, when not in use for them, was employed as an auxiliary to the horse in the preceding case for raising the barrows, which it did by travelling along its pair of rails with the end of the rope hooked to it.

Where material had to be raised a short distance and then taken further away to some other spot, the hand-carts or barrows were wheeled on to horizontal platforms, worked in pairs, travelling on inclined rails, one ascending while the other was descending. In this case the platforms were raised and lowered by a small steam engine.

Fig. 2 shows the excavations in progress, but taken some time ago, for the Eastham Locks, which have been lately completed and opened for traffic. The view is taken looking in the direction of Liverpool. The full depth is not yet reached in sketch even in the lowest pit shown.

The above are only a small proportion of the many devices in use, among which are concrete-mixers, a vast quantity of which is used. There are steam pumps, engines, and locomotives innumerable, and I should strongly advise anyone in the neighbourhood to pay a visit to this gigantic work.

## OUR GUIDE TO GOOD THINGS.

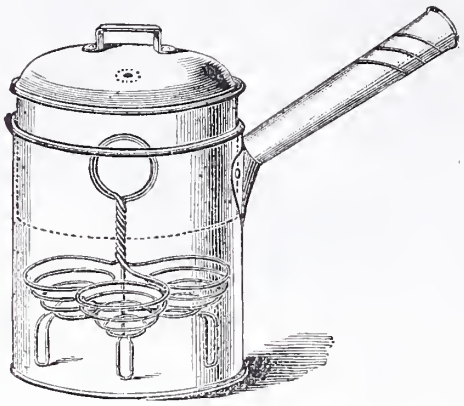
*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 63.—Planner's Patent Signal Egg Saucepan.

Not a very important kitchen utensil, perhaps, is the Patent Signal Egg Saucepan introduced by Messrs. H. G. Planner & Co., 1, Arthur Street East, London Bridge, E.C., and supplied by the inventor, Mr. Planner—who was for many years with Messrs. Deane & Co., the well-known ironmongers near London Bridge—or by any ironmonger or hardware dealer, at 1s. each, or 1s. 3d. post free. Its lack of importance, however, is counterbalanced by its great utility and unerring action, and the trouble it saves to all who boil eggs by its aid by saving them the trouble of watching the clock to see when they have been boiling for the regulation three minutes, or three minutes and a quarter, as some prefer to have it. The construction of the saucepan may be seen from the accompanying illustration. The eggs are put in the holder and deposited in the saucepan; just sufficient cold water is put in to cover the eggs, the deep-rimmed cover is put on, and the eggs are left to boil. Do not put in more than enough water to cover the eggs, for on this depends the generation of just sufficient steam, when the eggs are ready for table, to sound the whistle by the rush of steam through the hole in the lid, and declare the eggs as done. It should find a place in every house.

### 64.—The "Apollo" Picture-cord Grip.

The "Apollo" Picture-cord Grip is another useful invention, patented by Messrs. Smith and Davies, 9, Acton Road, Harlesden, London, N.W. I am unable to give the price, but this may be easily ascertained by writing to the patentees. The construction of the grip may be seen from Fig. 1 of the accompanying illustrations. From a substantial brass back plate projects a kind of box, whose interior is hollowed out in such a manner that the sides of the interior are slanting and slightly closer at the top than they are at the bottom. In this hollow or slot a couple of jaws are placed, grooved on the inner surface and slightly roughened to retain a better grip on the picture-cord when placed between them. The jaws are then held in position by a plate screwed across the opening, as



**Planner's Patent Signal Egg Saucepan.**

shown in Fig. 1. The jaws are furnished with flanges projecting laterally and in opposite directions from the top of each to prevent withdrawal from the box-like cavity when a downward pressure is exerted on them, and the left-hand jaw has a similar projection at the foot, which acts against the bottom of the other jaw and brings it up with the jaw to which it is attached when an upward pressure is applied. The grip is fastened on one side of a picture in the position shown in Fig. 2 by a screw through a hole made to receive it in the bottom of the back plate, and if the picture be large and heavy, another screw may be placed through the slot visible at the head of the back plate in Fig. 1. One end of the picture-cord is tied to an eye screwed into one side of the picture in the usual way, and the other is placed downward through the jaws of the grip. When the weight of the picture is thrown on the cord the jaws are drawn upwards and forced together by the pressure of the bevelled sides of the box on the similarly bevelled

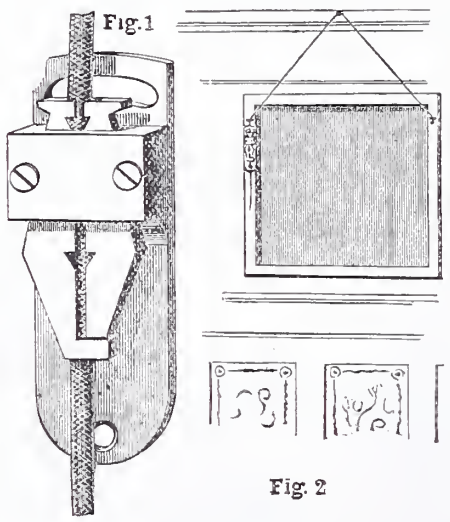



**Fig. 1.—"Apollo" Picture-cord Grip. Fig. 2.—Mode of Attachment to Back of Picture.**

sides of the grip. If it be desired to adjust the picture, or raise it or lower it, as is often the case, all that is needful is to raise the picture with the left hand so as to take the weight off the cord, and then with the right hand to manipulate the cord until the desired height is ascertained. It is in this ready regulation of the height of pictures that the "Apollo" Picture Grip becomes doubly valuable.

### 65.—New White Developer.

Mr. G. W. Secretan, 210A, Tufnell Park Road, N., has sent us a sample of his "New White Developer," which we have tried, and find it well bears out his statements as to its value for developing snap shots and rapid exposures generally, and giving a good, clear, and brilliant image. In these days, when hand-cameras are so much in fashion, such a developer is, undoubtedly, a great acquisition. It can be used repeatedly, retaining its clearness and active properties for some time; of course, gradually becoming slower in its action until exhausted. Being in one solution, requiring only dilution with water, is much in its favour, simplifying the process, and ensuring a proper working solution without any trouble. We can recommend it to our readers with every confidence. It is sold in half-pint bottles at 1s. each. He also sends us a specimen of Dunmore's "Unique" Black and White Cloud Negatives, for which he is agent. These clouds are extremely delicate and rapid printers, and no two are alike, and are very effective. When added to landscapes where the sky would otherwise be a blank space, they have a wonderful realistic effect, and their price places them within the reach of all. For the future we should not see so many landscape pictures destitute of clouds. The Editor.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Hydraulic Propulsion.—The substitution of the screw or paddle by some method of hydraulic propulsion is still engaging a good many minds, and has recently been much discussed at the meetings of engineering societies, etc. We do not deem it likely that the speed hitherto attained of nine miles per hour is ever likely to be exceeded with the existing form of sea-going hull. But for extremely light draught steamers, such as are necessary for some of the tropical and Australian rivers, the fact that the machinery could be placed in any convenient position would be a distinct gain. Very light draught, again, would permit of a much higher rate of speed being attained in proportion to the power, while it, of course, entirely precludes the use of a screw and is not advantageous to a paddle-wheel. Breadth, too, has often to be taken into consideration in tropical river navigation, so that, on the whole, an effective hydraulic propulsion engine has a field open to it. The existing patterns must, however, be improved on, if the engine is ever to be adopted even for the restricted uses above specified.

Sheet Iron in Castings.—Some few of our readers do their own casting, and a yet larger number have castings made for them when fitting up small engines, etc., in their amateur workshops. It may interest them to know that American iron founders are adopting a simple system of strengthening castings, which renders them practically unbreakable either by extreme changes of temperature, such as sometimes occur in stoves, or by an accidental blow. This consists in placing sheet iron in the centre of the casting, even ¼ in. oven plates being found to be rendered safe against fire by this protection. It is estimated that a plate thus prepared possesses six times the strength of one cast without a sheet-iron core. As the breakage of brass castings is also an occasional source of annoyance, especially when they have to stand heavy jerks and strains, such as come upon boat-cleats, crutches, hooks, etc., it would seem worth experiment so as to ascertain whether they could be similarly strengthened.

Rapid Printing of Stereos.—A direction in which inventors could usefully set their brains to work is that of a rapid process for printing engraved blocks or stereotypes. The output of an illustrated journal is restricted by the fact that printing it by means of the continuous web has as yet been found impossible, and that the reciprocating motion has therefore to be adhered to. It certainly does not seem as if human ingenuity were unable to overcome the difficulty; but the machine has yet to be invented.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**A Lathe Wanted.** — J. B. (*Leeds*) writes:—"There are lots of things I should like to make, and could make, if I had a lathe. I have saws, chisels, and gouges, but I want to do some turning. I noticed that in Vol. I. of WORK, page 444, under the *nom-de-plume* of STOKER, and under the heading of 'An Opinion of WORK,' a writer says he has made a lathe, and the materials in it only cost him about 4s. 6d. I should be very glad if STOKER would kindly enumerate in WORK the materials which only cost him that amount."

**Elizabethan Twist in Lathe.**—C. C. E. (*London*) writes:—"With a polite letter I have received from W. P. W. the specimen of work proffered on page 270. It is simply a double stranded spiral cut with a ¼ in. hollow drill, in no sense an Elizabethan twist, which may be described as a cylinder wound round an imaginary axis, the pitch of which may vary as you please, but the section is always circular."

**Saws and Lathes—Erratum.**—A. R. (*Scorrier*) writes:—"In my reply to A. C. (*No Address*) (see No. 125, p. 332), the passage halfway down should read: 'A machine with two belts will clean up from fifty to sixty spokes per *hour*,' not per minute."

**Fret Machine.**—NORTH JACK writes:—"Will you please note that in Fig. 2 (see WORK, No. 58, Vol. II., p. 91) the measure given is shown from top of foot to underside of table board, while it ought to he from the floor line to the top of table. The figures 1 ft. 7 in. should be 17 in., thus making the distance from floor to top of table 2 ft. 7 in., as given in Fig. 1. Also, that the distance between the uprights is 18 in., not 1 ft. 8 in. (see Fig. 1); and the table board is 23 in., not 2 ft. 3 in. The side bearing pieces are given too short in the timber list."—[You and all other correspondents submitting intricate drawings, involving such an array of figures as is contained in your fret machine and its parts, should be careful to indicate very clearly what dimensions, etc., are really intended.—ED.]

**Water Glue.**—J. B. (*Poole*) writes:—"I have tried this, and do not think it can compare with Le Page's fish glue for strength of joint; it also has the disadvantage of showing a line of colour at the joint darker and thicker than other glue. Nevertheless, being waterproof, it is a useful adjunct to the workshop."

**Brush-making by Machinery.**—W. B. (*Huddersfield*) writes:—"As a journeyman brnsh-maker I should esteem it a favour if you would give us some particulars on brush-making by machinery."—[I shall be glad to receive on approval any paper on "Brush-making by Machinery."—ED.]

**Birmingham Punch Trade.**—W. B. (*Huddersfield*) writes:—"If at some future time a chapter could be given to the Birmingham punch trade, I think it would be of considerable interest to many readers of WORK."—[I shall be happy to hear from any reader who can write on this subject.—ED.]

### II.—Questions Answered by Editor and Staff.

**Bear on Pole.**—OLRAC.—Your own common sense should tell you that if the bear is, as you say, constantly facing the man who walks round the pole, he is not going round the bear.

**Bookcase and Chiffonier.**—F. N. (*Manchester*).—If you purchase the Index to WORK, Vol. I., and that to Vol. II., you will find several designs which, with no great ingenuity, may be adapted to your requirements.

**Protection Stamp.**—HIGGINS (*Altrincham*).—The Government stamp on a provisional protection costs only £1. Duplicate specifications must, however, accompany this proper stamped form, and all must be done in strict accordance with the Patent Office regulations. A patent agent's usual charge for obtaining such protection is £3 3s. to £4 4s.—R. & C.

**Watch-making Tools.** — Makers' names and addresses have frequently been given in "Shop." Consult the Indexes of WORK, Vols. I. and II.

**Draughtsmanship.**—DEWDROP. — This subject will be treated in WORK shortly.

**Umbrella Silk.**—M. A. H. (*Richmond*).—Consult the London Directory for wholesale silk merchants. Any one of them will supply umbrella silk.

**Basket-making.** — J. K. (*Middlesbrough*). — When I receive papers on the subject they will appear. I await the convenience of the practical hand who offered to write on this subject, and whose offer was entertained by me. You may lead a horse to the water, but, as you are probably aware, you cannot make the said animal drink. In the same way you may accept proposals for articles, but you cannot make the proposers write.—ED.

**Camera and Banjo.**—D. M. S. (*Glasgow*).—Purchase the Index to Vol. II. of WORK, and you will find much upon cameras and banjoes.

**Glass Shades.**—R. S. S. (*Trevor*).—Glass shades can be procured of Messrs. James Powell & Sons, Whitefriars Glass Works, Temple Street, London, E.C. They have one very nearly the size you want, viz., 21 in. high, by 38½ in. by 13½ in., and which they quote at £4 10s., less discount for cash. If this would suit you, it would, I think, be much cheaper than having one specially made; I would advise you to correspond with them. I may say, for the benefit of those interested in electricity, that the above firm supply glass jars for Wimshurst induction machines.—W. E. D., JNR.

**Indiarubber Stamp Making.**—E. P. B. (*Penge*).—A paper on this subject will shortly appear.

**Violin Varnish.**—R. O. B. (*Edinburgh*).—Write to Mander Brothers, Wolverhampton; they will be able to supply you, or at any rate direct you to one of their agents who will do so. Several articles on violin making have appeared in the present volume.—B.

**Weights of Galvanised Iron Sheets, etc.**—OLD SUBSCRIBER.—A sheet of 24 gauge (6 ft. by 2 ft.) galvanised iron will weigh 14 lbs. or thereabouts; 22 gauge 17 lbs., and 20 gauge 19 lbs. You would not want to use much thicker than that, I suppose, though you do not state the size boat you want to build. I think you will have some difficulty in making a boat of this material. The worst thing about galvanised iron is its tendency to peel when seamed or worked, and whenever the galvanising peels off, it will soon rust. The best way is to galvanise articles after they are made, but in the case of a boat this would be rather awkward.—R. A.

**Magnetising a Clock.**—KENILWORTH.—I do not think it possible to magnetise the steel works of a clock simply by connecting the brass frame to a battery and bell, and using it as an electric time alarum. If an electro-magnet is used in or near the clock for any purpose, the steel portion of the works might become magnetised.—G. E. B.

**Electric Bell Jumpers.** — AMATEUR BELL FITTER (*Clapham*).—I confess to entire ignorance respecting "electric bell jumpers." Heat the soldering iron by any means at your disposal.—G. E. B.

**Sable Pencils, Glass Embossing, etc.** — M. T. C. C. (*Belfast*).—Prices of sable pencils (Brodie and Middleton's): lark, 5d.; crow, 7d.; duck, 9d.; goose, 11d.; extra goose, 1s. 6d.; small swan, 2s. 6d.; middle swan, 3s. 3d.; large swan, 4s. 4d. each, post free. To test a sable pencil, wet it in the mouth, put the point upon thumbnail, and twirl round; if it keeps its point it is good, if it opens or splits reject it. M. T. C. C. cannot have read my early chapters on sign writing or he would not have asked this question. I am sorry to say I cannot give any useful information on glass embossing and gilding on glass in this column; it would require several pages to do so. If the Editor thinks fit, I shall be glad to contribute some articles on the subject in the next volume.—H. L. B.

**Repairing Silver Umbrella Handles and Collars.**—H. L. (*Bradford*).—Very many of these mounts are so extremely thin that it will take a very good workman to make a decent job of repairing them. The way to set about it will be to get the mount perfectly clean, and then to solder it with silver solder. Many details on this matter can be obtained from answers in No. 46, page 732, Vol. I. of WORK, and in No. 111, page 92, Vol. III. If these answers do not make the matter clear, then write again, and give me the points on which information is particularly wanted; and also state what you know of soldering. The greatest difficulty is, I think, in getting the solder to run in the seam. Now, if that proves so, then it may be well to put pieces of silver across the seam, or else put a plate of silver on either the inside or outside to help to draw the solder across the join; but in very many cases it is simplest and cheapest to make a new mount entirely. I have not taken pewter solder into consideration, as no good workman likes to use it. If, however, it is to be used, then see that a good-sized plate is made large enough to well cover the join. And it will be better if it be made to form an ornamental addition. For example, if a hole is to he covered, a shield or lozenge-shaped piece would do. If a collar is to be added, then two lines near the edge may improve it, or it may be made into the form of a strap and buckle, etc. etc. Pewter solder is of no use by itself, whereas hard solder amply suffices for this kind of job as a rule. There is a book that gives many details of silversmiths' work. Its name is "The Silversmiths' Handbook," published at 3s. by Crosby Lockwood & Co., but it is intended for those that have already some experience in that kind of work, and would not, I think, help you much.—H. S. G.

**Overmantel.** — J. H. S. (*Romsey*).—An article describing a dressing-chest is in hand, and will shortly appear. It is one that you would have little difficulty in making after your experience with the overmantels.—D.A.

**Converted Fret Machine.**—J. L. (*Airdrie*).—Much has appeared in Vol. II. upon this subject. Consult the Index to the volume.

**Stripping Electro-plated Coats before Re-plating.** — TOMMY HEATH. — All good workmen strip off old coats of gold, silver, and nickel before re-plating the articles. Although the old coat may look smooth to the eye, it may not be firm, and we cannot he sure of the new deposit adhering firmly to the old deposit. If it is worn away in places quite smooth, those bare places expose the metal beneath, and this will form, with the coat, two elements of a galvanic pair when placed in the plating solution, the result being a loose deposit at the junction of the old coat. Again, let the old coat be worn off ever so smoothly, it will look patchy, and these patches will show distinctly in the newly-deposited coat. The few operators you saw at work at the Crystal Palace and elsewhere had not the conveniences at hand for stripping off the old coat. The operation was performed there for the amusement of the puhlic. I do not find the operation of stripping any more tedious than other parts of the necessary preparation. The whole process is fully described in "The Electro-plater's Handhook," pages 101-104.—G. E. B.

**Varnish for Bright Spokes.** — K. M. D. (*Harling*). — The best transparent varnish for bright spokes is the Silico transparent enamel, in 1s. bottles, with brush. It is put on with the brush. The best varnish for iron beds is the Club black enamel, 1s. bottles, or 12s. per gallon, wholesale; both the ahove from the Silico Enamel Company, 97, Hampstead Road, London, N.W.—A. S. P.

**Griscom Electro-motor.**—T. J. (*Warrenpoint*).—I am sorry to have to disoblige you and other readers of WORK, but really cannot see my way clear to describe and illustrate every part of a Griscom motor, in the narrow confines of "Shop," in such a way as to enable you to make one from the instructions and illustrations. This motor is most difficult to make because of its compact form, which necessitates the exercise of more than ordinary skill and patience to wind with wire, and fit with armature and commutator. There are better and even more powerful types of motors in the market, and these will receive my attention at no very distant date, when I may also have something to say about the Griscom type. The Leclanché battery is altogether unsuitable for working a motor. A book on electro-motors is in course of preparation, and will shortly be published.—G. E. B.

**Tinting Photographs.**—W. T. A. P. (*Portsea*).—There is no method of tinting photographs and opals with water-colours that can dispense with a trained knowledge of colouring and considerable practice, if the results are to be worth looking at. Procure a handbook on the subject and carefully read it; you will then see that considerable knowledge and skill are required to attain a passable proficiency. There are just the same manipulations required for these pictures as for any other. In case the photograph itself is to show and form the shadows, light tints of suitable transparent pigments may be applied. This is probably the most easy method of colouring; especially when the high lights are strengthened by the application of touches of opaque colour to impart solidity of effect. Another method formerly much in vogue was to apply powder colours to the flesh, with a suitable brush or stump, and put a flat tint of transparent colour over the drapery. To make passable pictures by this means did not require much practice; but it can he easily understood that pictures so coloured would hear no comparison with skilful water-colour painting. To give crude directions for tinting, first of all prepare the surface of the print by a wash of oxgall to receive the colour, then proceed to colour the flesh and lighter portions, finally the drapery, using a little gum in the deepest shadows.—E. D.

**Platinum Contacts.**—F. W. (*Addlestone*).—As the price of platinum has more than doubled during the last few months, and is now nearly equal to that of pure gold, you will get but a very small bit of No. 20 wire for a shilling. I therefore advise you, and other amateur readers, to use platinum foil for contact points, instead of platinum wire. A tiny piece can easily be soldered on to the tip of a screw, and will last a long time.—G. E. B.

**Pocket Accumulator.**—S. G. V.—(*Boro'*).—As I described these in my series of articles on "Model Electric Lights," I will not take up the valuable space in "Shop" by repeating the description, but must ask you to be good enough to refer to those articles.—G. E. B.

**Frame Gilding.**—G. A. H. (*Stockport*).—Smooth your frame free of dust, and give it a couple of coats of gilders' clay; when dry, brush over with gilders' oil of gold size, and let it remain for about twelve hours, when it will bc found just tacky; put your gold-leaf on with gilders' tip, and dab down with cotton wool. When dry, go over work with clear size; when this is thoroughly dry, it is ready for picture.—G. R.

**Adjustable Rebating Cutter.**—M. E. M. (*Heywood*).—The little tool mentioned in Vol. I., page 301, will do very well for cutting the rebate in an "oval picture frame, photo size."—ED.

**Ferrotype Photography.** — FELLOWS. — There are numerous one shilling handbooks published on the wet process. One by J. Wergo, of Berners Street, is perhaps as good as any. Any bookseller will supply them. The "Ferrotype" process only

differs from the glass process in respect of the material on which the collodion is spread—glass in one case, and enamelled iron plate in the other. Ferrotype plates being opaque, do not require backing as glass plates do, otherwise the finishing is precisely the same.

**Wood Carving.**—"UT SPES NON FRACTA."—Unless you are by trade a wood carver, or have a thorough knowledge of the art, there is no way in which you can earn money by it, as there is little demand for any but the best work. You might refer to WORK, Vol. II., Nos. 64 and 74, and try what you can make at "chip" carving, which is the easiest form of work, but I doubt whether you would find much of an opening in that way.—M. E. R.

**Polishing and Mounting Horns.**—PIP will find directions for polishing horns in Vol. II., page 440, No. 79. As regards mounting, he might cut out an oval in 1 in. board, cover it with plush, and screw the horns upon it.—M. M.

**Labels.**—J. G. N. (*Manchester*).—You should advertise in our "Sale and Exchange" column.

**Cyclometer.**—H. C. S. (*Ipswich*).—I am practically unacquainted with the mechanism and movement of the cyclometer; further than that, it is an instrument for measuring the distance travelled by the machine. They are now greatly improved, and can be adjusted to any size of wheel. The instrument is fastened to the revolving shaft of driving wheel, and every revolution produces a click which is indicated on the face-plate similar to a gas-meter. There are numerous different makes of the instrument, and I should think that unless your correspondent is a watchmaker or a working optician, the job would be too much for him; at any rate, he would need to have one to copy, and I rather think the parts could not be procured from a maker. The instrument can be bought at prices from 17s. 6d. to £2 2s. The "Signal" cyclometer is sold at 30s., and can be had of Wilkins & Co., 66, Holborn Viaduct, London, E.C.

**Setting out Dulcimer-Blocks.**—G. A. (*Parkhead*).—I expect you have worked your stuff to the full dimensions given, and consequently your back edge, including the moulding, measures 1¼ in. I intended to convey in my paper, when giving thicknesses, those usually accepted when speaking of them. Thus, ¾ stuff is ¾ stuff less the saw mark, and this, when planed on both sides, would be not more than ⅝ in. Again, it is recommended to make the moulding from "a piece of inch stuff rounded up and divided into four lengthwise." These, when cleaned, would not be more than ⅝ in. thick, which would leave the back about 1 in. in thickness, and allow sufficient room for the top strings. However, it will be easy for you to allow ¼ in. more at top in "setting out," and this should give you ample room, and the difference divided by 20, the number of notes will not be appreciable.—R. F.

**Clock Wheels.**—WATCHMAKER.—I am sorry to say I cannot give any information how to cut out a clock wheel from sheet brass. As a rule, I believe, they are cast and then filed out to finish. When I was an apprentice I know we used to get them in blanks cast—that is, just like your drawing. We used first to well hammer them to harden, then drill a hole in the centre, turn them down to size, and make a circle width of band, allowing for teeth; then finish crossing out, and cut the teeth. I would advise you to do the same. Send to the tool shops for the sizes you require, or you could get them already cut with the teeth and ready, with a little filing at the crossings to mount; or drill a hole at each corner of the crossings, and punch out roughly with a keen chisel and finish off. I wish I could give you an idea how to make a die or stamp, but I doubt if you could make it pay unless you went in for making them wholesale, as you would require powerful machines to do what you require.—A. B. C.

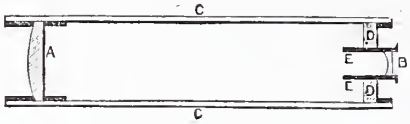
**Fixing Brass Plates.**—NAME-PLATE.—I gather from your letter that you are compelled to rivet your plates on the machines. Would not round-headed brass bolts, secured in rear or beneath, do as well as riveting? and which would look far more workmanlike. Another way would be to send the part of the machine on which the plate is riveted to the engraver, who would do his work as usual. The other alternative is to take a graver and cut out all the old spoilt wax, grind up some wax with gold size till liquid enough to run freely, fill the letters, and clean off when dry with spirits of wine. You will, perhaps, gather some further information from "Engraving on Metal," which appeared in Nos. 33, 38, 43, 45, and 48, Vol. I.—N. M.

**Japanese Stencils.**—M. S. (*Todmorden*).—I tried at the chief shops for Japanese stencils in vain; they were all out of them. Should I succeed in finding the address of a salesman, I will let you know in the pages of WORK. To cut them accurately would be less easy than to trace a design on your enamel (with carbonic paper) and paint it neatly by hand; so that unless you can come across the real thing, I fear you must be content to wait. If the Editor of WORK has room for them I would allow him to reproduce some I have belonging to me.—E. B. S.

**Chemicals for Portraits.**—J. D. (*Bethnal Green*).—Your best plan would be to purchase some elementary work on photography—say Burton's "Photography for Beginners" (1s.). You would then see what chemicals would be required. Any photographic chemist or dealer would supply you with reliable materials. The book can, of course, be obtained from any bookseller.—D.

**Camera.**—PHOTO.—Any photographic material dealer will supply your wants. A camera for ferrotypes would be fitted with what is termed a wet plate dark slide. The size is quarter plate, and the price varies, according to the quality, from 30s. upwards. A second-hand one could be bought at very much less. We do not make a custom of recommending any particular firms. The advertisement sheets of any photographic publication contain numerous addresses where all you require is supplied.—D.

**Telescope.**—W. M. (*Honiton*).—You will find very considerable difficulty in making a telescope "about 6 in. when closed"—that is, if you mean one having three or four draw-tubes. The difficulty would lie, not in the selection and arrangement of the lenses, but in the lathe-work connected with the tubes. I think I am right in assuming that you have not a lathe, but even if you have one, and can use it, you will learn more of the tube making and fitting by five minutes' examination of an ordinary pocket telescope than you would gain from a column of detailed instructions here. You say, "I do not want to make an expensive telescope; I want to see a good distance, and to be able to say that I made it myself." The latter is a very commendable desire, and you had, perhaps, best start to satisfy it by trying to make the least expensive and most simple form of all telescopes, the only form of instrument which, without sliding tubes, can be contained in 6 in. This form is called the "Galilean telescope." For its construction you will want two lenses. A plano-convex, say, 1⅝ in. in diameter




**Telescope.—A, Object Glass; B, Eye Glass; C, C, Tube (Brass or Paper); D, D, Disc of Wood bored to take the Small Sliding Eye Tube, E, E.**

and 6 in. in focus (the object glass), and a plano-concave, say, ½ in. in focal length. These should be arranged as in diagram: the one at a distance of about 6 in. from the other. The magnifying power will be 12, and is found by dividing the focal length of the object glass by the focal length of the eye glass—that is, $\frac{6}{\frac{1}{2}} = 6 \times 2 = 12$. You can increase the power either by obtaining an object glass of greater, or an eye glass of less, focal length. The cost of the two lenses necessary should not be more than a couple of shillings, if you use the common lenses. Of course, if you get achromatic lenses you will have to pay more. Your letter is in very general terms; and that is why I cannot definitely answer you. Will those readers of WORK who send telescope queries remember that the more information they give me the better information I can give them? They need not be afraid of making their letters too long.—E. A. F.

**Bending Brass Treads.**—P. D. (*Liverpool*).—I am not aware of any machine made specially for bending these step plates, or treads, as they are termed in the trade, but I can tell you a very simple way to do it, without anything but home-made appliances. Supposing that you have a bench with its front edge quite flat and true; then get a piece of wood cut out the thickness of the step that the plates are for, have one edge of it rounded off to what you want, and let it be about 3 in. longer than you want the treads to be. Bore two ⅛ in. holes an inch from each end, and screw it to the bench with two coach screws; bore two

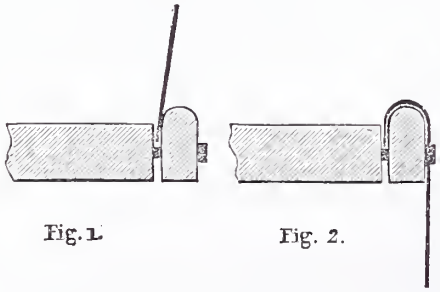


Fig. 1. Fig. 2.

**Bending Brass Treads. Fig. 1.—Section of Arrangement for bending Brass Plates. Fig. 2.—Showing Plate bent.**

smaller holes an inch away from the bolt-holes, and tack into the bench two wire nails for the brass to rest on as you slip it between the block of wood and the bench. These must be adjusted so as to give the right amount of turn under to the tread. The *modus operandi* will then be as follows:—Slip a plate of brass between the block and the bench; screw the coach screws tight, and bend down with both hands; undo the screws and take out. Half a turn of the screws will be sufficient to tighten and loosen the plates, and I think you will find it answer very well. Figs. 1 and 2 will still more plainly show what I mean. Of course, this will not remove dents; but I think you will find it a saving of time against the rollers, besides getting every plate exactly alike.—R. A.

**Patent.**—J. K.—I do not see anything in this to sustain a patent, nor do I think it would be upheld on a trial. There are some disadvantages. For instance, I do not see what is to hinder the sewer gas from flowing out through fresh air inlet. Also, should any pressure occur, the gas will be forced into the houses sooner than into the street.—F. C.

**Fret-saw for Lathe.**—S. P. (*Penarth*).—Where can you and your friends have lived if they don't know of the numerous "rigs" for fret-sawing on the lathe? You don't say whether you wish to buy or make one. You can buy one from the Britannia Company, Colchester, but it is an easy thing to make, and can be done in many different ways. I think your first step might be to get some of the catalogues published by dealers in fretwork materials, as besides the prices you would see many illustrations of tools, etc., from which you could gain new ideas. For instance, write to Messrs. Harger, of Settle, Yorks, sending six stamps; or to Messrs. Churchill, Cross Street, Finsbury, E.C., and enclose twelve stamps; you will get a delightful picture-book, richly worth the money, containing hundreds of illustrations of new American tools, etc. You can certainly utilise your brass face-plate by screwing a ¼ in. steel pin into it about ½ in. from the centre to drive the lower arm of the saw; but take a good look round first, and see what others have done, is the advice of F. A. M.

**Paint or Enamel.**—ANCONA.—There is no article of the above nature that will resist the continual action of soap or similar alkaline natures. "Bath varnish," which is specially made for re-painting, etc., insides of house-baths, is the most durable article you can use, without, as you remark, the firing process. If you use this for finishing your painting on tin surface, mix your paint itself with three parts of turps to one of bath varnish only—no oil or other driers—and then, when finished, leave it to harden as long as possible. For using on grained work, get "fine copal oak varnish." This will do for all ordinary purposes, excepting floors or furniture that is *sat upon*, for which "hard-drying" or "church oak" is required. Varnish should never be tampered with, especially by the novice. Adding oil will ruin it.—F. P.

**Dry Point Work.**—J. H. (*Bacup*).—The process alluded to in the photographic advertisement you sent, and which is termed "dry point work," is a method of working up enlargements. It is done by a needle-point brush, and consists of fine dots. There is one apostle, though I forget his name, who turns out splendid work, but he stands alone. The others are not, as a rule, very good hands.—F. P.

**Medium for Tile Painting.**—KILN BURNER.—"Fat oil" of turpentine is the most serviceable and least expensive of the various mediums used for china and tile painting. Other oils, possessing naturally the same qualities as the above product, are oil of aniseed, oil of tar, and oil of lavender. These necessary qualities are: First, that the medium should not "set" until sufficient time for manipulating the colour is given; secondly, that they shall be of a nature such as the firing process can properly carry away or disperse. The greater portion of tile painting—treating the art from the unprofessional aspect—is executed upon china or *glazed* tiles, and not upon "biscuit," as you desire. With the former, the firing can be done without much risk or trouble; but when it comes to *glazing* and firing the painting, you will agree that the process requires the convenience of a pottery works. The district from which you write suggests that you are able to command this latter aid, and as I presume you have some object in painting on "biscuit" direct, I therefore aid you as far as I can. Now, respecting the "tube colours," are they made for the purpose?—viz., kiln work. If not, then don't suppose you will do any good with them, since only such pigments as are *chemically* adapted for firing must be used. Assuming they are the right pigments, "fat oil" cannot be bettered, so far as I am aware, for the medium. Fat oil of turpentine can be made by exposing a little ordinary commercial oil of turpentine ("turps") in an open vessel and to an atmosphere both warm and dry. The fatness arises from the bulk of the "volatile" element or "spirit" evaporating, and leaving behind the resinous part of its nature. A table-spoonful may be exposed in a saucer—as in such a vessel it is largely exposed to the oxidising action of the air—until it thickens and diffuses itself all over the vessel. If the latter is stood in a second saucer, nothing is wasted, and there is least "mess." When once "fattiness" is obtained, the property is readily communicated to the fresh turps added thereto as the former is gradually required. Fresh turps is used to thin and spread the colour with after the pigment has been worked into a stiff paste with fat oil alone. Tile painting may also be done in water-colour by adding a little dissolved sugar to the *dry* prepared colours, using just sufficient to prevent the work from dusting off. Tile and china painting is not, as you are doubtless aware, a matter within the province of "Shop" to more than touch upon. It is an art, a difficult professional art, requiring knowledge of chemical properties as well as artistic ability and experience. I fancy it is your tube colours that are all wrong in chemical nature.—LONDON DECORATOR.

**Printing on Tin.**—CURIOUS.—A reply was given to this query in quite an early number of WORK, recommending the querist to inspect the various patent specifications relating to the decoration of tin plates; but it has occurred to the writer that every town does not present the same facilities for search as the one in which the writer is at present residing; he, therefore, gives an extract from the complete specifications, Nos. 13738 and 14321, 1887 (No. 14321 was completed 1st February, 1888), of a Mr. Rees, "for decorating or printing tin plates and other sheets," as follows:—"The object of my invention is to produce a simple and very efficient means for, and method of, decorating or printing on tin plates and other sheets, which shall have many excellences over the usual methods, especially in the results obtained and in the speed and economy of material and labour with which the operation is effected. In the ordinary methods of decorating and printing on tin plates and other sheets, as at the present system usually employed, the following evils are generally experienced: In the direct system the two hard surfaces of the tin plate or sheet and the stone or other printing block are brought into direct contact, whereby one or the other is very quickly damaged, and therefore, although this is the speediest method, the expense caused by this injury is so great that the most common method is the transfer system. In the transfer system, on the other hand, the impression is oftentimes spoilt by the necessary subsequent operation of removing the paper or other transferring material, which also is wasted after being once used, and fresh paper or material has to be prepared for each impression, whereby also increased expense is incurred; and when this system is employed, the tin plate or sheet has to be coated with a film of transfer varnish, by which the lustre of the tin plate is diminished. By this invention these and other evils are obviated and removed, and the operation is, or may be, effected as quickly as by the direct system, without injury to the tin plate or sheet and the stone or block, while the increased labour and expense of the transfer system are saved, the results are improved, and there is no danger that the impression will afterwards be spoilt in the manner as aforesaid. To carry out this object, and to perform my invention, I take a piece of millboard, cardboard, or other similar material, preferably a hard-rolled and glazed millboard, or it may be a metal or wooden plate, of the required size and shape for the tin plate that is to be decorated or printed; and when made of millboard or other material that requires treatment to render it waterproof, I rub the same with hydrocarbon oil, which, if required, may hold in solution paraffin wax or other similar substance; and on the board or plate before mentioned I secure a piece of varnished cloth or canvas, or vellum, or parchment, or skin, or other material having an impervious surface, preferably leather cloth or oil haize, which covers the board or plate either wholly or in part, in accordance with the design, pattern, or lettering to be printed, and the surface of this material is then, in any convenient manner, made perfectly smooth and level, and is treated with hydrocarbon oil or turpentine, or a mixture of the same, in such wise that a thin film covers the entire surface of the material, or so much of the same as will receive the design or pattern or lettering, the surplus oil or turpentine or mixture, if any, being removed. The required design, pattern, or lettering is created in the usual manner upon a stone or metal plate, or on a wood block or other ordinary material, and is inked over as is customary, and the aforesaid prepared surface of the board or plate is pressed thereon in any usual manner, taking off the impression. The so-treated surface of the board or plate is then similarly pressed on the surface of the tin plate or other sheet that is to be decorated, and the design, pattern, or lettering is properly imprinted thereon, being taken off the prepared surface of the board or plate, which is then lightly rubbed over with fresh hydrocarbon oil or turpentine or a mixture of both to ensure that the aforesaid film is duly in position, and is ready to take another impression from the stone or other printing block, which, if required, has again to be inked, and to transfer this impression in the same manner to the same or to another tin plate or other sheet. To save time and labour and expense in thus decorating or printing on the tin plates or other sheets, I preferably form the prepared surface as before described on both sides of the board or plate, and when one of these surfaces has been pressed as aforesaid, and the stone or other printing block having (if required) been again inked, the other prepared surface of the board or plate is pressed thereto, and the tin plate or other sheet is placed on the treated surface of the board or plate, and on pressure being applied in any usual manner the tin plate is properly decorated or printed or lettered as before described, while at the same time the other prepared surface of the board or plate receives the impression from the stone or other printing block. The tin plate or other sheet is then removed; this so-exposed prepared surface of the board or plate is treated as before described with fresh hydrocarbon oil, or turpentine, or a mixture of the same, and the board or plate is again reversed in position on the stone or other printing block, and the aforesaid procedure is repeated, and so on. In the same manner two or more colours can be worked into the same design or pattern or lettering, in, and by, the usual course of procedure, care, of course, being taken that the several parts are always placed in the same positions in respect of each other by using any of the ordinary registering appliances. It is obvious that this invention can be used and performed as before described, in any of the usual machines, such, for example, as the ordinary hand-working lithographic press, or the ordinary lithographic machine with cylinders or rollers, or otherwise."—N. M.

**Sundial.**—TIMA asks for a method of calculating the various angles of the hour lines with the meridian line for a sundial lat. N. 53° 36'. Also whether the same angles are gone over in each hour in all seasons. I will answer the last question first. There are but four days in the year when the sun casts its shadow correct with a good clock. The sun as a timekeeper is exceedingly irregular, though its irregularities are absolutely regular. This arises from the fact that the earth's equator is not coincident with the plane of its orbit round the sun. Any almanac will give clock fast or slow with the sun to show correct time. Suppose the almanac shows clock fast 15', then when the shadow of the style falls, say, on the four o'clock line, the true time is 4.15, and so on. First of all, we must make our gnomon. The elevation of the

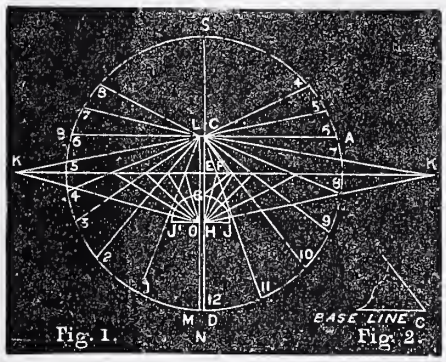
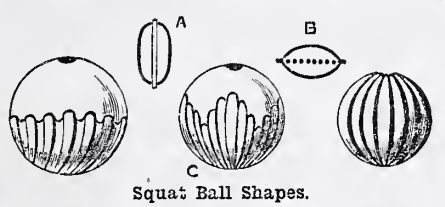


Fig. 1. Fig. 2.

Sundial.

gnomon must be of the same angle as the latitude of the place for which it is intended—that is to say, the edge which casts the shadow must be coincident with the polar axis of the earth. To mark off the angles, draw a straight line, C D; perpendicular to this draw A B. Draw an angle, E C F, equal to the latitude of the place, 53° 36'. Cut this angle by the line K K—the precise position is of no consequence—and make the same angle, E F G. Measure the distance from E to F, and mark off the same from G to H. Place the point of the compass at H, and strike a quadrant from G to J. Divide the distance from G to J into six equal parts. From the point H draw lines cutting those divisions on to the line K K. Now from the point C draw lines to cut through K, intersecting the lines previously made. Line A is six o'clock, K is seven, and so on to eleven, the line C D being noon. Measure the exact thickness of the gnomon, and equal to that draw the line L M, and from that lines corresponding to those already made must be drawn. Carry the lines seven and eight a.m. through the centre, and we shall have our seven and eight hours p.m., and carry the five and four p.m. lines through the centre, and we shall get the five and four a.m. lines. The point of the gnomon, C, Fig. 2, must be placed at C on the lines L and C. If TIMA does not know how to find the angle of the gnomon, or the true meridian of the place where he intends his dial to be fixed, I shall be happy to give him the needed information.—O. B.

**Squat Ball Making.**—NO NAME.—I am sorry your inquiry respecting mill, etc., was delayed. The weight of the mill is 150 lbs., and 20 in. in diameter. I would have sent working drawing, but as the mill is the only one in use, as far as I am aware, it will become the subject of a patent. The delay has been caused by my desire to find a manufacturer of fancy balls in Birmingham, as I understood they were made there; but I have not found one. In Sheffield, Messrs. Tucker and Sons, York Street; Messrs. W. Gallimore and Co., and Messrs. J. J. Maxfields, Arundell Street; Messrs. Pearson and Co., and Messrs. Oates and Co., Rockingham Street,




Squat Ball Shapes.

are agents for them. The fancy balls are made almost round, and then put into a hydraulic press, under dies which, having the flutes or ornamental parts cut in them, are forced into the balls to form the ornaments as shown at C. The squat balls and balls with flanges are made the same way as round ones. To make this shape, edges are not trimmed off, but pressed in two halves and soldered, as at A. These edges are used for turning a bead on the ball as shown at B. The balls are manufactured chiefly in France and the United States of America. The cost of the machines varies from £100 to £300: they are made by Messrs. Bliss & Co., Brooklyn, New York.—B. W. R.

**Marbling.**—HAMMER-CHEWER.—If you can afford about a couple of guineas for six good hand-painted specimens, write Mr. W. G. Sutherland, 15, St. Ann Street, Manchester, and mention WORK as your source of advice.—LONDON DECORATOR.

**Patterns for Turning.**—A. H. J. (*Norwich*).—Mr. Fritz Collins, Summerhays Place, Bath, did supply, and probably still supplies, sheets of patterns for this purpose; but I cannot, of course, say whether they would be such as would suit your taste.—M. M.

**Hot-air Engine.**—J. R. (*Liverpool*).—It would probably take too much room to give directions for making a hot-air engine in the "Shop" columns, but you can get information on the subject in Nos. 1,154, 1,156, 1,088, of the *English Mechanic*. The first contains a drawing by Mr. Seal, which was followed, but failed to work well owing, I think, to the air displaced being too small in comparison with the working cylinder; I think the displacer should move through three or four times the cubic inches that the working piston does. The last number, 1,088, contains a section of Robinson's hot-air engine.—F. A. M.

**Wimshurst Machine.** — W. A. (*Bury St. Edmunds*).—(1) Thin sheet brass will serve equally as well as, if not better than, tinfoil for the sectors of a Wimshurst machine. They need not be lacquered. (2) The brass wire used in making scratch-brushes would be much too rough for the collector brushes, and would, as you say, scratch the sectors and render them useless. The best material for brushes is "yellow warp twist," sold by lacemen at about 8s. or 9s. per lb. This is made of fine electro-brassed copper wire, flattened to form a ribbon, and twisted around a thread of cotton, then several of these threads are twisted together to form a loose cord. A small bunch of these cords forms an excellent brush for a Wimshurst machine. If you experience any difficulty in getting this material, write to Messrs. Bonney & Co., 19, Avenue Road, Lewisham, S.E. They are connected with the trade, and will get you the twist at a reasonable cost.—G. E. B.

**Polishing Bullocks' Horns.**—J. M. (*Sutton-on-Hull*).—If they are at all rough, the roughness must be got rid of by rubbing with rather fine glass-paper, and then by scraping with a sharp steel tool, such as a razor, or else with a piece of glass. The actual polishing is done after this by some cutting powder—such as Trent sand and water or powdered pumice and water—applied by means of cloths, until quite a smooth, regular surface is obtained. After removing all particles of this coarse powder, we next try a finer one, such as powdered charcoal or very fine brickdust; both of these with water, and on some pad or bob made of cloth, to allow of a great amount of friction being used with them. To finish and obtain a bright surface, the horns should be washed quite clean; and then washed chalk or very fine whiting can be applied, as before, on a cloth pad. This can be moistened advantageously with some very weak acid—vinegar will do—and a final finish can be given with some dry whiting applied by the palm of the hand. It is not the materials so much as the friction that is essential in obtaining a good polish.—H. S. G.

**Combined Knife and Spoon.**—J. H. (*Uxbridge*).—We cannot advertise your article in WORK free of cost. You must be prepared to pay for gaining publicity for your invention. If it is a good thing you would do well to consider the patenting of it.

**Kaleidoscope.**—R. W. I. L. (*Gawler, South Australia*).—I have forwarded a second letter (registered) to your address, seeing that the first had failed to reach you.—T. R.

**Sauce.**—ONE IN A FIX.—Questions concerning sauces, pickles, or condiments, do not come within the scope of WORK. You cannot do better than refer your question to the Editor of *Cassell's Saturday Journal*.

**Applied Mechanics.**—R. R. (*Dumbarton*).—You cannot do better than purchase "Applied Mechanics," by Sir R. S. Ball (Cassell & Co., London, E.C.), price 2s.

**Ebony Stain.**—A. C. (*Leicester*).—Your query has been fully answered since your letter was written, under "Ebony Stain," in "Shop," p. 332, No. 125, which please read.—LIFEBOAT.

**French Polish.**—T. F. (*Willington on-Tyne*).—As regards your sideboard, we can only surmise that you wished to stain it in imitation of walnut; or why use vandyke brown? for in getting it nearly black you must have been very lavish in its use. A too lavish use of stains generally gives to the articles thus treated a painted rather than a stained appearance. It is always best, in staining, to build up the colour gradually. Two coats of weak stain will be found far better than one strong coat; and it is always better to try their effects on odd pieces of wood previous to using on the finished article. Had this precaution been taken, it would have saved you much trouble, for we regret to say it will *not* be possible to make your sideboard lighter coloured without removing the varnish. Which kind you used, by the way, you did not tell

us. For hints "How to remove French polish or varnish," please refer to "Shop," p. 188, No. 116. If, however, you decide to make the best of a bad job, the varnish can be French polished on if the precantion be taken to make it smooth with fine glass-paper, taking care not to rub the stain off the sharp edges when working on the carvings and mouldings. If, when "bodying up," you still find the colour hold out dark, you may give to the whole a richer appearance by using red polish, made by adding a few drops of red stain—which is made by dissolving two-pennyworth of bismarck brown in a quarter of a pint of methylated spirits. Your sideboard, if made true to the design, would look remarkably well thus finished. It may be that you have been misled by these so-called browns. Bismarck brown gives a rich red colour, while, as yon know, vandyke varies from brown to nearly black. We hope these hints will be of use to you, and help you out of your difficulty. If not, write again.—LIFEBOAT.

**Tools.**—GRANITE.—Both S. J. Addis and J. B. Addis & Sons are known as makers of *first-rate* carvers' tools. Unless GRANITE wishes to buy in large quantities, it will be better to get the tools through the nearest tool dealer, any of whom will supply Addis's tools. Nurse & Co., who advertise in WORK, pnblish a catalogue which contains a list of carving tools, tabulated as Addis's tools are numbered. Melhuish also does the same. As to the other maker, GRANITE will perceive that these answers should be so framed as to benefit other readers as well as the querist, and should not depreciate any tool maker in comparison with others. That being so, I can only say that I have not chanced to try any gouges by Greaves, but that I have had chisels and plane irons by that maker, and that they have been of excellent quality.—B. A. B.

**Organ Pipes.**—E. A. P. (*Beckenham*).—It has already been pointed out (col. 1, p. 382, No. 128) that the statement that the 16 ft. tone can be obtained from a 4 ft. pipe is a slip. You can reduce the height of your organ in several ways: (1) by planting some of the largest pipes on the floor; (2) by

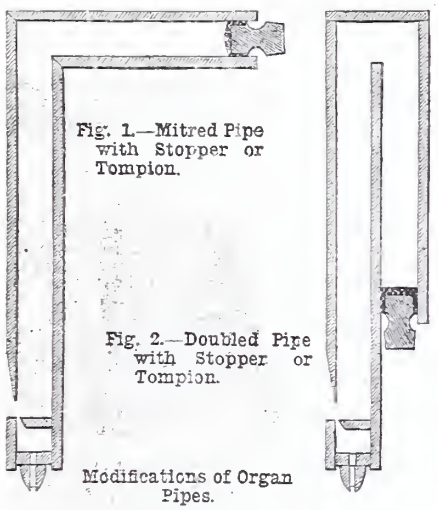


Fig. 1.—Mitred Pipe with Stopper or Tompion.

Fig. 2.—Doubled Pipe with Stopper or Tompion.

Modifications of Organ Pipes.

laying them horizontally at the back of the instrument; (3) by mitreing some of the largest pipes; or (4) by doubling them. I annex a sketch showing the last two items. So long as you obtain the length and diameters of the pipe, it does not matter whether the pipe is straight or not. Indeed, bonrdon pipes are often improved by being mitred. Both open and stopped pipes can be treated in these ways for the purpose of redncing their height.—M. W.

**Machines for Blowing Organs.**—J. A. G. (*Southport*).—There are motors made to work by electricity, and others by gas; bnt I am unable to state the initial cost or the cost per hour of working. Inqnire of the small engine makers in the London Directory.—M. W.

**Bicycle Chains.**—H. H. C. (*Yeovil*).—I am not aware of any chain being made small enough for a model tricycle. Information on the subject can be had of the following firms (chain makers): Brown Bros., 7, Great Eastern Street, London, E.C.; Perry and Co., Limited, Birmingham; F. Brampton & Co., Oliver Street, Birmingham. If H. H. C. can make a model tricycle, it should not be difficult to make the chain any size he wants. He has only to make a punch in the shape of each link, to cut the links from a bit of sheet brass, then get a bit of very fine brass tube, say, ⅛ in. out, and cut in lengths for the rollers.—A. S. P.

**Safety Bicycle.**—CYCLE.—(1) Messrs. Cassell and Co. will snpply back numbers of WORK, containing cycle-building papers, four of which are now pnblished. (2) W.S. tubes in large quantities from Herbert & Hubbard, Coventry, and Credenday (tube makers), Birmingham. Tubes, small quantity cut to length, of St. George's Cycle Co., Upper Street, Islington, London; Brown Brothers, 7, Great Eastern Street; and others. (3) The best enamel I know of to pnt on with a brush without stoving is the club black, hard-drying enamel, sold in all cycle shops in 1s. bottles; got in large quantity of the Silver Enamel Co., 97, Hampstead Road, London.—A. S. P.

**Boiler Feed.**—INNEK.—In place of a force pump an overhead boiler feed may be used, but the tank must be at a sufficient height to resist the pressure of steam, which would otherwise drive the water out of the boiler up into the tank. To find the necessary height of tank in feet above the boiler, multiply the gauge pressure of steam in pounds per square inch by 2¾. Thus, if you have fifteen pounds pressure in the boiler, the feed tank must be 15 × 2¾ = 35 ft. above it. You may, instead, feed your boiler by a small injector. These are now sold by model makers.—F. C.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Stick Handles.**—APPRENTICE writes:—"Will anyone give me information on the mixture of imitation silver for making stick handles? the cost of same, etc., being a consideration."

**Black Varnish.**—T. L. (*Chew Magna*) writes:—"Will any reader of WORK kindly inform CARADOC the ingredients used, and their proper quantities, for making black varnish suitable for ironwork, etc.?"

**Inlaid Oval Table Top.**—A. E. (*Wandsworth*) writes:—"I have a mahogany table (round) diameter 2 ft. 9 in. I want to make a movable *deal oval shape top* for same, and would be glad of any advice in 'Shop,' particularly about the thickness of wood, how to find dimensions, joining, fixing the top easily and firmly, also what the exact length of the oval would be if the narrowest part is 3 ft. 6 in. Would one of the exhibitors of inlaid tables at the recent WORK Exhibition kindly give me instructions how to inlay the table top? Every time I visited the Exhibition I spent some time in admiring and examining the work both of prize and non-prize winners, but failed to find out how the wood was cnt so even, and fixed in so true. I should also be glad of a list of suitable woods, thickness, and the best place to obtain them. Should I begin to inlay work in the centre or outside? A design would be acceptable."

**Metal Plate Book.**—SHEET IRON writes:—"In No. 58 of WORK, page 94, ALIQUANDO mentions a book on metal plate work, by C. T. Millis; would he kindly give price and where pnblished?"

**Bamboo Work.**—E. C. W. (*London, E.C.*) writes:—"I should like to be informed where I could obtain small quantities of lacquered panels for bamboo work; also buttons for the ends of cane. I should also like to know whether there is a book published on bamboo work."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Lubricating Oil.**—PETER writes, in reply to F. F. M. (*Edinburgh*):—"The following is a recipe for lubricating oil for bicycles. Use one-fourth of paraffin oil to neatsfoot oil. It will work all right. Just shake up before oiling machine. I use it for my own machine."

**Mandrel for Lathes.**—H. F. (*Stratford, E.*) writes:—"I do not know what size mandrel J. T. (*Walworth*) (see page 159, Vol. II.) requires, but I snppose it is not larger than one I had made some time ago, for a 4 in. heavy metal-turning lathe, and it only cost me 15s., and was hardened cast steel. I can recommend the firm as being very moderate in their charges, and workmanship and materials A 1. The address is: Price's Manufactnring Co., 24, Randall's Market, Poplar, E."

**Wood Pulp.**—J. W. G. (*Redhill*) writes, in reply to ÆON (see page 538, Vol. II.):—"There is the Wood Pulp Company, Thetford, who make all kinds of hollow ware of the above kind."

**Punt.**—W. H. M. (*Preston*) writes, in reply to W. P. (*Cardiff*) (see page 634, Vol. II.):—"Does this correspondent require information as to making a dinghey or yacht's punt, or does he refer to a Thames punt? In either case I shall be glad to assist him on hearing further."

**Mining Engineering.**—M. (*Bishop Auckland*) writes, in reply to S. H. M. (*Liverpool*) (see page 334, No. 125):—"You should, about the age of seventeen, be articled to a mining engineer in practice for four years, and at or near the end of the term go in for the examinations which are held in various towns. You will have to pay a preminm, and will not receive any pay during the time you are serving your articles. You can go in for one branch of mining only, but it is better to know all. If you had given more definite particulars, I would have been better able to advise you."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, npon which there is great pressure:—W. B. (*York*); T. S. (*Liverpool*); J. R. (*York*); G. F. C. (*Hastings*); RUNNER; J. S. A. (*Lancashire*); BRIEF; M. P. B. (*Finsbury*); T. B. (*Islington, N.*); R. M. (*Glasgow*); CONSTANT READER (OF "WORK:" J. P. (*Hollinwood*); T. W. (*Kendal*); J. H. (*Glasgow*); J. G. (*Glasgow*); ROB ROY; H. W. (*Southampton*); CYMRO; H. F. (*Rye*); M. N. (*Rochampton*); H. T. H. P. (*Hull*); C. V. (*Bath*); T. & E. (*Blackburn*); A. R. (*Manor Park*); CHARLES; G. W. (*Bournemouth*); H. L. G. (*Edinburgh*); TELYN; A. B. (*Renton*); M. D. C. (*Liverpool*); GUARD; F. M. (*Wotton*); AXLE; H. S. A. (*Wolverhampton*); W. R. (*Cressington*); J. R. M. (*Liverpool*); J. R. (*Skerries*); F. T. (*Liverpool*); SOLOER; F. R. (*Sunderland*); F.S. (*Harlesden, N.W.*); J. M. (*Liverpool*); T. C. C. S. (*Liverpool*); J. T. (*Biggleswade*); J. W. C. (*Tavistock*); H. J. M. (*Bristol*); BUTTON; E. S. F. (*Charlton*); R. F. (*Newcastle*); M. P. B.; HARROWGATE; LIGHT; J. D. (*Hull*); E. J. T. (*Lancaster*); W. W. (*Manchester*); J. M. (*Parkstone*); H. (*Tunbridge*); T. M. (*Walton-on-Thames*); D. B. B. (*Glasgow*); S. C. (*Ashton-under-Lyne*); H. H. (*Ashbourne*); C. F. (*South Shields*); C. L. H. (*Reading*); A. T. (*Burnley*).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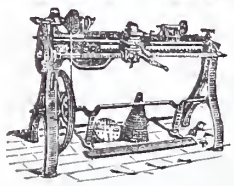

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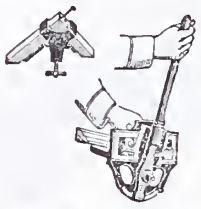

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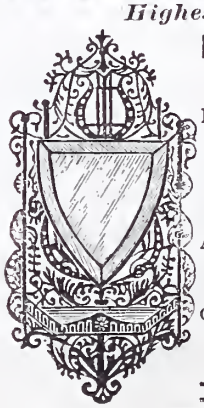

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 133.] SATURDAY, OCTOBER 3, 1891. [PRICE ONE PENNY.

### MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

INTRODUCTORY REMARKS—MY HOUSE AS I FOUND IT—A WHITEWASHED KITCHEN AS A SNUGGERY—MAKING MY STUDY—THE FIREPLACE.

*Introductory Remarks.*—Of that estimable class of persons to which the writer, in common, probably, with many of the readers of WORK, belongs—those, namely, who have more taste and skill than money—the great majority have to live in something very different from what they would picture as "ideal homes." The ordinary dwellings of those who have to work for their bread are, as a rule, unsightly and uninteresting. Effectual shelters from the elements they may be, but in other respects they are mere makeshifts.

Now I wish to show how we, who have taste and ingenuity, may do much to improve matters (so far as our own homes are concerned) without money. We, the readers of WORK, are not helpless beings. We know how to use our hands in many ways, and in various arts and crafts are independent of paid help. From my own experience I propose to give some hints to those who have the will and the ability for this kind of work, but may not see exactly how to set about it.

I propose to describe and illustrate some of the changes that I have myself made in a most unpromising house. I do not suppose that any reader can follow exactly in my steps, ugly houses being of so many different sizes and patterns; but I trust he will find what I have to say suggestive, and that he may be able to adopt and improve upon my plans. Also, that I may be of as much practical use as possible, I hope to point out alternative methods when such seem likely to be of more general service than those adopted by myself.

Before I bring these preliminary remarks to a close, there are certain points to which I should especially wish to call attention. They are, that from first to last I had, for imperative reasons, to carry out my work on the most economical lines; that, with some few trifling exceptions, all that was done was done with my own pair of hands, and

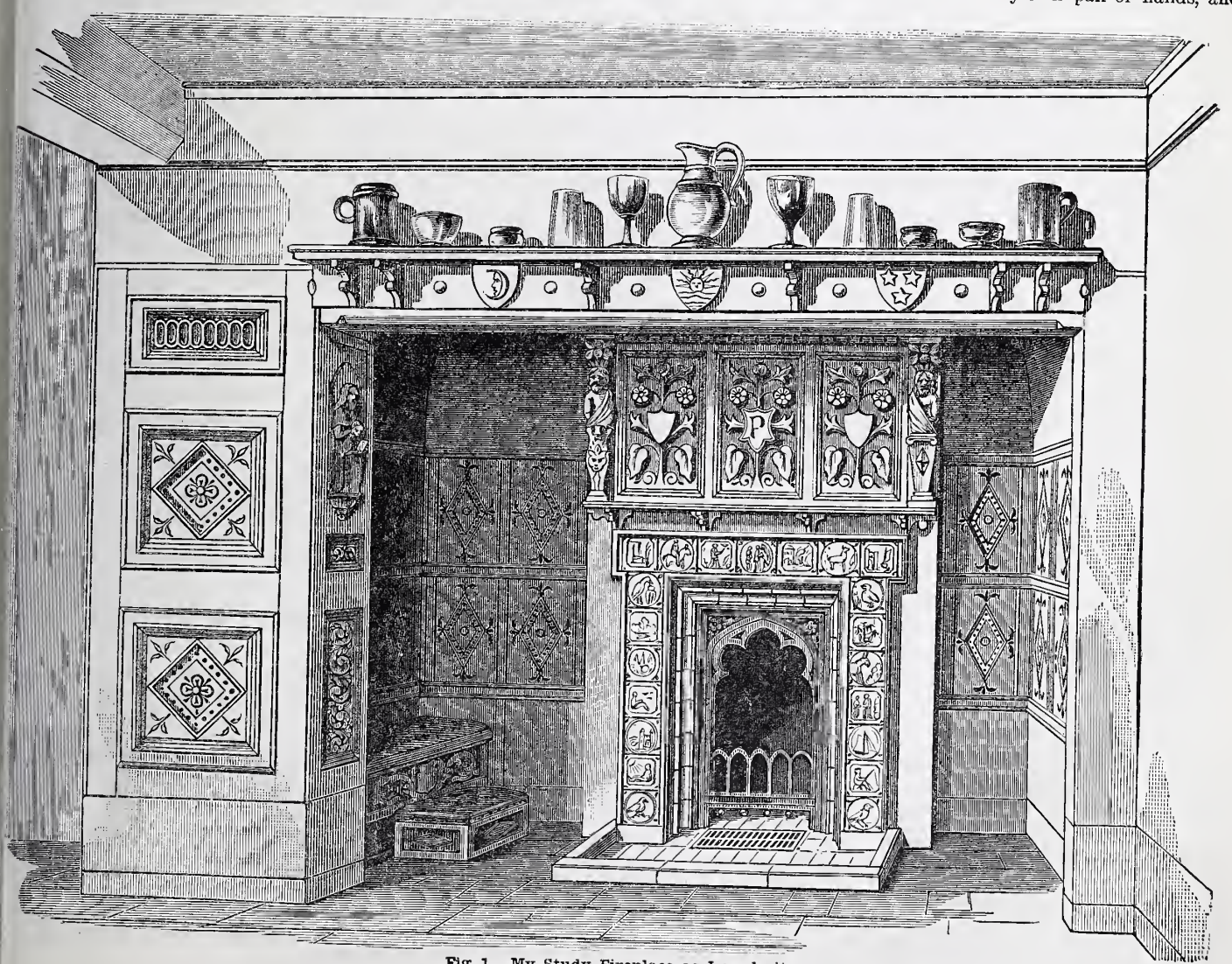


Fig. 1.—My Study Fireplace as I made it.

that what I accomplished was not the amusement of a life of leisure, but the occupation of the evenings and odd times of days spent in that toil for daily bread which falls to the lot of most of us. I particularly mention these things for the encouragement of those fellow-workers who, in respect to the gifts of fortune, may not be better situated than myself.

*My House as I found It.*—That house which has been the scene of my labours, and which came into my hands some few years since, is in a country village, and probably was once a farmhouse. It is an old stone building, with low ceilings, and though the principal windows seem once to have had good stone mullions, these have long since been knocked away to give place to mean wooden frames. When I entered upon it I found the walls, where not whitewashed, covered with cheap and tawdry papers, and the woodwork throughout painted of a uniform and dismal drab. When I mention that its rateable value was estimated at ten guineas *per annum*, I shall enable the reader more clearly to realise what manner of house it was.

I must admit that it was not what would generally be considered an attractive residence. Such of my friends as I carried to see it in its pristine state wondered at my choice, and one or two of the more intimate told me candidly that I should never be able to make anything of it.

But I was not disheartened. I gave my friends to understand that my house had one point in its favour which they had not taken into account—namely, that it was so utterly bad as to have no part on which I should fear to make experiments or fear to spoil, and it was therefore the right sort of subject to take in hand. In short, it was my private belief that there could be no house so hopeless but that its inmate might, by judgment and perseverance, make it a thing of interest and beauty. The reader shall judge whether in the case in hand I was in the right.

*A Whitewashed Kitchen as a Snuggery.*—On the ground floor of my house was one room into which my friends looked with more than the usual amount of despair on their faces: it was that which I had selected for my especial den and sanctum. Its size was 18 ft. by 12 ft. On one side a door led to it from the modest entrance hall, and on the other a second door opened from it to the garden. It was lighted by a single window of no great size at one end. Across the middle of its ceiling ran a heavy wooden beam. The bare, whitewashed walls had neither cornice nor skirting-board. It had a large, open fireplace some 7 ft. wide, which projected three or four feet into the room. It appeared to have been used as some sort of kitchen (though not needed as such, there being a sufficient kitchen elsewhere), for, in place of the old flat hearth, a kitchen range had been introduced. One good feature only could my friends see in this room—it had a really fine old oaken floor.

*Making my Study—the Fireplace.*—It was on the fireplace that I began work. To find a substitute for the kitchen range, I hunted through the old stock of an ironmonger, and for 5s. 6d. bought that grate, of the fashion of forty years since, which appears in Fig. 1. In the days when it was made people had not learned that a room is best warmed by a fire near the floor level, and this grate was intended to be perched six inches higher than met my approval. I therefore caused my mason to bury the lower part beneath the level of the floor. And here I should state that, though I employed a mason to set this grate and the bricks and tiles around it, this was the one and only instance in which any paid workman entered the room.

The reader, as he looks at Fig. 1, may think the arrangement of my grate eccentric. Immediately surrounding it is a course of moulded bricks, which scarcely cost me more than bricks of ordinary shape would have done, but these lead very well to the course of tiles which succeeds them. Mine are old Dutch tiles; I got them from builders who had saved them from the wreckage of ancient houses. Some of them were not thought worth making a charge for, others cost me twopence or threepence each—2s. 6d. in all. But, being genuine old things, they have more interest than costly new Minton tiles could have. As ornaments for the hearth, such tiles, made chiefly at Delft, in Holland, seem to have been introduced to this country about the time of "Dutch William," and they were largely imported during the reign of the first George.

The overhanging of the two end tiles of the top row was a matter of necessity; the alternative lay between that arrangement and cutting a tile in two, but I think it will be admitted that I have so dealt with this difficulty as to make it rather add to the effect than otherwise.

I must also call attention to my fender of stone curbing. This cost me nothing. It is made of waste strips of Portland stone, which I looked out in a mason's yard and had for fetching away. I trimmed off their edges and dowelled and cemented them in place myself. Of the woodwork of my fireplace I must speak in my next paper.

## A WORKSHOP GRINDSTONE.

BY ELECTRON.

MOUNTING CONVENIENT FOR ORDINARY ROOM—FRAME, HOW MADE—AXLE—GRINDSTONE—FIXING GRINDSTONE—CAST-IRON BEARINGS—DRIVING-WHEEL AND AXLE—BEARINGS—CRANK—TREADLE—CONNECTING-ROD—SCREWING DOWN FRAME—LEATHER BELT—TRUING GRINDSTONE.

ANYONE having a workshop in an attic, or other room where it is not convenient to have a grindstone, must have felt the want (especially when working at night) of some means of grinding any special tool. The grindstone about to be described may be set in any room, and will be found very useful. A grindstone is sometimes made to fix between the centres of a lathe for any small work, but it is not always convenient to remove work from the lathe to fix the grindstone; and the wet and dirt from a grindstone are liable to spoil a good lathe.

Fig. 1 is a side view of grindstone, to a scale of 1½ in. to the foot. The frame is of wood, 2 ft. 8 in. high. The rails may be any size: 1½ in. by 1 in. will be suitable. They must be made as shown, mortised, glued, and pinned together. Make two frames, equal in size, and fix them 6 in. apart by four rails, which may also be mortised; also fix under each cross-rail a ⅜ in. bolt, passing through both frames, and screwed up with a nut; this will secure them firmly together. Next prepare an axle for grindstone of wrought iron, 8 in. long. The grindstone should be 3 in. or 4 in. in diameter, and if the hole in it be 1 in. square, the thickest part of axle should be forged 1⅛ in. in diameter. A collar must be formed in the centre, about ½ in. deep and ¼ in. thick. The ends should be forged down to ¾ in. in diameter. Turn the axle and bearings true, making the thickest part to fit the hole in stone. Slightly reduce about 1 in. at the outer end and screw it, and fix a nut and washer. When the grindstone is put on, it can be fixed by screwing up tight with the nut and washer. A piece of hard wood should be fixed at the opposite side of the collar, and turned up to form a driving-pulley for flat belt. Fig. 2 is a section of axle.

Next provide four bearings of cast iron, as shown in Fig. 3. The holes may be cast in them, and reamed out to fit ends of axle. Fix two to top of frames by screws.

Next prepare a driving-wheel and axle. The wheel should be about 18 in. in diameter, with a flat rim for belt. A barrow-wheel will make one. The axle for this

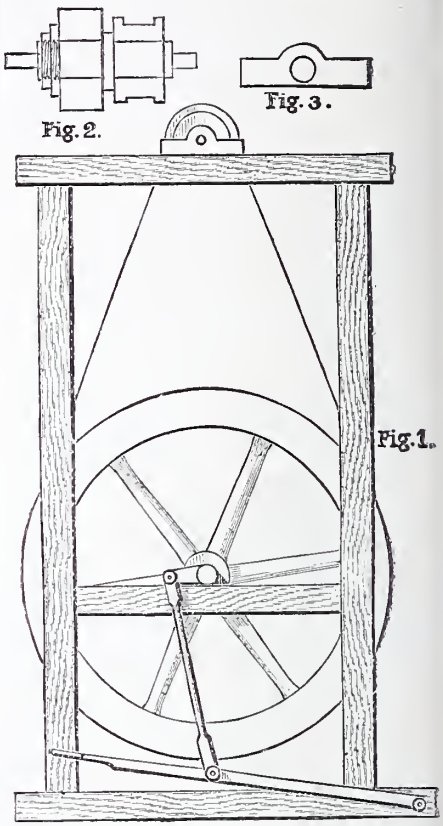



**Fig. 1.—Side Elevation of Grindstone. Fig. 2.—Axle of Grindstone. Fig. 3.—Bearing.**

wheel should be 9 in. long, projecting an inch through one bearing. The wheel may be fixed in the same manner as the stone, or keyed on.

The bearings may be made of hard wood, if preferred, as it will last a long time.

The crank may be of either wrought or cast iron, with not more than 2 in. throw. It must be keyed on the projecting end of axle.

Next prepare a treadle and connecting-rod. The treadle is about 18 in. long, of iron ¾ in. by ¼ in., one end being hammered out for the foot to rest on. It may be fixed to a bolt passing through frames, or to a bearing fixed on the floor.

The connecting-rod has a double end fixed to treadle by a small bolt and pin, and the top end is fixed to crank-pin by a pin and washer. The connecting-rod should be made so that when the crank is at its lowest point the treadle is just clear of the floor, or by using oak or ash the treadle and connecting-rod may be of wood.

When all is fitted up, the frame may be screwed to the floor, and a flat leather belt fixed on driving-wheel and pulley, and the machine is ready for work.

If the edge of grindstone does not run true, it must be trued by using the end of an old file as a turning tool. A rest may also be fixed on the top of framing to rest the tools on while being ground. Anyone making this machine will find it very useful, and the cost need not be much.

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

### Practical Work: Colour.

Number of Printings — Tracing — Tallies — Register Marks — Gripper — Numbering Tallies—First Tracing from Printers—Order of Printing Colours, etc.—Strength of Colour—Mixtures of Colours—Yellow —Blue—Pink—Brown — Greys — Roughing —Production of Texture.

The first thing to be decided on is the fewest number of printings in which it is possible to reproduce the sketch, which is done by looking carefully over it and finding out which colour it is possible to do without, by mixing two or more of the other colours together to get the desired shade, when the remaining colours will be the fewest number in which the sketch can be reproduced.

Commence by making a careful tracing of the sketch on diaphanie paper in lithographic ink, and as this paper contracts and expands it should not be lifted uutil the whole tracing is finished; all the corners should be gummed to the sketch, and if necessary a piece of white paper can be slipped between to see the effect of the tracing. Draw the outline, and mark any different colours it may contain in very clear, steady lines, making the lines of the outline rather thicker than the others, so that the different objects can be easily distinguished, then every variety of colour and difference in light and shade should be drawn in dotted lines. Six little squares, technically termed "tallies," should be drawn at the side of the drawing, and three little crosses made at the top and bottom, to use as register marks. One would be sufficient, but it is usual to do three or even more. Fig. 34 is a facsimile of how the tracing of a humming bird and leaves should look when finished; and as it is impossible in Work to give coloured drawings, I must ask the reader to accept as illustrations the few following diagrams, being the black impressions of the different colours which were worked from an original water-colour drawing.

The crosses or register marks enable the printer in proving to fit the different colours exactly one over the other, and they should be ruled in lithographic ink on each stone. The colours are registered by means of pins; for instance, in the gold stone, that being the first, the impression is taken, when of course the crosses will print at the same time; then for the next colour, say the yellow, the printer takes two pins, pricks a hole in the centre of the two middle crosses, and makes a slight hole in the duplicate ones on the stone. He then, holding the paper in his hand face downwards with the pins, places them in the holes on the stone, thus pinning the paper to it, then removing the pins, the paper is left flat in position on the stone, and the proof pulled. Thus, if blue were printed over yellow, a green cross should be the result; and so on with each colour.

In machine printing the register marks are done away with, as the gripper (a piece of metal that catches hold of and places the sheet of paper in the right position on the stone) answers the same purpose; therefore in placing a drawing on the stone that is intended to be printed in the machine, about ½ in. on one side should always be allowed for the gripper. This edge of the stone is bevelled, and cannot be worked upon. Supposing a sketch, A B C D, were required to be drawn on a stone, E F G H, it should be placed in the position indicated in Fig. 35, E F being the gripper edge.

The tallies should be numbered, and on the first stone No. 1 must be ruled up and filled in solid, with the name of the colour written underneath, the reverse way, and the same done with each of the other colours on the different stones, using a separate square for each colour, so that when the drawing is being proved, the artist can tell the exact shade that has been used, and so have it altered, either lighter or darker, warmer or colder, as the case may require it; and when a correct finished proof is obtained, the printer can be told to follow the exact colour of the tallies for the machine impressions, as the drawings are proved by hand which the artist superintends, and printed by machinery.

The drawings in the next page are worked in chalk, but the same rules should be

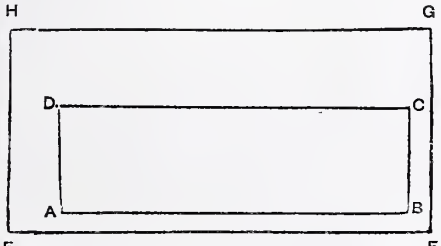



Fig. 35.—Correct Position of Work on Stone.

followed were they done in stipple, and if a great number were required it would be necessary, to enable them to be transferred to a large stone, and perhaps a dozen or even more printed at the same time. After the tracing is made it should be sent to the printers without delay, as it does not keep longer than a few days, and therefore, unless transferred to stone at once, will not go down.

Having received the stones with the red tracings on from the printer, the register marks and tallies should be ruled in first in case they might be forgotten, and the name of the colour to be worked written on the stone so as to read legibly in ordinary writing ink, besides that underneath the tally, in order that the printer can easily distinguish which stone is meant for the colour he desires to print. This writing being in ordinary ink will not print, but will mark the stone, and thus can be always read.

In any drawings containing gold, silver, or bronzes, these colours should invariably be printed first, as they are what are termed "dusting colours"—that is, printed in an adhesive ink, and the powder colour dusted over it; and as this powder flies about, if printed afterwards it would perhaps stick to the other colours in places where it was not required.

In drawings which contain no dusting colours, the yellow should be the first colour worked and printed, as it is a body colour. It does not require such finished work as some of the other colours, although the right strength as to light and shade should be drawn on the stone, and it should be worked with an open texture, being a colour that is likely to clog up in printing.

To work this or any other colour, make a pattern of the colour intended to be printed in water colour, and pick out every part of the original sketch that contains that colour as strong as, or stronger than, the pattern. Those parts should be put in solid on the stone, and any places with the same colour that are in the slightest degree lighter must be tinted accordingly—a very strong tint if it be only a shade lighter, and a light tint if in the sketch the same colour is very much lighter than the pattern.

A good way to judge the necessary strength the colour to be printed should be, and also the strength to work the different tints on the stone, is to take that part of the drawing that is the nearest approach to the pure colour and match it as nearly as possible for the pattern to work from; then take two pieces of white paper, and cut a hole in the centre of each; then by holding one over the sketch excluding the surrounding colours, and one over the pattern, it will be easily seen whether solid or tinting is required to be drawn. In this way a great variety of shades can be obtained from the one colour. The student must remember that wherever the least shade of that colour appears in the original sketch, a corresponding tint of the necessary strength must be made on the stone, for it cannot be put in afterwards unless an extra colour be used; and here the artist's knowledge of colour should assist him in judging what colours mixed together in certain proportions produce the necessary and desired effect.

Everyone knows that yellow and blue mixed together produce green, and therefore a green colour need not necessarily be used in a chromo, but can be obtained by printing blue over yellow. In the same way purple can be produced by printing blue over red, or *vice versâ*, orange by red over yellow, etc. etc., but it must be brought before the student's notice that blue printed over red produces a purple colder in tone than if the red were printed over the blue, and the same applies equally to any other mixture of colours.

Fig. 36 is an impression taken from the yellow stone, and it must be remembered that it would appear much darker on the white paper than in the finished sketch; this is because it is the only colour, whilst in the finished proof it is thrown back, and a good deal covered by the darker ones.

Although two separate printings were required for the gold and yellow, still only one impression of the two colours is here shown, as they do not interfere with each other. The diagram is also a good specimen for showing the result of two colours not being registered correctly.

After the stone is finished it is required to be etched, as previously stated, an impression taken, and all mistakes rectified before any further proofs are pulled.

The blue (Fig. 37) could be worked next, and requires a little finer and better work than the yellow, especially if, as in the present instance, only one blue is used. These two colours will give all the blue, yellow, and green tones necessary to the picture.

The pink (Fig. 38) also requires a nice piece of work, unless the subject was such that one or two reds were going to be used, in which case reserve the good work for them, only putting the necessary quantity as regards light and shade in the first pink.

This colour used with judgment, coming on the top of the blue, gives an excellent grey. We now find that from these three colours a great many varieties are obtained, such as a pale purple, orange, light greys, in different tones, light browns, etc.; and at this stage of the work it is advisable that the artist should have a proof, as far as it has gone, before him, as well as the sketch, and, by continually comparing one with the other, so judge the necessary quantity of work to put in the remaining colours. He may find that in some parts the pink and blue will give a grey dark enough without any additional work, therefore when the grey stone is worked no tinting will be r quired in those places.

The brown stone (Fig. 39) gene ally does the drawing, and i therefore, a very importa colour. It generally requires slightly different treatment i working to the other colour and should be done as early i the work as possible, especially i large subjects, so as to give for to the picture.

The greys should be worke last, and will, therefore, to down all the bright colours, bri the whole drawing into harmon and generally finish it (see Figs. 4 and 41). The light greys nee not be worked as carefully the darker ones, only the to and not the work showing. Th

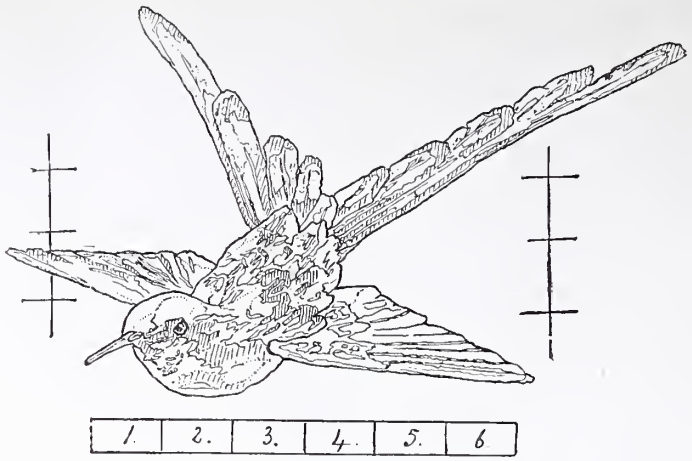



Fig. 34.—Tracing of a Humming Bird.

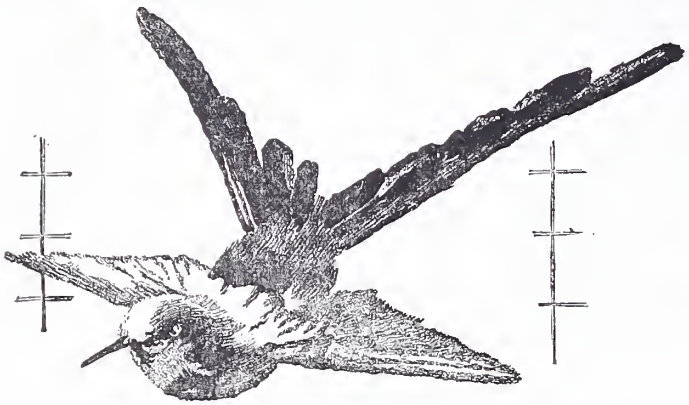


Fig. 36.—Black Impression from Yellow Stone.

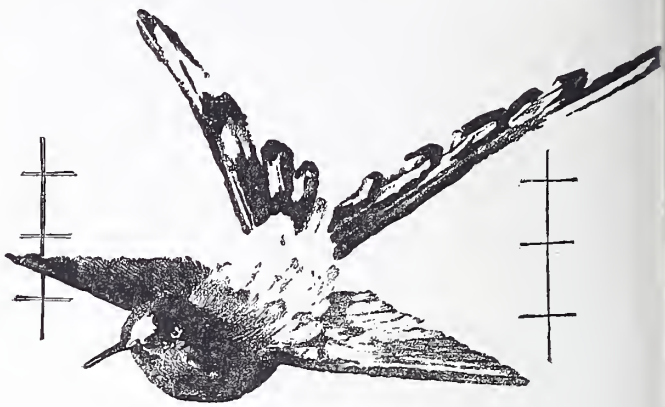


Fig. 37.—Black Impression from Blue Ston

Fig. 38.—Black Impression from Red Stone.

Fig. 39.—Black Impression from Brown Stone.

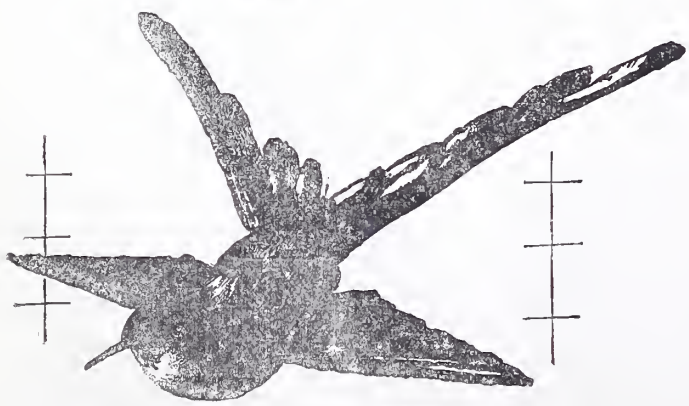


Fig. 40.—Black Impression from First Grey Stone.

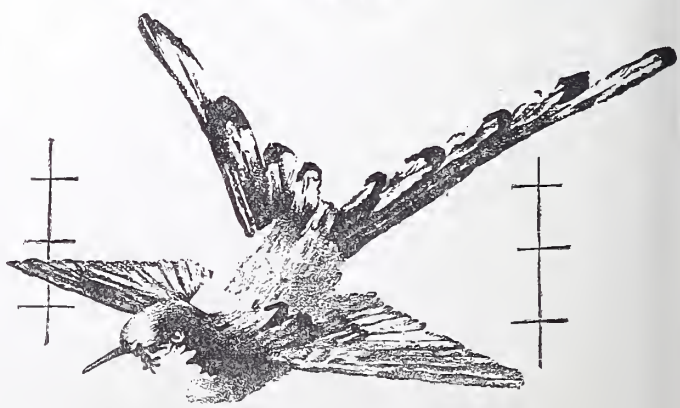


Fig. 41.—Black Impression from Second Grey Stone.

applies equally well to the blues, reds, etc., but the student will soon find out on which stones the best workmanship should be put, and on which to spend the most time. Although it is necessary to do the work as quickly as possible, especially in the light colours, still, it should never be scrambled.

After the picture is entirely finished, it is sometimes roughed—that is, an artificial surface is given to it in imitation of water-colour paper, canvas, etc. This is done in the printing department by inking a grained stone, and then etching it with strong acid. The coarser the texture is required the more the stone should be etched, this being sometimes done as many as three or even four times. Another way is to ink a stone and take an impression upon it from the sheet of paper, canvas, etc., which it is intended to imitate, and which must have been first prepared with gum; then etch the stone in the ordinary way, only stronger, and if the chromo be damped, laid on the stone, and pulled through the machine, it will come out marked as required. In this way any kinds of texture can be copied. The marks of the brush in an oil painting can be imitated in the same manner, by gumming a stone in those parts where they appear, then etching it according to the depth required, and pulling an impression.

There are a great many subjects appertaining to lithographic work which it is simply impossible to touch upon in these papers, such as varnished chromos, photo-lithographs, transfers, and many others; but the above hints on the general principles of the art of lithography in reference to drawing on stone I trust will be of assistance to the student of this very interesting and useful art, and perhaps in some future work I may (subject to the approval and leniency of my readers) enter deeper into the subject of lithographic drawing.

## A USEFUL METAL LATHE.

BY SELF-HELPER.

Introduction—Style of Lathe Castings—Headstock Pattern—Pulley Pattern—The Bed—Poppet Pattern—Hand-wheel Pattern—Holding-down Plates—Fly-nuts.

I was permitted in former numbers of Work to describe two lathes which were of rather simple and makeshift character. One was the primitive dead-centre lathe which might be made by almost anybody who could handle tools, while the other was more elaborate, but still formed principally of wood. Judging from the number of queries which I have received relative to them, I believe that a paper describing how to make an iron lathe will be acceptable to numerous readers of this Magazine. Iron possesses many advantages over wood as a material for lathe-making, the principal being that it is uninfluenced by the weather. We need never fear that the mandril of an iron lathe will stick through the swelling of the headstock by damp. An iron lathe is also lighter-looking and much more graceful than one made of wood, which must ordinarily be rather ponderous-looking and unsightly.

In this paper I will endeavour to write for those who know very little about engineering and carpentry, and if I appear too simple to some, I will ask them to consider that there are other readers of Work who are not as clever as they, and who must be catered for.

At the very outset two questions suggest themselves to us—namely, what size shall the lathe be, and where shall I get castings? There are, I think, two classes of lathe users. The first, who want only a table lathe, would embrace boys and those who require the machine for the production of very small pieces of turnery, such as are used to decorate fretwork and small articles of joinery. For this class, a lathe whose centres are two inches and a half or three inches from the bed would be suitable; and such a lathe might be easily carried in a large box and mounted on the lid when in use.

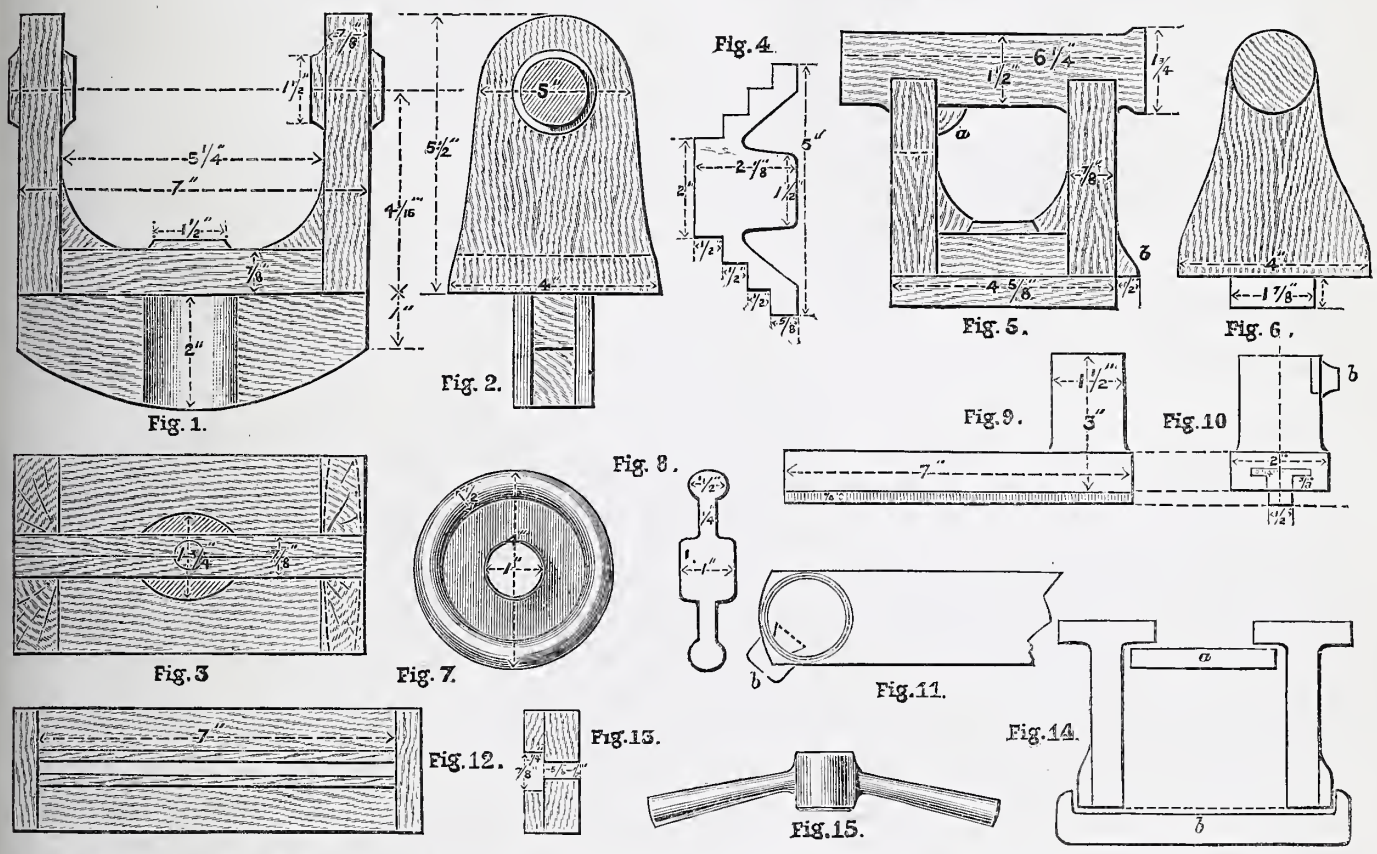



Fig. 1.—Headstock Pattern (Side View). Fig. 2.—Ditto (End View). Fig. 3.—Ditto, as seen from below. Fig. 4.—Sectional View of Pulley Pattern. Fig. 5.—Poppet Pattern (Side View). Fig. 6.—Ditto (End View). Fig. 7.—Hand-wheel Pattern (Side View). Fig. 8.—Ditto (Sectional View). Fig. 9.—Hand-rest Socket (Side View). Fig. 10.—Ditto (End View). Fig. 11.—Ditto (Plan). Fig. 12.—Core-box (Plan). Fig. 13.—Ditto (Section). Fig. 14.—Section of Lathe-bed, showing two Sorts of Clamping Plates. Fig. 15.—Fly-nut. All Figures drawn to Scale of 3 in. to 1 ft., or quarter size.

In the second class of lathe users I would place all those who have room enough to keep the lathe as a separate machine, and I would not recommend such to have less than four inches intervene between the lathe centres and its bed.

Table and bench lathes are usually mounted on short legs four or five inches long, by which they are fastened to the bench or table, the fly-wheel having a separate existence; while in the other class of lathes, which I believe has no distinguishing name, the fly-wheel, treadle, bed, and headstocks are all secured to the same legs.

In this paper I will take the four-inch centre lathe for my model, but it will be easy for anyone to make a lathe of a different size just in the same manner, always remembering that everything must be reduced or enlarged nearly in the same proportion. I would say a word of caution to those who think of making a very tiny

lathe, and expect to have it in every way as perfect and efficient, for its size, as a large one. It can be made as perfect, nearly, but it will not be as efficient: neither would a miniature man-of-war. Such a lathe would be almost as troublesome to make as one of a larger size, and would not be anything like as handy or as useful. My advice, then, to the readers of Work is: If you have room for it, make a lathe of four-inch centre such as I will describe in this paper.

With regard to the next question—Where can I get castings?—my advice would be to send your own patterns to the foundry and get castings off them. That is what I generally do myself, and I find it pays, not alone in cheaper castings, although this is also the case, but the experience in pattern-making is valuable, and the consideration of the various stresses to which the tool will be subjected when finished, and the provisions made to resist them, are useful exercises in theoretical and practical mechanics. While, however, this is true for me, others might find it more convenient to purchase the castings ready to work up, and it is not difficult to do so now, as most lathe-makers are sensible enough to supply castings at fairly moderate prices. A glance at the advertisement sheets of Work would give addresses of makers, and I shall be always happy to supply information to those who seek it through "Shop."

To make this four-inch centre lathe *easily*, the use of a good six-inch centre lathe, with slide-rest, also planing machine or shaper, would be necessary; but it can be made *successfully* with a much smaller outfit, consisting, at the least, of a hammer, cold chisel, file, some sort of lathe (the dead-centre one I formerly described would do), and a machine capable of boring a hole $\frac{7}{8}$ in. in diameter through cast iron. To this I must add screwing tackle.

We will begin by making the patterns for the two headstocks, pulley, hand-rest socket, ties, and clamping plates. They should be made of yellow pine or mahogany, and carefully finished with sand-paper. If they were required as stock patterns they should get five or six coats of varnish, but as we only want one set off them they will do very well without. I may mention here that "off" is the technical word used to express that castings are required from these patterns.

The patterns for the headstocks, pulley, hand-wheel, clamping plates, and tees are exactly like the castings, but the hand-rest socket differs somewhat, and will require a core-box.

*Headstock Pattern.*—Figs. 1 and 2 represent the fixed headstock pattern. It will be seen that the vertical ends are nailed firmly to the baseboard, and the corners filled in with pieces of wood which act in the double capacity of strengthening the casting and making its contour graceful. The bosses towards the top are to lengthen the bearing for the mandril. It will be noticed that the centres of these bosses are $4\frac{1}{16}$ in. from the base; the extra $\frac{1}{16}$ in. is to allow for the shrinkage of the metal and for chipping and filing the base flat. The bridge-shaped piece underneath is to strengthen the base; note that this piece itself is in turn strengthened where the holding-down bolt will pass through by putting a piece at each side, as shown in Fig. 3.

A matter of great importance in pattern-making is taper. All patterns should be smaller in the parts which go deep into the sand, so that they can be withdrawn without breaking the mould. The dotted lines in Figs. 2 and 3 show, in a much exaggerated scale, how taper can be given to these patterns. It is only necessary to have the centre of each part slightly thicker than its edges: $\frac{1}{32}$ in. would be quite enough.

*Pulley Pattern.*—It is well worth considering whether the pulley for this lathe ought to be of wood or cast iron. If the latter is used, it will be found to be by far the most difficult piece of metal-turning in the entire job, and should not be lightly undertaken. However, as I have already described a wooden pulley, I give in Fig. 4 a drawing of the pattern required for a pulley such as we will use in cast iron. The hollow at one side is to lighten it, as if made solid it would be inconveniently heavy. The pattern would be turned out of a piece of mahogany $2\frac{1}{4}$ in. thick, well sand-papered, and having the steps tapered so as to leave the sand without difficulty. I prefer gut to a flat belt as a driving band in a lathe of this description, which will be used mostly for wood and light metal turning.

*The Bed.*—It will be necessary at this stage to consider what sort of a bed will be used for this lathe, and where it is to be got. I would not advise the amateur to make a pattern of his bed for the following reasons: first, it takes a large quantity of valuable wood, for not alone must the pattern of the outside be made, but a core-box for the space inside must also be supplied. Then, when the bed is cast, it must be planed, and as they cannot usually do that at the foundry, it must be sent to an engineering establishment, and the cost will be great—so great, that a bed could be got from R. A. Lee, High Holborn, or some other maker, ready for the headstocks, for almost as little as the planing would amount to. An amateur might, indeed, file a bed fairly true, but the work would be very long and tedious, and straight-edges, surface-plates, and other expensive tools would be actually requisite. If any of my readers, however, wish to have a description of a lathe-bed pattern, they have only to ask for it through the proper quarter, and I will be happy to supply it.

A very common practice is to mount iron headstocks on a wooden bed whose upper surface is protected by plates of flat iron screwed firmly to it, and filed true on top and edges. This plan I would heartily recommend to my amateur and apprentice friends. At any future date, if they are found to be worthy of it, the headstocks could be mounted on a more permanent base. In any case, I will go on the supposition that the space between the two sides of the bed is $1\frac{3}{4}$ in. wide. I now pass on to the

*Loose Headstock or Poppet Pattern.*—It is shown in Figs. 5 and 6. I usually begin by preparing the upper cylindrical part, which is 6 in. long and $1\frac{1}{2}$ in. in diameter when finished. One end is enlarged somewhat to take the disc, which will be screwed against it. I cut spaces in this, half through, for the supports to fit into tightly. I find this plan much easier than cutting a semi-circular hollow in the vertical pieces would be.

The only thing to note in this pattern is to have all the corners nicely filled up with putty. The piece *a* should be carefully put in so that when the locking-bolt is passed through it will not weaken the support too much. The piece *b* need not necessarily be there at all, but it will serve to make the supporting base larger. The tenon which is eventually to go between the sides of the bed will be $1\frac{7}{8}$ in. wide in the pattern to allow for shrinkage and fitting.

*The Hand-wheel Pattern* (Figs. 7 and 8) can easily be turned from a piece of mahogany 4 in. in diameter and 1 in. thick. I show it without spokes, simply a disc, but spaces could be cut out by anyone who does not mind the trouble. Hand-wheel patterns can be got at most foundries.

Hitherto, all the patterns have been just as the castings will be. In the hand-rest socket pattern two new features in pattern-making become prominent. The first is the piece *b* (Fig. 10), which should be loose, simply held on by a pointed piece of wire; or, better still, let down from the top with a dovetail as shown by the dotted line in Figs. 10 and 11. This piece is placed at an angle of 45 degrees with the length of the socket, as is seen clearly in Fig. 11. We want a slot cast in the socket base like that shown by the dotted line in Fig. 10. This could be managed only by means of a *core*, which I will now endeavour to explain.

A slip of wood the exact width which the slot is required to be is nailed centrally along the base and its entire length. This is called a *core-print*. We next require a *core-box*, which is shown in Figs. 12 and 13. It is made of four strips of wood nailed together as shown, and two other pieces tacked to the ends to keep them the correct distance apart. The moulder fills the space with sand pressed firmly together and mixed with some liquid which makes it quite firm and hard. When dry it is a T-shaped strip of sand, which is placed in the mould in the space made for its reception by the print. When the casting is made the sand can be shaken out, and in its stead will be the T-shaped recess or slot.

A couple of tees had better be cast, as they are cheaper than wrought-iron ones. The stems will be 3 in. long and $\frac{7}{8}$ in. in diameter, and the horizontal pieces tacked to them $\frac{1}{4}$ in. thick and $\frac{7}{8}$ in. wide at the centre, tapering to $\frac{5}{8}$ in. at the ends. They may be 8 in. and 4 in. long respectively. The tees used for iron-turning are flat on top, and could easily be made by nailing flat strips of wood $\frac{1}{2}$ in. thick on the ends of the stems.

*The Holding-down Plates* may be made of either wrought or cast iron. Their shape will depend somewhat on the construction of the lathe-bed. They are mostly pieces of wrought iron having the ends slightly turned up and the space between wide enough to embrace the underneath surface of the bed. Sometimes, however, they just clamp the upper cheeks. In Fig. 14 I give the section of a lathe-bed with the two sorts of clamping plates, shown at *a* and *b*. That at *a* would pass over any stays which might be cast in the bed, but should either be screwed tight from above or have a nut attached to a tube and handle to clamp it; *b* is suitable for a plain bed without stays.

The last pattern we will require is one for *Fly-nuts*, about the easiest of which to make is shown in Fig. 15. The centre boss is turned, as are also the arms, and they are driven into holes bored into the boss. The point of juncture is then filled up nicely with putty. The arms need not be quite as long as shown in the figure, but I like to have a good purchase. It would be as well to get a plain round disc cast also. It is to fit at the end of the poppet, and will be $\frac{1}{4}$ in. thick and $1\frac{7}{8}$ in. in diameter.

If any of those who follow my instructions in lathe-making will construct all these patterns nicely, well enough to please the moulder, they will get some useful practice in joinery which will pave the way for more important undertakings, and teach

them a good deal about the various parts of a lathe.

I will suppose that they are now sent to the foundry, and in my next article describe what is to be done when they are returned with the castings.

## HOLDFASTS FOR WOOD-CARVERS, ETC.

BY OPIFEX.

ORDINARY CRAMPS — OBJECTIONS — SUGGESTION No. 1—SUGGESTION No. 2.

*Ordinary Cramps.*—One of the first essentials to success in wood-carving is the possession of some efficient means of holding the work steady and solid upon the bench, table, etc., and, as far as my experience goes, the cramps to be had in the tool market are inadequate; at least, I have not been fortunate enough to find, either in the shops or in any of the numerous illustrated price lists advertised, any appliance of this nature which is entirely satisfactory. This, I grant, may be my misfortune, or my fault, or both, and the "very thing" may be easily obtained by one who knows where to look. Be this as it may, however, pending the discovery, I have had recourse to several devices from time to time, some of which have been rather successful, and I therefore venture to offer two of them, by means of the accompanying drawings, to any reader who may require such things, and who, like myself, rides his hobby in fields remote from those centres of attraction, the tool shops.

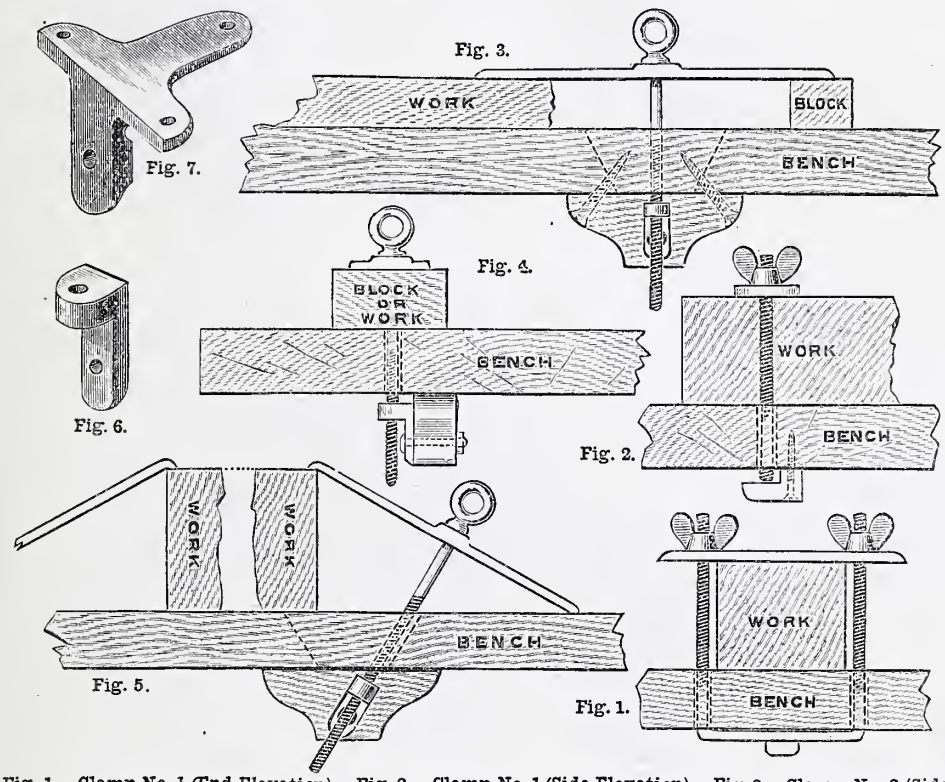



**Fig. 1.—Clamp No. 1 (End Elevation). Fig. 2.—Clamp No. 1 (Side Elevation). Fig. 3.—Clamp No. 2 (Side Elevation, showing details). Fig. 4.—Clamp No. 2 (End Elevation). Fig. 5.—Clamp No. 2, showing Method of using two Clamps. Fig. 6.—Sketch of L-Piece. Fig. 7.—Suggestion for Cast Bracket. Figs. 1, 2, 3, 4, 5 are on Scale of 1½ in. to 1 ft. Figs. 6 and 7 are not drawn to Scale.**

The chief objections to the ordinary clamp or cramp—which is it?—are that it does not reach far enough, that it is more or less "wobbly," and that it can only be applied at or near the edge of the bench, etc., whereas it is often desirable to apply pressure to a point altogether beyond its reach, especially in wide and thin subjects.

*Suggestion No.* 1.—Fig. 1 represents an old and, to me, a valued friend, or rather one of a pair, which I have found very useful for many purposes other than carving.

These are easily made, and are very suitable for holding long and narrow work—say, from 6 in. by 6 in., and any length down to the thinnest stuff.

To make the pair we only require two pieces of ½ in. round iron, of good quality, and about 27 in. long; run a good screw thread on each side, six or seven inches in length. Bend at right angles at points 10 in. from the ends, and provide for suitable thumb-nuts; also two plates of ⅜ in. by 1½ in. iron, 9 in. long. Drill out holes seven inches apart, or to suit the exact width of the clamps, and sufficiently large to allow the threaded ends to pass freely through.

Fig. 2 explains the method of using these clamps, from which it will be seen that each clamp requires two holes through the bench, and also a button of hard wood of any kind to prevent the clamps from falling through, but which allows of their removal when not in use.

*Suggestion No.* 2.—Figs. 3—5 will, I hope, give the reader a correct idea of the construction and mode of using another form of clamp, which will also be found effective by wood-carvers and wood-workers generally.

In its simplest form it consists of an L-shaped piece (Fig. 6) of cast iron, pivoted to a hard wood bracket, which is attached by strong screws to the underside of the bench.

A threaded rod of ½ in. round iron, provided with an eye and shoulder at the upper end, passes through ¼ in. by 2 in. by 10 in. steel plate and through a tapered slip or mortise ⅝ in. wide and about 5 in. long at top, tapering to 3 in. at bottom.

The L-shaped piece is accurately tapped to suit the threaded rod, and is held in position by a ⅜ in. cheese-headed bolt and nut passing through the wood bracket.

The cramp may thus be applied to work in a horizontal position, the other end of the plate being levelled up with a block of wood, etc., as in Fig. 3, which is a front elevation, and Fig. 4, end elevation; or the clamp may be applied to the work at an angle, as in Fig. 5, the pivoted L-piece and tapered opening allowing the pressure of the rod to be applied at right angles to the plate.

Another similar clamp may be placed in line at a suitable distance upon the bench, when, if several plates of different lengths are provided, the pair may be applied to various sizes of work in the manner suggested at Fig. 5.

The "weak spot" in the appliance as described above is the wooden bracket, and although I have found it work very satisfactorily for a considerable time, I can only regard it as a makeshift, and therefore recommend a casting something like Fig. 7, which, with the other parts as already described, would make a good and reliable bench holdfast.*

## STAGE PERSPECTIVE.

BY WILLIAM CORBOULD.

OBLIQUE OR ANGULAR PERSPECTIVE.

My last article finished with the first rule in perspective; we now come to the second: oblique or angular perspective. The difference between the two rules is that in the first rule the point of sight is invariably fixed in the centre, but in the second rule the point of sight may be shifted to the right or left of the centre of the horizontal line; the points of measurement, *a*, *a*, in Fig. 4, become the vanishing points, all receding lines above and below the horizontal line falling into those points.

In Fig. 4 in the next page, if you were to place a square block with one corner towards you, it would appear in oblique perspective. Should you wish to represent a building, or anything perfectly square, you would draw your first perpendicular line, *b b*, then the base line, *c c*. Supposing your block to be 10 ft. square, you must mark 10 ft. from your perpendicular line each side to points at *c*, *c*. From the front corner draw a line to vanishing points, *a*, *a*, on the horizontal line, A A; this would be the ground line of your block; the height, of course, would be 10 ft. marked on the perpendicular line, *e*, it being a square we are working with; but a building might be any height. When the proper height is settled, a line drawn from that point, *e*, to the vanishing points, *a*, *a*, gives the top perspective line of the block or building. To find the proper perspective of the two sides, draw lines from dots, *c*, *c*, on the base line each way to points, *a*, *a*, on the horizontal line; where the lines intersect the ground line, *d*, *d*, you place the two perpendicular lines,

* Since this paper was in type, the suggestion in the last paragraph has been acted upon by Messrs. Booth Brothers, Upper Stephen Street, Dublin, to whom the ownership of the design for No. 2 Clamp has been transferred, and very soon it may be obtained from them either in the form above described or otherwise improved or modified as their wide experience in such matters may suggest.

*f*, *f*, which completes the two sides of the block ; *g* is the distance point.

I will now illustrate this by supposing we have a scene, as in Fig. 5, which shall represent a roadside inn, standing at the junction of two roads looking right and left, consequently drawn in oblique or angular perspective. It will be seen that the lines of the house and roads, fencing, etc., fall into the vanishing points, *a*, *a*. The point of sight, or distance point, is shown at A.

In drawing this picture, first settle on your horizontal line, *a a*, and vanishing points, which are shown at *a*, *a*, those dots being on the horizontal line, and also the distance point or point of sight, A. The base corner of the building is shown where your first perpendicular line, *e*, Fig. 4, rises, which would be to the right of the point of sight. Draw this first line, using your plumb-bob line for that purpose ; you may measure all other perpendicular lines from the first one, as it will be perfectly upright. The line *b b* is the base line.

Now dot the height of your doors and windows on your first perpendicular line, as at *b*, *b*, *b*, Fig. 4, by holding the line which you have hooked in at one or other of your vanishing points, *a*, *a*, on to the dots marked on your perpendicular line, drawing it tightly (see Fig. 6). In the other hand you have a piece of charcoal, and make a dot where your cord crosses the outer perpendicular line, *c*, Fig. 4. After you have completed all your dots, take the straight-edge, draw lines from dot to dot, and set the doors and windows out on these lines. The lines of the roads, water-trough, etc., are obtained in the same way.

By this time you will have become pretty well used to your two lines or cords—that is, you will have found out that you cannot draw a correct scene without them. The base line in Fig. 5 is 15 ft. along the front of house, and 5 ft. the other way.

I want you to well study the two rules I have shown and made as simple as possible—that is, "parallel," and "oblique or angular perspective," because every scene or study you may have to do must be done under one or other of these rules.

I wish you to bear in mind, however well a scene may be painted, one line wrong in the perspective would spoil the whole.

I had better here explain the meaning of the point of distance, which means the spot where the spectator is standing from the scene, looking straight before him, without turning the head to the right or left, depicting only what he sees while so doing.

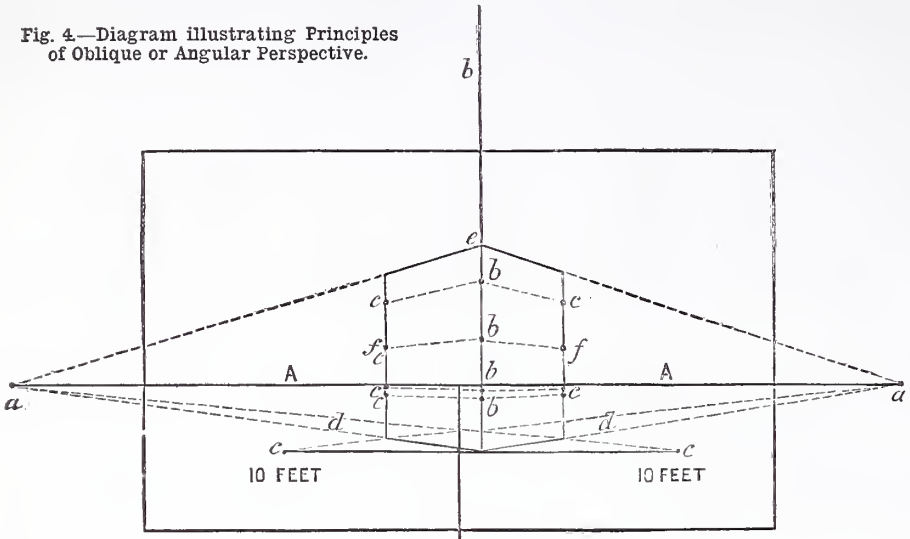
Supposing that you were to have a large hoop fixed in front of you, so that the eyes caught the edge of it, you are looking through this to the far distance—looking, as it were, through a funnel, by way of illustration—every object getting smaller and smaller as it recedes from the eye, all falling into one spot, which would be the small end of the funnel or dot, called the point of sight : this constitutes the rule of parallel perspective.

In angular perspective, as an illustration, if you place yourself opposite a square block set angularly, and look steadily at the corner near you, without moving the eyes, you will find you can only see a certain distance right and left—that is to say, you see the outer rim of a circle ; now, it is on the rim of this circle that the two measurements or vanishing points are fixed (see *a*, *a*, Fig. 5) ; A being the spot at which the spectator is supposed to stand.

The part of the circle you are looking through would be within an angle of 60°—that is, a section of the whole circle of 360°, that being six times 60° ; you would have to turn yourself six times before taking in the whole circle of 360°, comprising a panoramic or bird's-eye view ; I mean before you could sketch all the objects you would have to take six different turns, you being the centre of this panorama. The panorama, which was called "Niagara in London" was a splendid illustration of this.

We have now come to the drawing of a few objects by the aid of these two rules, which are simple enough in themselves and easily understood. It requires a little practice to do the work with facility, but this may be obtained by working on a tolerably large scale on paper. It will render the work all the more easy when the beginner commences outlining and painting on the canvas itself.

Fig. 4.—Diagram illustrating Principles of Oblique or Angular Perspective.



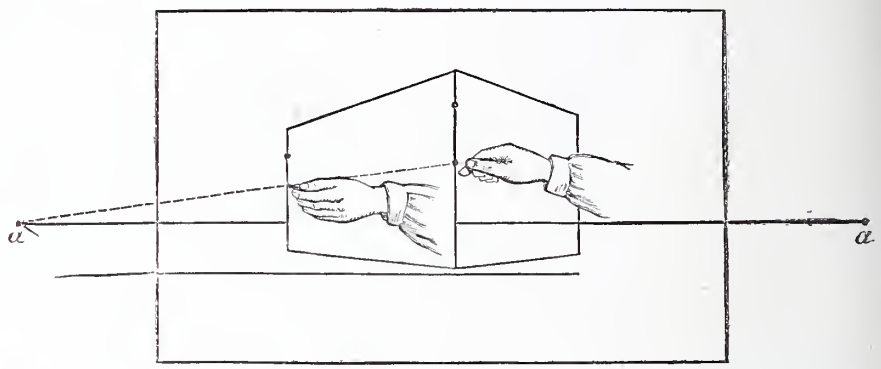




Fig. 6.—Mode of setting out Points on Cloth.

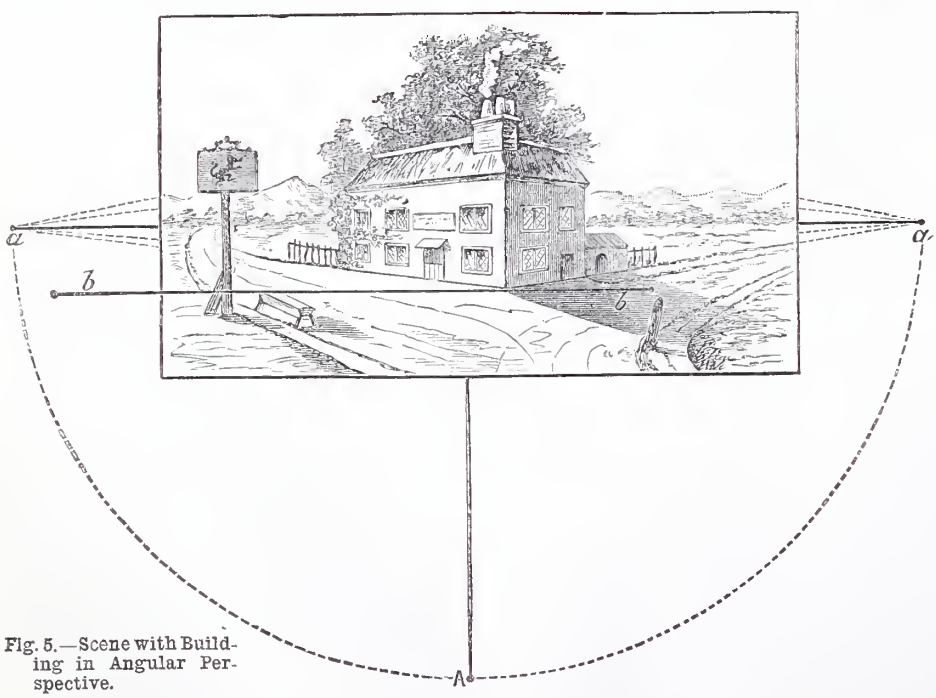



Fig. 5.—Scene with Building in Angular Perspective.

## SCRIBING-BLOCKS:
### THEIR USES, AND HOW TO MAKE THEM.

BY J. H.

THE scribing-block or surface-gauge is indispensable to the fitter and turner, and extremely useful to the pattern-maker. Where compasses, compass callipers, scribers, and rules would be of no use for the marking of centre, and various other horizontal lines, the scribing-block is of service. No matter how irregular a face, or how many faces there are which bear no relation to any other faces, lines can be carried along them all with a scribing-block in a true plane, or in various planes parallel with one another. The marking-off table, or the surface-plate, supplies that true basis which is wanting in the piece of work itself, whether it be rough casting or forging. The scribing-point of the surface-gauge being clamped in any required position, and brought against the vertical face of the work, the broad base is slid over the marking-off table or surface-plate, and the point travels perfectly parallel therewith along the face of the work. Or the turned-down point tests the parallelism of an upper face of a piece of work true in itself, with the face of the table, preparatory to the marking off of some other portions of the same. Or heights and dimensions are transferred more directly and more accurately by means of the scribing-block than they can be by the compasses, particularly when the faces on which they are measured slope diagonally. Chucking centres are also marked upon work which has to be turned, the work being laid upon packing-blocks of V or other shape, and turned round into new positions, after the scribing of lines across the ends, the mean of all the lines, or their points of intersection, being the true centre for chucking.

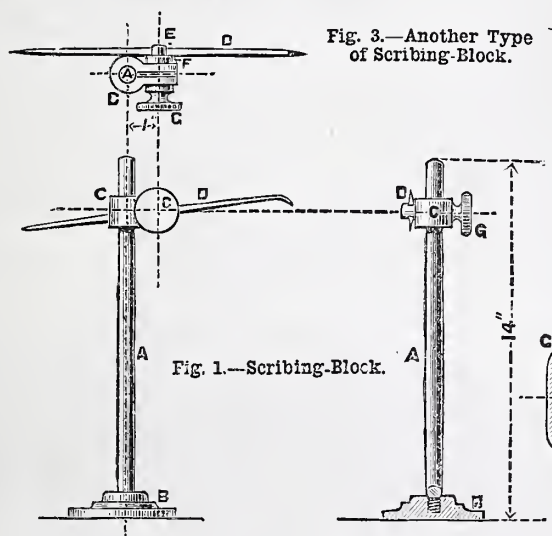



Fig. 1.—Scribing-Block.

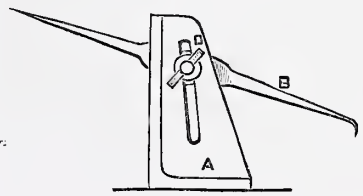



Fig. 3.—Another Type of Scribing-Block.

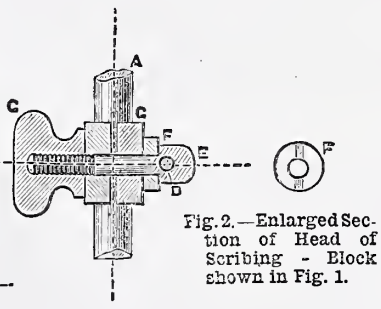



Fig. 2.—Enlarged Section of Head of Scribing-Block shown in Fig. 1.

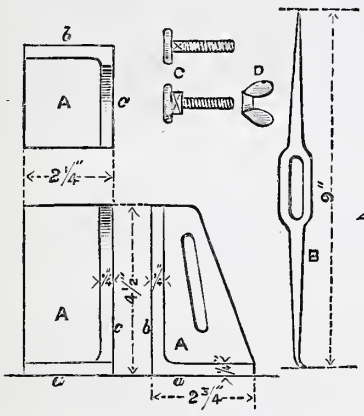



Fig. 4.—Details of Scribing-Block shown in Fig. 3.

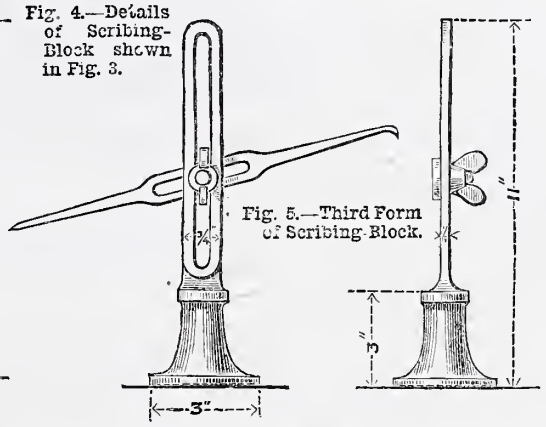



Fig. 5.—Third Form of Scribing-Block.

These scribing-blocks are made in many modified forms, according to taste. The essentials are to have a broad, steady, and somewhat heavy base, and ease of movement of the scriber leg, and stability.

I show three forms of scribing-block, in which these conditions are fulfilled.

In the first form, illustrated in Figs. 1 and 2, there is a rod, A, of iron or steel turned to $\frac{1}{2}$ in. or $\frac{7}{16}$ in. diameter, and screwed into a base, B, of cast or of wrought iron. A divided block, C, slides upon this rod, and carries the scriber-point, D, which swivels to any angle, along with the tightening-screw, E, and washer, F. The sliding-block is shown enlarged at Fig. 2 for clearness. To make it, proceed thus:—

File a block of forged steel or wrought iron to the outline of the block, C, in Figs. 1 and 2. Drill a hole through it in one direction for the pillar, A, and another at right angles therewith—say, about 1 in. away from the centre of the first hole for the tightening-screw, E. Then, with a hack-saw, cut the slit carefully and parallel with the sides, so giving the elasticity required for pinching up the block.

The pin, E, will be turned down from a bit of rod, originally of the diameter of the head, and screwed about as far along as shown. A hole is drilled to take the scriber, D, which, it will be noted, is of circular section, and the precise position of the hole is of vital importance. Observe that it is drilled to come just a very trifle under the face of the washer, F, and the face of the washer is hollowed across to a corresponding depth to allow the scriber to lay against it, so that the washer and scriber turn together. When the screw-bolt is pulled hard with the milled head, G, the effect is therefore to pinch the scriber between the head and the washer.

The milled head is made of steel, iron, or brass. Turn and mill it first between centres, cut it off, and then drill and tap the hole for the screw. It is better, to ensure truth, to drive the milled head into a hard wood chuck, or hold it with the dogs and drill in the lathe than to drill in the vice.

Another and quite different type of scribing-block is shown in Figs. 3 and 4. It is a form which possesses the merit of great steadiness, but involves a little bit of pattern work and casting. There are three parts—the base, A, in cast iron or gun-metal, the scriber, B, the screw, G, and wing-nut, D.

The pattern of the base is like its casting, and the slot can be cast out by using a print and making a core-box—making it a little narrower than the screw to allow of cleaning out with a file. When cast, plane or file the three faces, *a*, *b*, *c*, at right angles with one another; and smooth over the other parts with the file, for the sake of good appearance.

The scriber, B, is made of steel, first roughed to outline on the anvil, then filed flat and parallel about the central portion, upon which the parallel lines forming the slot and the bounding metal will be marked and filed. The tapering ends may be turned for a portion of the distance out from the centre, but it is not necessary, as a little rough grinding, followed by filing, will bring them to a good shape.

The screw, C, is provided with a turned head and a square shoulder, to fit the slot, A. The wing-nut, D, is cut from iron, steel, or gun-metal—either will answer.

Another scribing-block is shown in Fig. 5. In this the stand is made of wrought iron entirely, the slotted portion being swaged down from a piece of 3 in. bar. The bottom is turned up to any good outline, and is hollowed at the bottom to rest only upon an annular ring of metal. The slotted part is then filed to thickness, equal sided from the chucking centre, and the slot and the outside edges lined out. Holes are drilled in contiguity for removing the bulk of the metal and the slot filed out.

Some trouble might be saved by making the slotted portion distinct from the base. The former would be of wrought iron, and the latter might be either wrought or cast. The scriber itself and the tightening-screw and wing-nut are like those shown in Figs. 3 and 4.

The dimensions given are not hard and fast. They are only given to assist in forming some idea of suitable proportions for blocks made either larger or smaller in size.

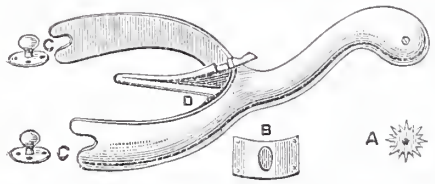
The height of a scribing-block is not of much importance, because when necessary for marking off work so high as to be beyond its range, it can be always raised up and slid along on a parallel block of iron placed upon the marking-off table. This is frequently necessary, and pieces of T-iron and channel iron of different depths, but planed truly parallel, are kept by the marker-off for this purpose, and also for blocking up work upon.

## SPURS WITH CONCEALED ROWELS.

BY J. C. KING.

To those who have been visitors to English or foreign museums, anything new in the way of spurs will come as a surprise. So small a utility, and with such limited topical fixture, there seems but little chance of improvement. This little seems attained by a larger head—as the knob end is termed—and by having two holes in the rowel, a centre one for free turning, and an eccentric hole to make the rowel a fixture, concealed in the notch of the head of the spur, as shown in the illustration. A screw instead of a rivet is used, so that with the point of a knife, in absence of a bradawl, the screw can be removed and rowel placed just as wanted, in or out of sight.

The object to be gained is that spurs may be worn in company, where projecting rowels are apt to catch in dresses and cause snags and rents, more especially in ball-rooms. The inventor could not keep to his one idea of the rowel, but tried to simplify the fixing in the heel of the boot, now done by the pressure of a box-spring built into the boot-heel when the boots are made. It is a doubtful fixture at best. Spurs are often lost, or boxes get out of order. Their general faultiness prevents them from being adopted for the rank and file of cavalry corps, which mostly have a long screw passing right through the heel, screwing into the end of




**Spur with Concealed Rowel—A, Rowel; B, Plate over Box to take Spring; C, C, Studs to receive ends of Spur; D, Spring.**

one of the bows of the spur. This is a clumsy way, the projecting screw-point sometimes snagging the trousers in walking. The method of holding the spur into the boot-heel is by a shield-plate with an oval hole. To catch in a hole in the heel of a boot, a spring fixed to the tang of a spur, with a notch in it, catches into the shield-plate and holds it securely. To release it, the projecting end of the spring is pressed down at the same time as the spur is pulled out.

Additional support is given by two strap-studs fixed on the fore-parts of heel sides, and the bow-ends of the spurs have a fork notch to hold to these strap-studs. These studs, by the straps, keep the trousers down. For jack-boots, the jockey-spur is best, and is always used with them in the army or hunting field. Some people imagine the spur inflicts harm on a horse. It is not the actual prick that can ever do harm, but the impulse it gives to a horse, which the voice may equally do, to urge to over-exertion. No one should ride without spurs. They may save the rider's life from the flinching of a shying horse being diverted by the spur.

They, moreover, teach a novice to keep his feet pointing straight forward, to keep the rowels away from the sides of a high-mettled horse. The sorry hacks do not mind them; hence the uncouth riding of most of our mounted police, and not a few would be cavaliers in Rotten Row. The inventor is the author of a pamphlet on "Riding," and gives this spur to the readers of Work if they think it worth adopting.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

### 66.—Sloane's Adjustable Gauges for Perforating Machines.

There are, doubtless, many paper-rulers, book-binders, and account-book makers among the professional readers of Work, to whom the description of an adjunct to perforating machines, invented and supplied by one of their own trade—namely, Mr. Thomas C. C. Sloane, 59, South Castle Street, Liverpool—will prove interesting, if not useful. It appears, from what Mr. Sloane himself tells me, that the merit of the invention consists in putting into the hands of book-binders, etc., a substitute, in a permanent, reliable, and ever-ready form, for some make-shift intended to achieve the same purpose, which is to be found in many workshops, it is true, but in so crude and untrustworthy a shape that it is next door to useless. Now many sheets—such as coal ticket and other check books—require several perforations on a sheet to overcome the difficulty of there being only one back "lay," and so users of perforating machines are driven to adopt various methods for securing "lays"—such as tacking or gluing strips of millboard on the front board, or making use of printers' quoins in the same manner, or even putting pins or pencil marks on the front board. It is clear that all such means are, to say the least of them, clumsy, calculated to waste the workman's time, never ready to hand when most wanted, and certainly unreliable. Mr. Sloane, however, claims that his gauges, on the contrary, are neat and handy, economisers of time, always ready for use, and such as may be always depended on. He says that when some look at the illustration of a perforating machine thus fitted, as shown in Fig. 1, they think that space is lost by having to come over some of the gauges; but this is not so, as the "lay" is set to suit the sheet, and all sheets that follow are bound to be the same. The nature of Mr. Sloane's appliance will be easily understood from Fig. 1, in which an ordinary perforating machine is shown fitted with five of the adjustable gauges, while Fig. 2 shows a sheet perforated once vertically from top to bottom and four times crosswise, the horizontal perforations being obtained by laying to four of the adjustable gauges. Fig. 3 shows one of the gauges by itself and off the machine. It also shows how they are secured—namely, by a short screw-bolt passing through the centre of the gauge, whose head is tightened on the gauge with a pressure sufficient to retain the gauge in position by a wing-nut which works on the screw. Yes, possibly some may say, "But how is the attachment to be managed? for there are no means whatever of attaching and securing the gauges to the perforating machines which I possess." The reply is, that it is necessary to modify the machine and render it fit to receive the gauges, and this is managed by cutting a slot parallel to the back lay right through the centre of the front board, leaving, as a matter of course, a portion of the board not cut through at the front and back edges for strength. This slot—which is clearly shown in Fig. 1—should be ⅜ in. in width. This done, the gauges must be placed on the board at the needful distances from each other, and having got them in due parallelism, put the bolt through each gauge and fasten from below with washer and nut. To set the lay, place the sheet under the teeth, and adjust the various lays, commencing with gauge No. 1, as in Fig. 1, draw sheet towards you, and set gauge No. 2, and so on. Prepare in the same manner, commencing with gauge furthest from the operator, who must draw the sheet towards him after each perforation. For use of gauges on back board, the slot of old back guide is made available, using large washer supplied to use with wing-nut. The gauges are made of wrought iron, and are supplied with fittings, washers, etc., complete, for 15s., or 15s. 6d. post free.

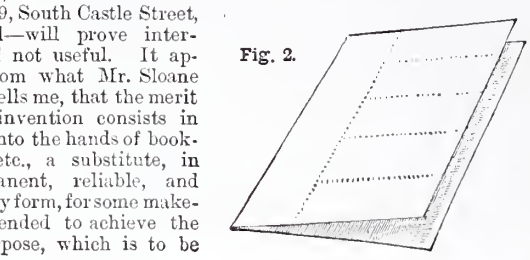


**Fig. 2.**

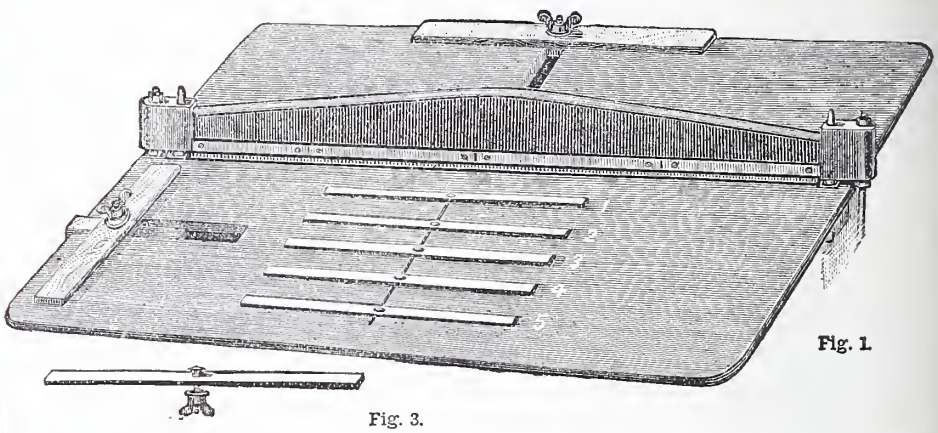


**Fig. 1.**



Fig. 3.

**Fig. 1.—Ordinary Perforating Machine fitted with five of Sloane's Adjustable Gauges. Fig. 2.—Sheet perforated on one half five times while passing through Machine once; the Upright Perforation made by setting Lay to old Back Guide; the four Cross Perforations, by laying to four of Sloane's Adjustable Gauges. Fig. 3.—One of the Gauges—Length, 11 in.; Width, ¾ in.; Height, under $\frac{3}{16}$ in.**

### 67.—Coulthard's Designs for Fretwork, etc.

In an early number of Work I spoke of these designs as being not only cheap but really and truly well suited for beginners, who are too often disheartened by commencing work on a difficult and intricate pattern. Mr. Coulthard, East Cliffe Terrace, Bournemouth, sends out a variety of designs in fretwork, stencilling, and turning at from 1s. to 2s. 6d. per packet. I believe I am justified in saying that any further information will be readily supplied by Mr. Coulthard to any applicant. Some have considered the designs somewhat rough in execution. Being from stencil plates some are unavoidably so, but the edges can always be set right with a camel-hair pencil and some Indian ink. The Editor.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letter from a Correspondent.

**Boiled or Unboiled Oil?**—A Weekly Subscriber writes:—"Having taken in Work from the beginning, and derived pleasure and knowledge therefrom, I should feel greatly obliged to have the benefit of practical men's experience as to whether boiled or unboiled oil is the best for external use. In a week or two I purpose painting my house outside, and am anxious that it should have a varnishy appearance, but cannot ascertain the proper oil to use for that purpose. I have consulted four different house painters. Two of them say it must be boiled oil, and two exactly the contrary. Under these circumstances, I went to a shopkeeper who sold only paint to have his opinion, and he said oil that was not boiled must be used. After such conflicting opinions, I should much like Work to decide the question, as I do not wish my house to have a dead, flat appearance a few weeks after it has been painted, but to look after two or three years as if it had been varnished. Perhaps, therefore, some of your practical correspondents will kindly inform me with certainty how the desired end can be accomplished. Also what good iron gutter for rain from the roof ought to cost per foot or yard."

### II.—Questions Answered by Editor and Staff.

**Field's Boiler.**—E. S. (*Birmingham*).—I do not know the registration number of this boiler, but you can obtain all particulars regarding it from Messrs. Lewis, Olrick & Co., Leadenhall Street, London, E.C.—F. C.

**Contributor's Address.**—R. A. B. & Co. (*Kensington*).—We do not give the address of any contributor. Send a stamped, sealed, and addressed letter, and it shall be forwarded.

**Paper for Stencil Plates.**—Stencil.—I am not aware of any paper specially made for this purpose; that in ordinary use is a stiff cartridge. To make it resist moisture from the colour and endure wear, some persons soak it in linseed oil, others go over it with "knotting." This latter is to be preferred. Knotting is used for going over knots in wood before painting, and may be bought at the colourman's. Another useful paper for stencil cutting is that known as "oiled foolscap." The original use of this is to lay between the sheets in the copying-press, and the larger stationers sell it. Its character is that of a thick tracing-paper. A drawn or printed design can be seen through and traced upon it, which is often a great advantage. It needs no further hardening.—S. W.

**Mirror.**—Old Furniture.—To re-silver the parts of the mirror which have been scratched will be a difficult job, but if you wish to have a try, the silver process will be decidedly the best. You must make up two solutions, as follows: Dissolve 75 grains of nitrate of silver in 3½ ozs. of water; add dilute ammonia cautiously until the precipitate is nearly dissolved: there should be a small quantity undissolved at the bottom. Should too much ammonia have been poured in so as to take it all up, a drop or two of silver solution must be added, then shaken well and left to settle. Bottle and label A. Second solution: Dissolve 15 grains of nitrate of silver in 6 drams of water, and warm the solution. Next dissolve 12 grains of Rochelle salt in 3 drams of water, and when completely dissolved add to the silver. Stir well, and set to boil for about ten minutes; filter hot, and make up to 16 ozs. with distilled water. Bottle and label B. Form a wall of beeswax or putty round the spot to be silvered, mix half of A and half of B together, and pour on the glass. Let it stand about an hour, then wash carefully. One great difficulty will be to clean the glass, as it ought to be chemically clean for the silver to deposit properly. This is done by washing with potass water, acid, and alcohol, and washing with water between each operation, finishing off with distilled water.—W. E. D., Jr.

**Mosaic Work.**—H. F. B. (*Barking*).—The pieces of glass for this, perhaps, you will be able to obtain of Messrs. J. Powell & Sons, Whitefriars Glass Works, Temple Street, London; or if not, they will, I think, be able to tell you where to get it. Write to them, *enclosing stamped envelope;* you can, if you like, refer to this answer.—W. E. D., Jr.

**Scrapers.**—Hodge.—Yes, surfaces can be got up more accurately with a scraper than with the finest files; but as the files cut faster than the scraper, this last tool should not be resorted to till the surface-plate and straight-edge show the surface is nearly true. There are many kinds of scrapers. Take an old "three-square" file—a large saw-file will do—say 5 in. long; grind the point for about 1½ in. on each of the three sides till the teeth are quite gone and the ground surfaces are very slightly rounded. Now rub them on an oilstone till each of the three edges is quite smooth and nearly, but not quite, straight. Now you will find you can scrape cast iron, steel, and wrought iron surfaces, taking off the metal just where you want to. For brass, the three-square scraper is too greedy, as it has an angle of about 60°. For this metal take an old flat file—a 6 in. file would be suitable—about ¾ in. wide; grind the end of this off perfectly straight and square, then it will be perhaps ⅛ in. thick; this must be reduced to about $\frac{1}{32}$ in. by grinding the flat sides. Thus you will obtain two edges, which you must finish, as before, on an oilstone till they are perfectly smooth and very nearly straight, just slightly rounded when laid on a flat surface; the end surface must also go on the stone by rubbing it while in an upright position. On wrought iron the scraper will not cut very smoothly without a little water or oil. These two scrapers are quite sufficient for all the work on the ¼ horse-power engine. The gentleman who lives at "the Hall House" could give you much useful information.—F. A. M.

**Finishing Turned Surfaces.**—Hodge.—I don't know how to give a short answer to this. If you only want to do such work as is required in the ¼ horse-power engine, you can do very well without any scraping in the lathe except for brass. You can scrape brass with the flat scraper just described if you put the T-rest a little way off, say ⅛ in., and then apply the scraper, with the handle held high and the point of the tool pointing down below the centre of the work. This causes the edge to present in a proper way, and also gives some elasticity, which absorbs the vibration. In the slide-rest you would require a spring tool; but as I don't think you need one, I will not describe it here. If chattering occurs in brass, you can remove it by taking a light cut with a point tool, or with a file, used as the work is running in the lathe. For finishing small iron work when turned and filed smooth in the lathe, you can do well enough with two grades of emery-cloth; but if you want to polish a larger surface, such as the rim of a 16 in. fly-wheel, take a piece of deal about ⅞ in. square and 1 ft. long, oil the end, and dip it into coarse emery powder; squeeze the powder into the wood, then put up the hand-rest and use the wood polisher like a tool, pressing it hard against the revolving surface. It takes some time to get a nice polish; the emery has to be constantly renewed, as it drops off the stick. It is hard work, and very dirty, and it will never do to let the emery powder get into your slides or mandril collar. Be very careful about this. You might as well have arsenic loose in the kitchen as have emery powder loose about a lathe. This stick is chiefly useful in curved hollows, into which it soon fits itself.—F. A. M.

**Shafting.**—Hodge.—Shafting can be turned on an ordinary slide-lathe, but it would be done at about half the cost on a special lathe made for the purpose. These have several tools working at once—for instance, there might be a *roughing* tool, adjusted to remove the bulk of the surplus metal, and then would follow, on another slide, fitted on the same saddle, a *finishing* tool, and then the travelling back-stay. The action of the finishing tool would, of course, be carefully watched with callipers, lest the edge should get damaged, and so the diameter of the work should increase. The turner would follow the finishing cut himself with a file and a ring gauge, filing till the ring gauge would pass. The ring gauge itself might be a trifle too large, and then the clamps would be used to grind the whole shaft to the exact size of a second and true ring gauge. Nothing like the same degree of accuracy can be attained by callipers.—F. A. M.

**Hollow Rose Cutter for Making Pins.**—Hodge.—I don't know of anything better than a rose cutter for making ⅝ in. pins from ¾ in. bars. If yours causes the work to jam, that must be because the mouth is too large. Probably it was drilled from that end, and where a drill enters is generally a little larger than the main part of the hole. This might have been prevented by turning away about ¼ in. at the end before cutting the teeth; *now* you might make a grinder to enlarge the hole a little, so as to leave it a little the smallest at the front end. A wooden grinder should do it. Turn a peg ⅝ in. in diameter, bore a hole up about ½ in., then saw it down the middle. Now make a taper pin to drive into the ¼ in. hole, so as to expand it as it wears away. That should grind it out well enough.—F. A. M.

**Incubator.**—F. B. J. (*Liverpool*).—A description of a hot-air machine may appear in the course of a few months. A description of a canvas canoe appeared in No. 80, Vol. II.—Leghorn.

**Rearer.**—No Name (*Maidenhead*).—Your wish may be gratified in the course of the next few months. An article on the subject is in hand.—Leghorn.

**Microscope.**—(1) Micro has a brass tube with a spring and a wooden thimble with lenses, and wants to know how to use it as a microscope. I am afraid I cannot assist Micro. *Is* it a microscope? If so, what about object lens? Is it not rather a part of some kind of instrument or toy? If I could see it I could give better judgment. (2) "Should I need Canada balsam to make objects transparent?" Objects are rendered transparent, and the balsam is used as a transparent cement. (3) "Can I use the cheap camera lucida, recently described, to sketch with?" A camera lucida is used for that purpose, but I do not think you could use it with the instrument you described, as an instrument is needed that has a steady stand or clip for holding the object to be sketched, also focussing arrangement. If the instrument Micro has is a microscope, or part of one, I judge it is nothing more than a simple instrument to use in the hand for examining objects such as flowers, etc.—O. B.

**Bicycle.**—E. G. says that he wishes to build a safety of the "Referee" pattern. The cut of machine shown in his letter is not a "Referee" pattern, but an "Impetus," by the St. George's Cycle Co. As I do not happen to have a "Referee" by me, I cannot give exact measurement of tubes, but the same lengths will make either frame. Accurate lengths cannot be given without a full-size drawing of the machine. Lengths to make the above frame or a "Referee" may be set down as follows, all the tubes being 18 B.W.G.: A, 19 in. × ⅞ in.; B, 16 in. × 1½ in.; C, 16 in. × 1¼ in.; D, 9 in. × 1⅛ in.; E, F (two of each), 16 in. × ¾ in.; tube inside steering barrel, 11 in. × 1 in. With regard to brazing, ample instructions are given in Work ("Safety Bicycle Construction"). The bottom bracket is brazed to the tubes with the end cups left out. These are afterwards sweated in with soft or tinman's solder. If the bracket has no cups, but simply the ends hollowed out for the balls, they, of course, get softened by heat in brazing, and must be hardened by tempering afterwards, when the hollow for the balls is very likely to get out of truth in the process, and the same with the ball-head. To harden, heat each end separately to dull red, and plunge in water.—A. S. P.

**Dark Slide.**—Newcastle-on-Tyne.—Slides for detective cameras are not particularly difficult to make. The protection afforded by the camera permits less accurate workmanship than in other kinds of slides. Very serviceable ones can be made of blackened cardboard and ferrotype plate. Procure some stout, hard cardboard, and cut out some pieces—as many as the number of slides you propose making—half an inch larger in length and

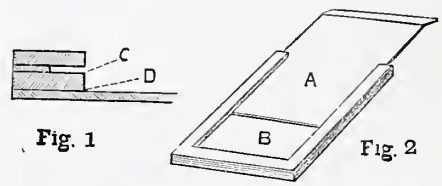



Fig. 1 Fig. 2

**Fig. 1.—Section of Home-made Dark Slide for Camera—C, Groove; D, Recess. Fig. 2.—Slide Complete—A, Shutter; B, Recess for Plate.**

breadth than the plates to be worked. Cut some slips of cardboard a little thicker than the glass of the dry plate, and a quarter of an inch wide, and glue them on to the edges of one side of the card to form a shallow cell to receive the sensitised plate. On these slips fasten other slips made of thinner cardboard on three sides, one-eighth of an inch wide, and on these again other slips a quarter of an inch wide, which will thus leave a groove for the shutter, which is to be made of a ferrotype plate bent at one end to form a cap to the slide, and act as a protection from the light. A coating of lamp-black in gold size, made to the consistency of paint, will complete the matter. The accompanying diagrams will show a section of the frame (Fig. 1) and (Fig. 2) the slide complete.—D.

**Transferring.**—R. W. D. (*Ardwick*).—In the first instance it is necessary to make a negative of the picture to be transferred in the usual manner, for, whatever process is afterwards adopted, much depends on the purpose for which the impression on wood is required (whether for blocks for printing or merely decorative purposes), or to the most suitable process. A slight sketch of how to do it is, firstly, to prepare the wood with a coating of chloride of ammonium in a weak solution of gelatine; drying; then sensitising by brushing over it a strong solution of silver nitrate, in a room lighted with a yellow light, and drying in the dark. The negative is then placed in close contact with the dry surface, and exposed to the light sufficiently long to print the image, which is afterwards washed and fixed in hyposulphite of soda solution, washed again, and dried. Or carbon tissue can be used, and the image transferred from the tissue to the wood direct, in the usual manner of carbon printing. Either process requires a certain amount of knowledge of photographic manipulation to be successfully conducted.—D.

**Simple Camera.**—Camera will find a working drawing of a camera in No. 13 of Work. The size and principles involved are pretty well the same in all cameras, the difference being in the workmanship and finish bestowed. In reality, a camera is neither more nor less than a collapsible box with a lens at one end and an arrangement for holding the plates at the other, so that the lens and plate may be approached or separated from each other at will. Why not get one of the numerous handbooks on photography already published? Your suggestion shall be considered.—D.

**Carpenters' Bench Maker.**—J. O. H. (*Wandsworth Common*).—The address of a man who makes all classes of benches, and whose business is an old-established one, is: Mr. Hollis, 286, Old Street, Shoreditch, E.C.—J. S.

**Telescope.**—G. C. B. (*Echuca, Victoria*).—Mr. Clarkson, 28, Bartlett's Buildings, Holborn Viaduct, London, deals in second-hand telescopes. It does not appear that he publishes a catalogue of instruments on hand, as these must, of necessity, be continually varying in character and quantity; but I cull the following particulars from a memorandum sent me in reply to a letter addressed to him on your behalf. From this I find he has a 6 in. object glass by Wray, partly mounted, can be completed for £50; a 4 in. on hand at £20; also has knowledge of a 5 in., owned by a gentleman, who wants £55 for it. These are refractors. In reflecting telescopes, he has an 8½ in. equatorial at £20, which cost £60 from Mr. Calver, and a 12½ in. reflecting equatorial at £55, priced in Browning's catalogue at £248. Eye-pieces or powers are 15s. each. Of course, any or all of these are liable to be sold ere this meets your eye; but the above will serve, in some measure, to indicate the probable outlay necessary for the purchase of an instrument such as you require. Meanwhile, I would suggest that in future communications full particulars should be given as to mounting, powers required, etc., also (seeing that you only give aperture and focus) whether a refractor or reflector is intended, as you will observe there is a very substantial difference in price between the two types.—T. R.

**Arc Lamp for Alternating Current.**—W. T. (*London, N.*).—The makers of the Brockie Pell, the Crompton, and the Brush arc lamps adapt their lamps to suit alternating currents. Either or all of these are good lamps. If you wish to know anything respecting the behaviour of these lamps, write to Messrs. Crompton, Chelmsford, Essex, on matters relating to the Crompton lamp, or to Messrs. Woodhouse & Rawson, United, Limited, 88, Queen Victoria Street, London, E.C., who are agents for the sale of a large variety of lamps.—G. E. B.

**Price of Covered Wires.**—J. B. (*Bradford*).—Nos. 18 and 20 d.-c.-c. copper wire command a price varying from 2s. 4d. to 2s. 9d. per lb. It can be obtained from any dealer in dynamos and electrical goods. Wire-makers do not care to supply small quantities of wire to amateurs at any price, and dealers must be paid for their trouble in getting the wire from the makers.—G. E. B.

**Electro-plating.**—J. G. (*Liverpool*).—A short series of articles on "Electro-gilding and Electro-plating" such small articles as those which fall to the lot of watchmakers and jewellers to deal with, were published in WORK of April 4th and 25th and May 5th, 1891. The "Electro-platers' Handbook," price 3s., has been highly commended by practical men, who say it is the best book for amateurs and beginners in the art of electro-plating. It is published by Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C.—G. E. B.

**Brass Ferrules for Fishing-rods.**—W. S. (*Pontefract*).—Messrs. T. C. Hughes & Son, fishing-tackle manufacturers, Redditch, will supply these *wholesale*. Your better plan will be to order them through some local dealer in fishing-tackle.—S. W.

**Wood-pulp Paper.**—H. D. (*West Norwood*).—Messrs. J. Spicer & Son, importers of foreign papers, 120, Edmund Street, Birmingham, might be applied to. They have a reputation for supplying these foreign papers on lower terms than the London houses.—S. W.

**Harvest Festival Decorations.**—A SUBSCRIBER.—In decorating for a harvest festival, the idea is a grateful acknowledgment of the Divine blessing on the labours of man. The fitness of things, therefore, seems to demand that the first and most important place should be given to such of the food products of the earth as can be used with decorative effect, and that next to these should come cultivated flowers, also a result of man's industry under the Divine blessing; but that wild flowers, the spontaneous gift of nature, should only be used sparingly, as being less appropriate to the occasion. This would be my view of the case, but the subject is not one on which to be dogmatic. A SUBSCRIBER should read the articles on "Temporary Decorations for the Interiors of Buildings" in WORK, Vol. II., pp. 510 and 552, in which harvest decoration has been dealt with.—A. Y.

**Paper Wheels.**—W. H. K. (*No Address*).—The so-called paper wheels are of iron for tire, flange, and hub. The intervening space between hub and tire is so formed as to retain a composition similar in some of its constituents to paper, but not actually paper as we generally regard it, being a composition of tough, fibrous pulp, said to be forty-four parts of pulp, to which is mixed one part of starch, one of gum, one of bichromate of potash, and three of benzine. Linseed oil and glue also form part of the composition, which is forced into the wheel between the hub and tire by hydraulic power, and the pressure kept on till the material is set. This composition has been found to yield at the hub, and allow it to get loose before the wheel is worn down, so that the composition must be renewed or the wheel cast aside as useless. It is found to be essential that some form of radiating spoke attachment to the hub is necessary to ensure long life to such a wheel, which, after all, has the composition in the most non-essential part of it. Wood is used to fill in the space sometimes, but that does not constitute it a wooden wheel.—J. C. K.

**Distance Register.**—KILOMÉTRIQUE.—The municipality of Paris, which determines the traffic management of Paris streets, and the regulation of hired vehicles traversing the city, are now trying

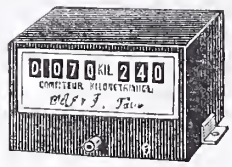



Fig. 1

Fig. 2

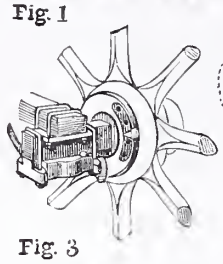


Fig. 3

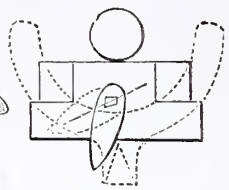


Fig. 4

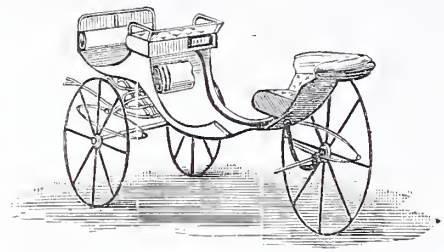


Fig. 5

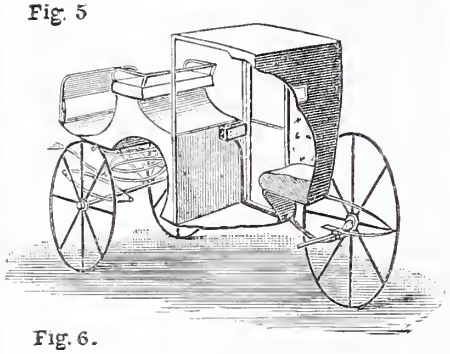


Fig. 6.

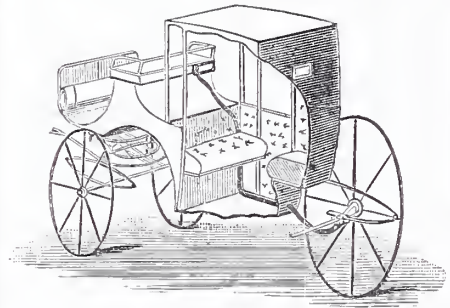


Fig. 7.

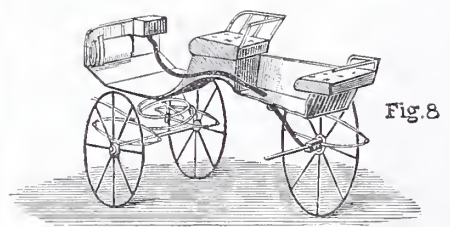


Fig. 8

Fig. 1.—Register of "Compteur Kilométrique." Fig. 2.—Wedge on Nave. Fig. 3.—Mode of applying Wedge. Figs. 4, 5, 6, 7, and 8.—Sketches showing Modes of fitting Register on Vehicles of different kinds and forms.

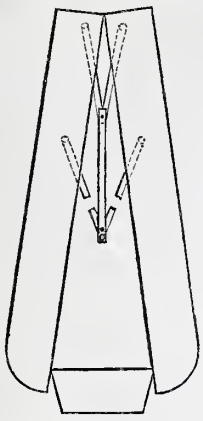
several competing systems of "distance registers," and at the beginning of the new year will report on them, and if one is more efficacious than others, will probably authorise its adoption by the Paris cab companies, so that the law of compulsion to use them is irrevocable till the municipality chooses to rescind or alter it. Amongst several registers now on trial, or are patented with the view to ulterior adoption, some indicate fare to be paid, as well as distance travelled; some the time occupied on a journey, and for parcels, register the weight carried, etc. Amongst the many is a distance register known as "Compteur Kilométrique," by Boiquand et Fils, 127, Rue Oberkampf, Paris. It is simple in form, and follows nearly, in its constructive application, most wheel-operating mechanism for the same object. The register is contained in a small box, about 4 in. by 4 in. by 5 in., with the statement of distance on the front, as shown by diagram, Fig. 1. Its action is pneumatic in its motor of transmission. This is fixed on the inside front rail of a single brougham, just under the rail of the glass-rest known as the "belt-rail" in the trade. (Fig. 6.) For an open vehicle it is fixed at the back of the coachman's seat; for a double brougham the same position is best, being out of the way of the backs of the front-seat riders; also for Victorias. For a phæton the dash-iron is used to attach the register to, as is shown severally by Figs. 7, 5, and 8. The plan of attachments, of course, varies with the vehicle, but the main device is by screwed clips, holding a box of transmission under the axle (as in Fig. 3), close to the back of the nave of one of the hind wheels of a four-wheeled vehicle, as shown by Fig. 4. A wedge (Fig. 2) is fixed on the back face of the nave, just inside the nave-hoop, as shown in Fig. 3. A pawl is struck by this wedge once in every revolution of the wheel: this acts in compressing the air in an indiarubber tube, which communicates its impulse to letters on the dial of a register forming the index. This tube is protected by a casing of copper pipe, carried from the axle inside the body under the lining up to the register.—J. C. K.

**Covers for WORK.**—J. H. (*Wolverhampton*).—The pasteboard covers were suggested as temporary means to keep the numbers clean until binding time comes. Your wish is that the advertisements could be relegated to covers, on the plea that as the numbers are now constituted the advertisement pages must of necessity be bound up with them. Otherwise, if they were cut away the front page of each number would be set adrift. There are more ways than one of killing pussy, and I have always found that if I am dead set on carrying out any laudable desire I can generally manage it in one way if not in another. You can cut away the 15th and 16th pages, leaving a narrow strip of paper to paste along the inner edge of page 14. This will secure the front page, and accomplish your purpose. Or you might annex a leaf, which would give you two blank pages for memoranda. Never mind the gaps in the pagination; there will be no reference to them in the index.

**Camera Obscura.**—BRIGHTON BIRD asks for the most simple way to construct a camera obscura 10 in. by 20 in.; also the way to make small paper balloons, material used, etc. If BRIGHTON BIRD has, or could procure, the fourth volume of *Cassell's Popular Educator* he would there find the subject treated more fully than can be done in "Shop." With reference to the camera, I presume it is 10 in. wide and 20 in. long. In one end a central hole must be cut to receive a focussing tube carrying a lens, which must have a focus a little more than the combined length and depth of the box. At the opposite end to the one carrying the lens, one-half of the top must be removed and replaced by ground glass, the rough side outside. A mirror is fixed in the box, slanting from the back at an angle of 45°. The light passes through the lens, and pictures the object on the mirror, which reflects it up to the ground glass. Under ordinary circumstances, the diffused light in the room would render the picture very faint; to prevent this, a hinged flap with side pieces is placed in front of the ground glass on the outside, which puts the picture in the shade, and thus allows the details to appear. The essentials are a lens with adjustable tube, mirror placed at an angle of 45°, and a ground glass plate to receive the picture; all else must be a matter of taste or cost. It may be said that there are many modifications of the instrument, but the one given is the simplest. *Balloons.*—I have made these toys, but not for many years. The material I employed, and what is generally used, was coloured tissue-paper. Decide the size of the balloon, and cut the gores accordingly. I fastened the pieces with gum. The making is a very simple affair, requiring more patience and gentle handling than anything else.—O. B.

**Re-charging Accumulators.**—W. J. D. (*Manchester*).—The plates which show white or milky patches have been discharged too much. The set of cells must never be discharged below a mean pressure of 2 volts per cell. If you fully discharge any of the cells, the plates will be ruined by the formation of lead sulphate. Test them when you think the charge is nearly run down, and re-charge any cell giving a less pressure than 1·9 volts. Sir David Salomons, in his book on the "Management of Accumulators," says:—"There must always remain about 25 per cent. of the total charge the cell is capable of taking, otherwise troubles arise." Did you re-charge the battery before you emptied the cells of acid? If not, you should have done so. You should also keep the cells charged when standing idle, by sending currents through them every day or two. The colour of the plates should be the same after re-charging as after the first charging. Your remedy now is to overcharge them with a reduced volume of current some few hours more than usual.—G. E. B.

**Parallel-acting Bench Vice.**—S. AFRICA.—The vice referred to is one that is in use, though but little known, and has acted properly with heavy work of carriage making, so that yours should do the same. I will help you to a comprehension of your difficulty, and explain the principle which determines the parallelism of the jaws under screw pressure with anything held tight at the upper parts. The diagram (Fig. 1) shows the jaws with a block of wood in, and the screw applied, with such excess strain put on it that the top parallel irons are rent apart. This would be the result if the joint-pins in the vice did not yield from their fixings. It is possible your joints spring, or are too loose, or the lower diagonal irons are a little short. To remedy any of these defects, have them a little longer than the upper ones, but they must be only so to a trifling degree, which will be compensated for by the slight free-play of the joints and fixings.—J. C. K.



Parallel-acting Bench Vice.

**Oil for Gas Engine.**—W. J. A. (*St. Helens*).—We use an oil specially made for Messrs. Crossley, the makers of the Otto gas engine. This is all that could be desired. Vegetable oils of a low flash point clog the piston and cylinder with carbon. Castor oil is unsuitable.—G. E. B.

**Heating of Dynamo Machine.**—W. J. A. (*St. Helens*).—If a shunt- or a compound-wound machine is run without a load—that is, unconnected to any work in the outer circuit—all the current generated in the armature coil is sent through the shunt coils on the field-magnet cores, and there is a consequent heating of the brushes, as evidenced by sparks from them where they touch the commutator. If the brushes are taken off from any machine, whether shunt, series, or compound wound, there will be no current passing through the coils, nor any heating of the machine from this cause. If your friends have observed a rise of temperature when the brushes have been taken off, this rise must be due to increased friction of the spindle on the bearings, consequent upon increased speed of the spindle. I cannot think of any other cause, and this would be insignificant in a well-made machine.—G. E. B.

**Engine without Valve or Eccentric.**—BONZO.—Oh, BONZO! how could you write to us on such a piece of paper! It surely comes out of the dust-bin. Yes; you can make a little oscillating engine, like those in the toy-shops, without either valve or eccentric. You will see a drawing of the parts, etc., of this in WORK for November 30, 1889, p. 589, Vol. I.—F. A. M.

**Monogram for Fretwork.**—T. W. C. (*Wolverhampton*).—I have drawn the T and C in outline to show that they are practically the same as the T

Monogram for Fretwork—T.W.C.

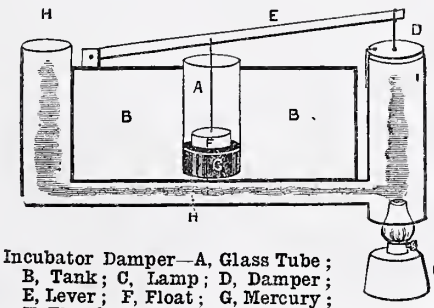
and G of the monogram T.M.G, appearing in No. 104, p. 813, and by sloping the sides and slightly rearranging the centre of the M, produced the W. If T. W. C.'s eye is sufficiently trained, and he possesses intelligence and patience enough to pierce an elaborate portrait frame, I should have thought him capable of making these trifling alterations himself.—A. C.

**Voltage of Dynamo.**—W. J. D. (*Manchester*).—Your dynamo is evidently a compound-wound machine. Consequently, when you are taking the full current of 35 amperes from the machine, this volume of current is passing through the field-magnet coils, and strongly magnetising the fields. If the normal speed of 920 revolutions per minute is maintained at this time, the voltage of the current will also rise, because the armature coils revolve in a more intense magnetic field and cut stronger lines of magnetic force than when the field-magnets were less strongly magnetised. I am not well acquainted with the machine named by you, so can only surmise the pins you mention to belong to a set of resistances restricting the output of the machine.—G. E. B.

**Candle-making and Tallow-refining.**—W. G. (*Bradford*).—I am unable to point out any book on this subject, but there are interesting and useful articles upon it in "Cassell's Household Guide," Vol. III., pp. 143 and 161.—M. M.

**Honey Extractor.**—S. L. (*Haslemere*).—If you procure Nos. 77 and 81 of WORK, you will find, at pp. 395 and 465, descriptions of the "Little Wonder" and "Cylinder" extractors. If you take up bee-keeping, I would strongly advise you to get Vol. II. of WORK, and read the papers on "Hives and other Apiarian Appliances" running through it. I shall be most happy to help you in any way.—APIS.

**Incubator Damper.**—R. T. (*Sunderland*).—The gas regulator does not work a damper, but the expansion of the mercury cuts off the supply of gas. Before R. T. will see this, he will have seen a section of Hearson's patent incubator, which does depend on the action of a damper for its efficiency, the temperature, when it rises above the desired point, causing the current of hot air from the lamp to pass straight away and not heat the tank of water. Any chemistry book will tell the boiling points of various fluids, but the special fluid used



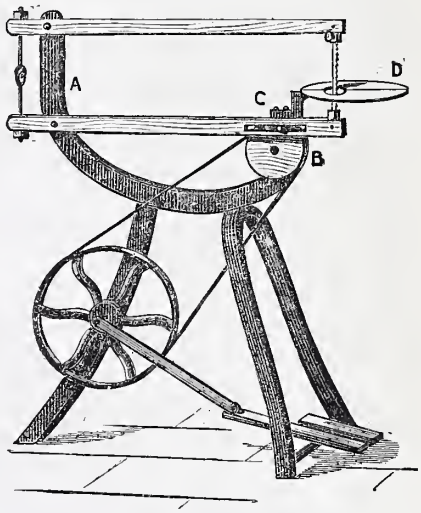

**Incubator Damper—A, Glass Tube; B, Tank; C, Lamp; D, Damper; E, Lever; F, Float; G, Mercury; H, Flue for heating Tank; I, To let off the Heat when Damper rises, which it does when Mercury expands.**

by Mr. Hearson is his discovery, and the vital part of his patent. R. T. can no doubt find other fluids to answer the same purpose, but I am not sure whether he may copy the invention of Mr. Hearson so closely. I think benzoline would come nearest the required temperature, but mercury might be used, according to enclosed sketch. Though I am always glad to help the readers of WORK, this is not a precedent to show that I can invent a scheme to assist everyone who is in a difficulty. It is not always possible.—B. A. B.

**Dark Slide.**—R. I. L. C. (*London, E.C.*).—The simplest plan is to get some good hard eight-sheet cardboard; cut a piece the same size as the focussing frame, glue some strips on to the face of it round the edges, so that a cell is formed in which the sensitive plate can be placed. On these strips glue others half the width, and again on these some wider ones, so that a groove is formed in which a piece of cardboard, to act as a shutter, can slide up and down. Cover the shutter with cotton velvet, and let it project ½ in. beyond the top of the rest part, so that it can be pulled out for exposure. The whole should be painted over with Bates' black varnish. In this manner a useful dark slide may be extemporised. Care, of course, must be taken to have the dimensions accurate to suit the camera, and so that the plate will occupy the same position as the ground glass of the focussing screen. Also the fitting of the cardboard must be good, so that all stray light is prevented from access to the plate. —D.

**Camera.**—QUÆSITOR.—(1) The camera and lens mentioned is a serviceable article, and very good work can be done with it. (2) Single portraits can be taken with these lenses; the drawback is that the exposure is somewhat long. The rapid rectilinear lens is better in two respects—absolutely straight lines are given, and the aperture of the slot is much larger, of course, working so much more rapidly. (3) Yes. (4) The price mentioned is low; consequently lenses by the best makers are not available, as they would exceed this figure. Only trying a lens will ensure that it is suitable for what you want, as the cheaper lenses vary very much in quality; very good ones may be had. Why not try Morley, Islington Green, or Sands and Hunter, Cranbourne Street, for a second-hand one? (5) Yes; but a short focus lens is most suitable for enlargement. A long focus lens requires a long distance between the lens and the focussing screen, which is sometimes inconvenient.—D.

**Fret-Machine Saw.**—HOMERTON.—With reference to my reply to you (see page 765, No. 99), the following illustration should have accompanied the text:—You will see that the arms are riveted to the framework (A). About an inch from the centre




Fret-Machine Saw.

of the wheel (B) a small pin is fixed, which works in a slot of the arm (C). There is a small grooved wheel fixed under the table (D) to steady the saw when running; perhaps that is where you have managed to get your idea that the saw is fastened to a wheel. —W. R. S.

**Luminous Flame Gas Stoves.**—W. P. (*Southport*).—You can obtain luminous flame gas stoves from almost any maker of gas-heating appliances. Try Messrs. Clark & Co., Park Street Works, Islington, N. I have been unable to trace the company you mention, but possibly you may obtain the information you require through the *Gas and Water Review*, published at 22, Buckingham Street, Adelphi, W.C. It will be sent post free for 3d.—T. W.

**Developer.**—STOP.—The developer may be obtained of Mr. G. W. Secretan, 210A, Tufnell Park Road, N., in bottles, 1s. and upwards. In compound lenses, the best position for the stop is midway between the front and back combinations. The nearer the stop is placed to the back combination, so much more is the area of illumination increased and the field made less flat. If the stop is nearer to the front combination, the area of illumination is reduced, with a corresponding increase in the

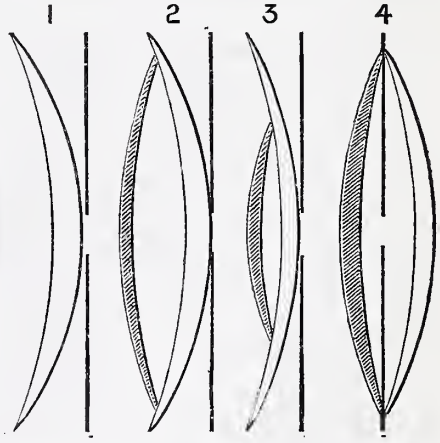



**Diagram showing Construction of Ordinary Spectacle Glasses for Photographic Work. No. 1.—Single Lens Long Focus; No. 2.—Medium Focus; No. 3.—Wide Angle or Short Focus; No. 4.—Medium Angle. The convection shown is greater than that usually found in Spectacles in order to show it more distinctly. The straight line shows the position of the Stops.**

flatness of the field; but in the case of portrait combinations the alteration is not very pronounced, and a spot midway between the two is generally chosen. When single lenses are used for portraiture or landscape, the stop should be placed in *front* of the lens, at such a distance that the area of illumination is just sufficiently large to avoid dark corners.—D.

### III.—Questions Submitted to Correspondents.

**Upholstery.**—A NEW SUBSCRIBER would like to know of any book on upholstery and decorative drapery. Also where it can be had, price, etc.

**Tuck Pointing.**—SLATER writes:—"Will any practical reader inform me, through the pages of 'Shop,' how tuck pointing is done? Also what materials and tools are required."

**Photo Sizes.**—J. A. MCL. (*Glasgow*) writes:—"I would be very thankful (should you consider them worthy of a place in 'Shop') if you would insert the following questions:—Would any reader supply me with a list of photo sizes—that is, after the photos are trimmed and mounted? My purpose is to have a list of those sizes to assist me in my work of cutting mounts; also how to prepare gold paper for edges, and bronze solution for line on mounts?"

**Cement.**—J. J. (*Ottawa, Canada*) would be glad to hear of a cement that would join the fancy ebonite handles of umbrellas when broken.

**Oil Engine.**—E. A. (*Ashford*) writes:—"I should be glad of readers' opinions upon this point. Many gas engines have one or more holes round the cylinder, which the piston, in its passage through the cylinder, alternately covers and exposes. These holes communicate in the Dugald Clerk engine with exhaust, and in the Maxim engine with supply, so obviating the necessity for further mechanism for exhaust or supply respectively. Is there any important condition to be observed in making such escape and supply parts—for example, must each piston ring, and each division between the rings, be broader than the holes so used as ports to prevent catching? And might such holes be made ¾ in. in diameter, the cylinder being 5 in. in internal diameter? Also would it be necessary to arrange that the split part of each ring should not pass over the holes?"

**Wicker Stains.**—A. B. (*Westminster, S.W.*) writes:—"I have a wicker chair as good as when I first had it, but the stain or brown colouring has rubbed off, and it looks bad. Will some reader kindly tell me how to colour it afresh?"

**Heating Room.**—C. J. P. (*Derby*) writes:—"I have a room about 8 ft. by 5 ft. by 9 ft. high, which I want to warm cheaply. Can it be done in some way with a box of lime? It is used as a study, and lighted by a duplex oil lamp. A stove of any kind would be disagreeable in such a small room."

**Tool Kits.**—JERRY will be thankful to anyone who will give him a guide to a handy kit of tools for use for odd jobs in carpentry, soldering, painting, glazing, and shoe repairs.

**Kites.**—H. N. (*Ipswich*) would be glad to know if any correspondent can inform him how to make ornamental flying kites representing birds, men, etc., or how kites of large proportion, equal to drawing small loads, can be made; and where books on the subject can be obtained.

### IV.—Questions Answered by Correspondents.

**Draughtsmanship.**—H. B. P. (*Hendon*) writes, in reply to NEMO (see Vol. II., page 686):—"In answer to above, the only book I know of is 'The Draughtsman's Handbook,' by André, published by E. & F. N. Spon."

**Coating for Damp Walls.**—THE AUTHOR OF "EVERY MAN HIS OWN MECHANIC" in reply to R. A. P.'s inquiry on this subject, wishes to call his attention to the following extract from the book named, which will afford a sufficient reply with regard to the proportions of the ingredients to be used:—"The writer has found nothing better or more effectual (as a coating for damp walls) than a solution of shellac and naphtha in the proportion of about four ounces of the former to a quart of the latter. This solution, when applied to the damp surface of the plaster, almost immediately hardens into a varnish impervious to water, and as soon as it is hard and dry the wall paper may be pasted to it. It gives a reddish colour to the wall, but this matters little, as it is covered over and hidden from view by the paper. The smell of the naphtha is most unpleasant; but, fortunately, this soon passes off, and the inconvenience falls chiefly to the share of the workman who applies the varnish."

**French Polishing.**—F. C. B. (*W. Brighton*) writes:—"Having noticed that T. A. (*Belfast*) asks for a preparation to prevent the oil coming through the polish, after polishing—put a rubber of patent glaze on; this is what I have used in the shop for years, and found it answered."

**Cylinder Marine Engine.**—C. J. W. (*Beccles*) writes as follows in reply to BON FIL:—"Let me advise BON FIL to send to J. Sutcliffe, Leek, Staffs., for his illustrated catalogue of model engines, castings, etc., price 3d., post free. 1½ in. bore and 1½ in. stroke would give him ample power. If he intends to have a twin-screw engine, ¾ by 1 in. would probably suit. He can get all parts with link motion reversing gear, either in rough or part finished, from J. S., who will also send him drawings of boiler supplies, instructions with castings, which are brass, and which I have found easy to fit, having made a nice-looking launch engine."

**Safes and Safe Locks.**—ONWARDS (*Nottingham*) writes, in reply to INQUIRER:—"I have been a subscriber to WORK from the first, and I like it very much. It is thoroughly practical. In a comparatively early number of WORK I notice that a correspondent (INQUIRER) is asking for advice about opening safes. The best way, if it is possible, is by picking them. If he will order a book called 'Lock Construction,' published by Crosby Lockwood (London), he will there find an apparatus invented by Mr. Hobbs, an American, who came to this country some time ago, and astonished Chubbs's by opening their lever locks. When there is a hard steel plate fixed behind the front plate I think they could be softened with a blowpipe or a Bunsen burner. And as to fitting a safe key to pattern, the way to do is to take the exact sizes with a pair of callipers."

**Ink Bottles.**—J. A. G. (*West Rainton*) writes, in reply to INK BOTTLE:—"Let him send to Kilner Bros., bottle manufacturers, Dewsbury, Yorks, for catalogue. I believe the size required by him costs a little over 2s. per gross."

**Frame for Wardian Case.**—J. T. (*Glasgow*) writes as follows in reply to W. P.:—"The frames or astragals for Wardian cases in wood are similar to window astragals for window frames with corner uprights, the glass being set in and bedded with putty. If you wish to set the glass without putty, prepare the wood for astragal without rebate for glass, and make a groove sufficient for thickness of glass to slip into, providing for the introduction of the glass by unscrewing the vase-shaped finials which have a double screw, the one half in finial, the other half in upright astragal."

**Furniture Polish Cleanser and Reviver.**—B. A. B. (*Hampstead*) writes, in reply to C. H. W. (*Hastings*):—"Without knowing the receipt C. H. W. is using it is difficult to advise, but revivers do not usually contain polish. D. A. has twice advised him to omit or reduce quantity of polish. He must omit it altogether if he fails with it, and he is sure to fail by using it for reviver."

**Banjo without Brackets.**—B. F. (*Birkenhead*) writes, in reply to ALPHA (*Birkenhead*):—"The patentee of this is in Conway Street, Birkenhead. The banjo can be seen in his window."

**Pitch of Roofs.**—DUMMY writes as follows, in answer to C. M.:—"I may say that one-third of the span is more generally used as the guide for the pitch of ordinary roofs, though it depends on what they have to carry, tiled roofs requiring a steeper pitch than slated ones, a square pitch being generally used. I have heard one-fourth span indicated in a technical school as being the best. Such a one on a large roof would require very strong timbers. For a lean-to roof, two-thirds span is generally used for the height of the pitch."

**Purchasing Timber.**—A. R. (*Scorrier*) writes as follows in reply to A. J. H.:—"I might say that I have been quite long enough in the trade to know that three 1 in. boards cannot be had from a 3 in. deal, no matter what the understanding may be; and that A. J. H. need not be surprised at my remarks on page 635, Vol. I. As A. J. H. was writing for the instruction of amateurs, it was folly to bring or try to bring them on a level with the professional before he gave them a clear explanation. Supposing the amateur wants the board to hold up ⅛, after he had worked it up and followed the advice of A. J. H., he would find that he had been misled, and that his supposed 1 in. board before it was worked could not have been more than ⅞. My motive in writing as I did was that that the amateur might have a clear understanding, and not to make him equal to the professional before he really was. I may add that at the time of writing my thinking cap was in its right place, and that I am not offended at the observations of A. J. H.; it is only giving light to those on whom the light should shine."

**Organ Building and Parts.**—AMATEUR ORGAN BUILDER writes:—"I see in WORK, No. 128, p. 382, that C. W. T. (*Old Trafford*) wishes information on organ building and organ pipe making. Now, if C. W. T. would call upon me, I may be able to assist him, as I am now building a small four-stop organ myself. I have enclosed you my address if C. W. T. would like to write you for the same."—[If C. W. T., or any other amateur organ builder, is wanting pipes, action, or any separate part of organ work, he cannot do better than apply to Mr. Beales, organ builder, of Limes Road, Croydon, who makes this part of his business a speciality, and has ample plant for turning out every detail in organ construction. His price list is clear and reasonable.—F. J. C.]

**Restoring Leather Chair Seats.**—A. J. (*Faversham*) writes, in reply to ANXIOUS (see p. 366, No. 127):—"If not worn in holes, these may be very satisfactorily restored with Jackson's varnish stains. I have used these several times with perfect satisfaction."

### V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. & Co. (*London, E.C.*); C. F. (*Wellingboro*); J. M. (*Hastings*); P. A. C. (*London*); A. W. W. (*London*); F. W. (*Wernetli*); C. W. B. G. (*Birmingham*); G. P. (*Elgin*); W. S. (*Ilford*); T. R. (*Sheffield*); G. J. W. (*Antrim*); G. F. J. (*Oldham*); PLUSH FRAME; A COUNTRY LAD; IRIS; G. W. C. (*Loughton*); W. S. (*Northampton*); W. L. (*Huyton*); CYCLIST; W. L. (*Hull*); NESCIENCE; J. W. (*South Lambeth*); E. R. (*Battersea*); READER FROM THE FIRST; E. F. B. (*Liverpool*); J. A. G. (*Inverness*); DENNISTOWN; A NEW READER; F. S. (*Kidderminster*); H. L. (*Carlisle*); J. P. & SON (*Hebden Bridge*); T. R. B. (*Newcastle-on-Tyne*); A. Y. (*Deptford*); F. C. S. (*Reading*); TIGER; H. S. G. (*Fulham*); W. J. (*Newcastle-on-Tyne*); BRASS; G. T. (*Bow*); NOVICE; R. A. P. (*South Kensington*); A. MCC. (*Holywood*); AMATEUR; S. N. (*Southsea*).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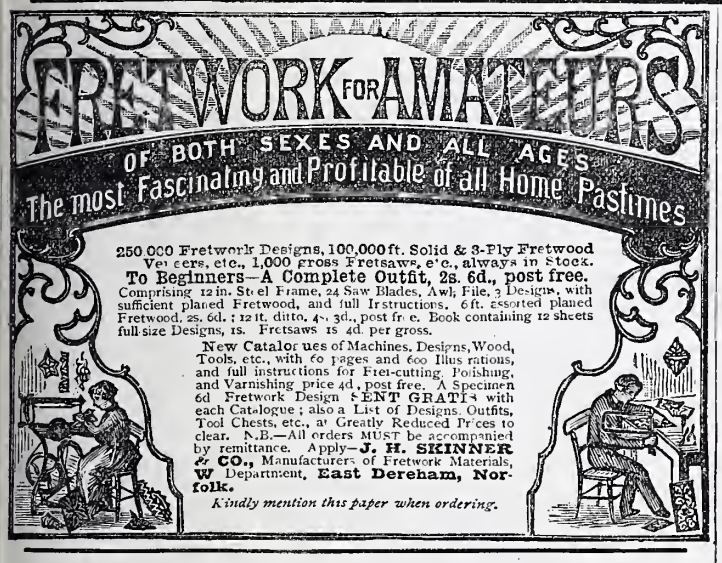


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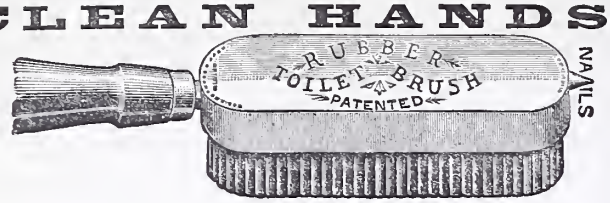


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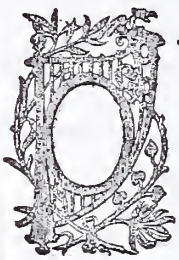

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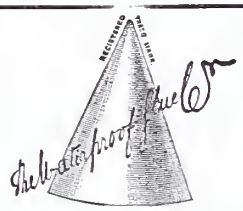


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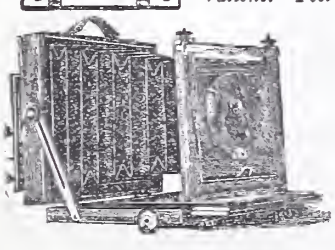

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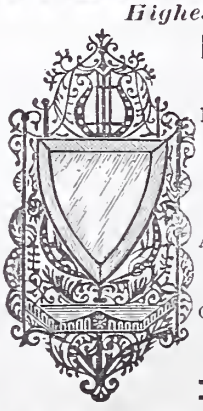

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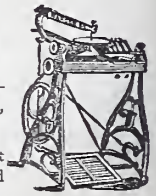

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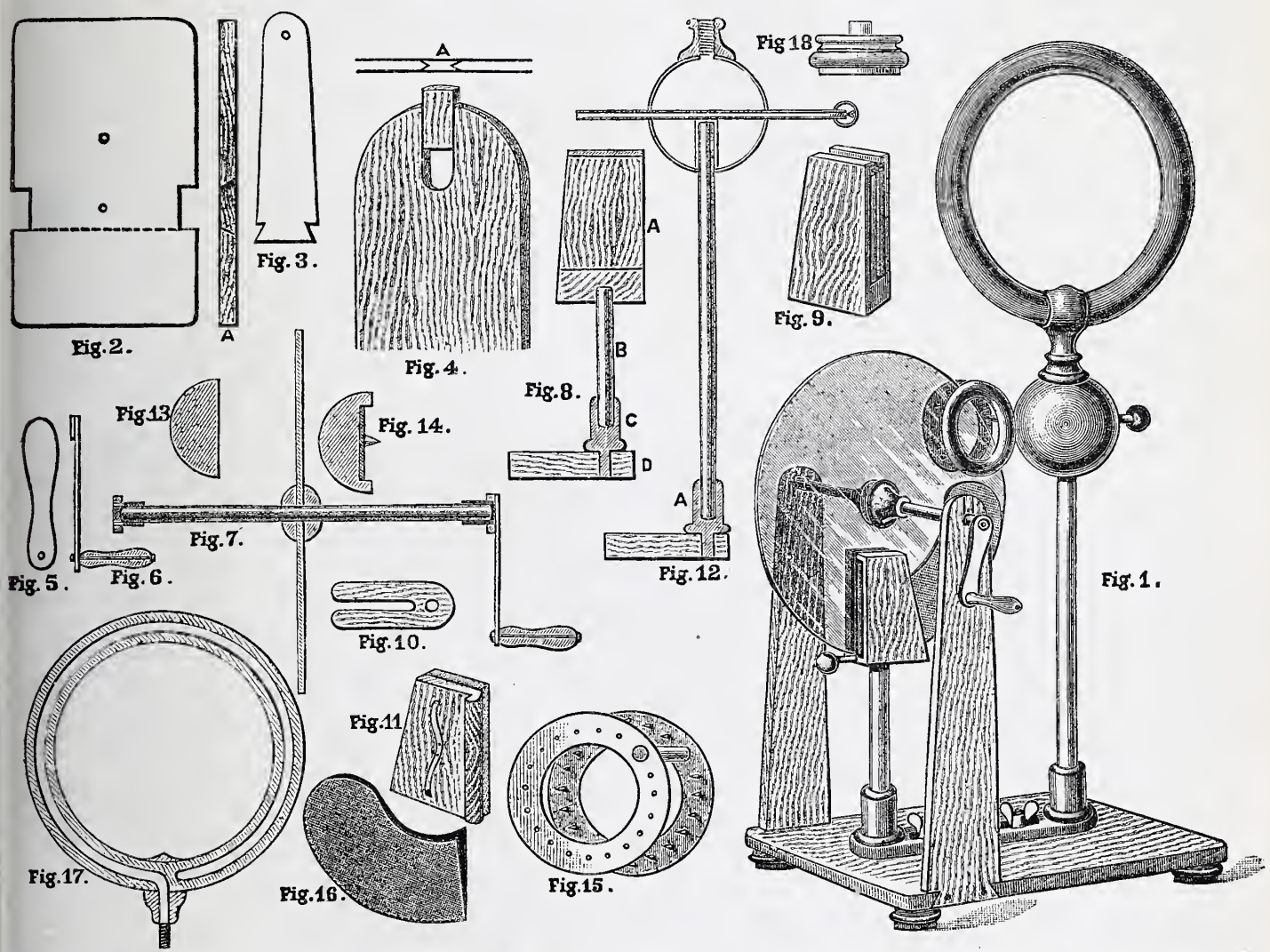



Fig. 1.—Winter Electrical Machine. Fig. 2.—Plan of Baseboard—A, Side Elevation. Fig. 3.—Plan of Supporting Standard for Plate. Fig. 4.—Enlarged Detail of Standard, showing Movable Wedge—A, Section of Wedge. Fig. 5.—Plan of Handle. Fig. 6.—Side Section of Handle. Fig. 7.—Section of Plate. Fig. 8.—Section of Rubber Holder. Fig. 9.—Side View of Rubber Holder with Cushions in Position. Fig. 10.—Plan of Foot of Rubber. Fig. 11.—Rubber. Fig. 12.—Prime Conductor. Fig. 13.—Section of Wooden Collecting Ring. Fig. 14.—Section of Collecting Ring, showing Inner Metal Ring. Fig. 15.—Metal Collecting Ring. Fig. 16.—Silk Flap. Fig. 17.—Section of Winter Ring, showing Inner Metal Ring. Fig. 18.—Supporting Foot for Baseboard.

## THE WINTER ELECTRICAL MACHINE AND ACCESSORY APPARATUS.

BY CHAS. A. PARKER.

PREFATORY—DESCRIPTION OF THE WINTER FRICTIONAL MACHINE—THE BASEBOARD AND SUPPORTING STANDARDS — THE PLATE-GLASS DISC—FITTING SPINDLE TO PLATE—ELECTRICAL CEMENT—THE HANDLE—THE RUBBER—THE RUBBER CUSHIONS—THE PRIME CONDUCTOR—THE COLLECTING RINGS—ADJUSTING SCREWS FOR BASEBOARD—THE SILK FLAP—MAKING THE WINTER RING—SUPPORTING FEET OF BASEBOARD.

THE science of electricity may be justly described as being one of the most sublime examples of the might of the human intellect, for by its agency man has brought a power subservient to his will which plays an important part throughout nature, and whose applications are now to be found in almost every branch of science. "*Nil mortalibus arduum est*," wrote Horace in speaking of Prometheus, of mythological fame, who is said to have stolen the fire from heaven; and it may be rightly said that the truth of this assertion has been repeatedly proved by modern science, although the writer of the passage could little have thought how near becoming verified would be the fable of Prometheus in after ages.

This subtle agent which we call electricity would appear to be uniformly diffused throughout nature, existing in almost every substance without giving any outward indication of its presence until called into existence either by mechanical, chemical, or physical action, when it is capable of producing effects that are as wonderful as they are startling.

During the present century electrical knowledge has progressed with rapid strides, and scientists have striven their utmost to subdue and apply this subtle power to domestic and commercial purposes, with the result that it has now become a most valuable helpmeet of man; the development of this branch of physics having resulted in such inventions as the electric telegraph, the electro-motor, electric light, electric railway, etc., and doubtless, as time goes on, we shall witness its still further development.

In the present series of articles it is the writer's intention to describe the construction of an electrical machine and accessory appliances, such as would be used by the student when studying that branch of electrical science known as frictional electricity, which, by the way, is always particularly fascinating to the experimentalist.

For obvious reasons it will be impossible to enter upon the theoretical or experimental portion of the subject in the present series of papers, as it would be out of place in this publication. I shall therefore confine myself to the practical construction of the apparatus necessary for the performance of experiments such as are described in the text-books devoted to the subject of frictional electricity.

The plate electrical machine may be said to be the most popular form of frictional machine ever introduced, as it affords a ready means of generating electricity for the experimental purposes of the student or science teacher; and of all the various modifications and improvements in plate machines which have from time to time been devised, the addition of the Winter ring must claim attention as being one of the most useful.

In construction, the machine about to be described may be said to consist of a glass or ebonite plate mounted between a couple of upright standards attached to a substantial wooden base. The rubber holder, which is mounted on a glass stem attached to an adjustable wooden foot, occupies a position on the baseboard about midway between the two standards, and is made in the form of a U, through which the plate passes as it revolves. A couple of flat pieces of wood furnished with felt pads and brass springs are pushed into the rubber holder, one on either side of the plate, against which they are forced by the pressure of the springs, a slight projecting ledge at the back serving to retain them in position whilst the machine is being worked. A double wing of thin silk is attached to the rubbers and curved in the form of the plate, to which it adheres by electrical attraction, thus serving as a means of conveying the electricity to the collecting rings of the prime conductor. The latter consists of a hollow brass ball mounted on a glass support attached to an adjustable wooden foot similar to the rubber, the side of the conductor next to the plate being fitted with a projecting arm and a couple of wooden collecting rings which are furnished with a row of metal spikes or pins on their inner faces, arranged in such a manner as to almost touch the plate on either side; the outer side of the conductor having a brass ball and stem from which to suspend the apparatus. The Winter condensing ring, which is the most important part of the entire machine, is made to fit into a hole in the top of the prime conductor, and consists of a hoop of stout iron rod let into a highly polished ring of wood, an attachment of this description enhancing the power of the machine about threefold. In the writer's estimation, this machine is undoubtedly one of the most perfect, useful, and convenient forms of frictional machines ever devised.

Turning now to the constructive details, we come first of all to the baseboard and supporting standards for the plate, which are illustrated in Figs. 2 and 3. For the first named we shall require a piece of thoroughly well-seasoned mahogany, measuring about 12 in. by 20 in., and about 1 in. or 1½ in. thick. The importance of employing thoroughly well-seasoned wood cannot be too strongly impressed upon the reader.

When the board has been sawn to the required size, it will be necessary to round off the four corners by means of a panel saw, after which the sides and edges should be dressed up and shot by the aid of a plane until they are perfectly square and true with the face.

When this has been done, the baseboard may be placed aside for a short time whilst a couple more pieces sawn from the same board are being dressed up in a similar manner to form the two supporting standards for the plate. Each of these should measure when finished 15 in. long and 4½ in. wide at the lower end, tapering to 3 in. at the top, the lower end of each standard being sawn to the form of a dovetail, as shown in Fig. 3, which will then allow of its being securely fitted on to the baseboard. A pencil line drawn across the surface of the baseboard at 6½ in. from one end of the board, as shown by the dotted line in Fig. 2, will indicate the position for the first cut of the mortise to receive these dovetails, which are now cut to the required form by means of a saw and chisel. Before proceeding further, a hole about ¾ in. diameter should be bored through the upper end of each standard, at exactly one inch from the rounded end of the wood, in order to form the bearings for the spindle of the plate; and when this has been done one of the standards should be provided with a movable wedge, fitted just above the hole, in order to make suitable provision for the removal of the plate. This may be done by making a couple of saw-cuts from the rounded end of the wood down to the aforesaid hole, thus forming a slot, each side of which will now require to be cut to a sharp bevel. A small block of wood of suitable size is now grooved along opposite sides in the form of a V by means of a saw and chisel, and then made to slide tightly along the slot just formed, as will be seen by reference to Fig. 4. If considered necessary, a hole of sufficient diameter to take a pin, about the size of an ordinary blanket pin, may be bored through the standard and into the wedge, for the purpose of retaining the latter in position during the working of the machine.

As soon as the two standards have been prepared, it will be advisable to mark the position for the mortises on opposite sides of the baseboard into which the lower dovetails of the standards are to be fitted; cutting each of these mortises by the aid of a saw and chisel, and afterwards attaching each one in turn to the baseboard by means of a couple of 2 in. brass screws and some good glue.

Now that the wooden framework of the machine has been described, it behoves us to turn our attention to the glass plate, and the manner in which it is to be mounted between the two standards. For this size machine we shall require a 12 in. circular disc of good plate-glass, provided with a ¾ in. hole in the centre through which to insert the spindle upon which it turns. It will be necessary to procure this from an electrician, as the size, shape, and thickness render it impossible for an amateur to cut and prepare a glass plate of this description. The usual charge for a plate of these dimensions will be found to range from 8s. 6d. to 10s. 6d. It may not be out of place to draw attention to the possibility of getting a plate from a clock-glass manufacturer at prices considerably lower than the above: for example, Mr. Jude, watch, clock, and barometer glass manufacturer, of Clerkenwell, would supply a glass disc according to the above description for 4s. 6d.—carriage, of course, being extra, as this is the price of the disc.

Having secured a suitable glass disc, we shall next require a 12 in. length of ¾ in. glass rod to form the spindle upon which the plate may turn: this can be readily obtained from any electrician at 1s. per lb. The rod must first be roughened at either end, also in the middle, in order that it may take the cement properly, after which a couple of bosses, about 1¾ in. diameter, should be turned from a piece of sound dry hard wood, and then made to fit tightly on to the spindle. One of the bosses should now be cemented in the middle of the rod by the aid of a small quantity of cement, and when this has set quite firm, a little more should be brushed over the inner face of the boss, after which the glass disc is very carefully let on to the spindle while the cement is moist, being pressed into the closest possible contact. When this has been done, the other boss is treated with cement in a like manner and then lowered on to the other side of the plate, when the whole is placed aside out of harm's reach until thoroughly hardened. Cement used for this purpose can be readily made by melting in an old iron saucepan: resin six parts, beeswax one part, plaster of Paris half a part, with just a small quantity of turpentine. A tin saucepan is useless for the purpose, as the bottom would come out; it is therefore necessary to use an iron pot or a suitable ladle. Another cement which will answer just as well can be made by mixing together Le Page's fish glue with plaster of Paris until a thick paste is formed. As this cement is made without the aid of heat, it will be unnecessary for the glass to be warmed before it is applied.

On returning to the plate, the next proceeding will be to fit a couple of brass caps on to the ends of the spindle, and likewise provide it with a handle. The caps or mounts may be readily formed from a couple of gasfitters' straight brass nose-pieces, which should be about 1½ in. long, with an internal diameter of about ⅞ in., each one being furnished with a small hexagonal or round nut tapped to screw on to it. Before doing anything else, it will perhaps be advisable to prepare the handle. For the arm of this a piece of stout brass plate about ⅛ in. thick should be cut and filed to the shape of Fig. 5, care being taken to finish it off neat and smooth, with a small hole drilled through it at the taper end, as shown in the diagram. A brass nut belonging to one of the nose-pieces may now be taken, and soldered on to the broad end of the metal in the position indicated in Fig. 6; after which a small wooden sleeve of suitable size should be turned in a lathe to form the handle of the machine. This sleeve must of course be furnished with a longitudinal hole, into which the metal rod of the handle may be loosely fitted. This

rod should now be riveted and soldered into the hole at the narrow end of the handle crank, when the wooden sleeve just prepared may be slipped on to the rod, and then retained in its place by means of a small button riveted on to the outer end of the rod. It is almost needless to say that the sleeve of the handle must be arranged in such a manner as to revolve with perfect freedom.

At this stage of the proceedings the two nose-pieces should be cemented on to the ends of the spindle, and then the plate may be mounted in position between the two standards of the machine, in order to ascertain whether it is running quite true and with perfect freedom; and if so, the nut may be screwed on to the projecting portion of the nose-piece on one side of the machine, whilst the handle is screwed on to the opposite end of the spindle—as will be understood by reference to Fig. 7, which shows the sectional appearance of the plate and spindle. When the plate has been remounted in a satisfactory manner, and is found to be running quite smooth and true, it will be time to turn our attention to the preparation of the prime conductor and the rubber, commencing with the latter, which is illustrated in Fig. 8. The rubber holder, shown at A, may be made from a single block of wood, measuring 5 in. by 2½ in., with the two sides tapering from 3 in. at the base to 2½ in. at the top, the rectangular slit to contain the rubber cushions being readily formed by first making a couple of parallel saw-cuts for 4 in. longitudinally down the block, and then removing the wood between the saw-cuts by the aid of a keen-edged mortise chisel, after which the sides are carefully smoothed off, and a narrow ledge glued on to the top of each side, as will be seen by reference to A, Fig. 8, and to Fig. 9. A 4½ in. length of ¾ in. glass rod (B, Fig. 8) is now cemented into a hole of sufficient size, bored for its reception in the under-part of the rubber holder by means of a suitable centre-bit, the other end of the glass rod being cemented into a turned wooden socket, similar in appearance to C, Fig. 8. This socket need not be turned according to any exact dimensions, but should be made proportionate to the remainder of the rubber holder. It should be furnished with a ¾ in. projecting pin at the bottom, which must be glued into a hole bored in one end of a small slotted foot, cut to the form of D, Fig. 8, which is drawn in plan in Fig. 10. This foot may measure about 4 in. long, 1½ in. or 2 in. wide, and 1 in. thick, being sawn from a piece of sound baywood by means of a fret or panel saw, and when carefully cleaned up it may be glued on to the lower wooden socket of the rubber holder, which is now completed, with the exception of a pair of cushions.

These cushions may be made from a piece of ⅜ in. mahogany, which is planed down to about ¼ in. thick in such a manner as to leave a slight ledge projecting along one side, as will be seen in Fig. 11. This arrangement will prevent them from being carried through the holder by the motion of the plate. A piece of spring brass, about ½ in. wide and 3 in. long, will require to be riveted to the middle of the outer side of the wood, in order that the cushion may be pressed against the plate with a uniform pressure, after which the rubbers are completed by gluing a piece of thick soft felt on to the outer side or face of each one, in the manner indicated in Fig. 11; the rubbers when in place occupying the position indicated in Fig. 9, which is a side view of the rubber holder.

The rubber being finished, we must next turn our attention to the prime conductor, which is illustrated in Fig. 12. This consists of a large brass ball, mounted upon an insulating glass stem, cemented into a suitable turned wooden foot, similar to the rubber. The ball has three openings for the attachment of apparatus—one at the top, to take the stem of the Winter ring, and the other two in the centre, upon opposite sides. For this large ball the writer can recommend a large brass knob, such as will be found upon good-class bedsteads, one of which will answer this purpose very well. The ball should be about 4 in. in diameter, and must be provided with two ¼ in. holes in the centre of the body, and a ⅜ in. opening exactly at the top, as may be understood by reference to Fig. 12. Two lengths of brass tubing must now be inserted, and soldered into each of these openings, in the position shown in Fig. 12: one piece of stout tubing, 9 in. in length, being soldered crosswise through the centre of the ball from one opening to the other, with about 2½ in. projecting on either side; the second piece, which is of much larger diameter, being put through the opening in the top of the ball, and soldered flush with the surface. A fair-sized brass ball is to be soldered to one end of the small projecting tube, and the collecting rings, about to be described, are attached in a like manner to the other end.

To make these collecting rings, turn in a lathe a pair of half round wooden rings, about 3 in. in diameter and ¾ in. in width, using for the purpose a piece of sound dry mahogany, the surface of which is rounded on the outside, and left quite plain on the inside, as shown in section in Fig. 13. A couple of flat brass rings, ⅜ in. wide, with an outside diameter of 2⅝ in., are now turned from a stout piece of metal, and are then made to fit into grooves prepared for their reception in the flat sides of the wooden rings, being sunk slightly below the surface of the latter, as shown in section in Fig. 14. About twenty small holes should now be drilled at equal distances apart round each of the metal rings, into which a corresponding number of small brass nails or pins, about ¼ in. long, can be riveted and soldered in the manner shown in Fig. 15, thus forming the comb of the conductor by which the electricity is collected from the plate. When this has been done, the two metal rings are joined together (with the pins inside) by means of a short bar of brass rod, which is of sufficient length to allow of the glass plate of the machine just passing between the pins of the rings without touching (*see* Fig. 15). This bar must be riveted into holes drilled for its reception in each ring, and after the collecting rings thus joined together have been soldered to the projecting rod of the prime conductor, the outer wooden casing may be cemented on to each ring.

At this stage of the proceedings a 13 in. length of ¾ in. glass rod should be cemented into the large opening at the top of the conductor, in the manner shown in Fig. 12.

Assuming one of these bedstead knobs to be employed for the conductor, it will be provided with a slight projecting stem, which will be found very useful for the subsequent attachment of the Winter ring, the stem of which should be furnished with a corresponding tap, to enable it to be screwed into the stem.

A mahogany socket must now be turned in a lathe to the form of A, Fig. 12, and then cemented on to the lower end of the glass stem of the conductor, the projecting pin with which the socket should be provided being glued into an adjustable slotted foot similar to the rubber before described.

A couple of brass wing-nuts, and screws, about 2½ in. long, should now be let into the baseboard from the underneath, being planted one at about 7½ in. from the front end, and the other at 8½ in. from the back. The exact position should, however, be ascertained by trial. They must, of course, occupy the central line of the baseboard, and the heads of each nut should be let into the underside of the wood, just flush with the surface, being afterwards cemented in position by means of the ordinary electrical cement, or a mixture of plaster of Paris and glue.

The rubber and the conductor may now be clamped in position upon the baseboard, in order to be certain that the plate runs perfectly true, and everything is satisfactory, as it should be. As soon as this has been ascertained, a curved silk flap (Fig. 16) must be prepared and affixed to the rubber, to serve as a means of conveying the electricity to the conductor. The exact length of the silk required may be marked upon a piece of brown paper, which is held in position against the plate whilst the rubber and conductor are in their place. The silk should be arranged so as to reach from the outer edge of the rubber to within about half an inch of the collecting rings of the prime conductor, the width being the same as the height of the rubbers. From the template thus obtained it will be an easy matter to cut a couple of duplicates in thin black sarcenet, allowing just a trifle more than the exact plan to allow for turning in when sewing them together. A portion of the covering of a disused silk umbrella will be found to answer this purpose very well, provided that it is not slit or damaged in any way. As soon as the pieces of silk have been cut they must be carefully machined together along the curved side, after which the flap thus formed is glued on to the outer sides of the rubber, with the machined portion turned inwards next to the plate. Thus prepared, the electrical attraction will cause the flap to adhere to the plate upon the handle of the machine being turned. Only the semi-eircular curve of the silk is to be stitched, as the remaining portion of the silk simply requires to be cleanly cut by means of a pair of scissors.

As before stated, the Winter ring, which forms the attachment of the prime conductor, consists of a stout iron ring enclosed in a polished wooden casing, which should equal the diameter of the plate of the machine, in order to obtain the best results. It naturally follows, therefore, that the construction of a ring of this description will be a trifle beyond the capabilities of the average amateur, owing to the necessity for using a large-size lathe in which to turn the wooden ring. Nevertheless, as there may be some who would be in a position to make the attempt, I will describe the mode of procedure.

For a ring suitable for the machine under description, a sufficient length of moderately stout soft iron rod, about the thickness of an ordinary cedar pencil, must be bent into the form of a 12 in. ring, having a short projecting stem about 3 in. in length, similar in appearance to Fig. 17. The stem should now be tapped, in order that it may

be screwed into the opening in the top of the prime conductor, after which it must be provided with a stout casing of thoroughly dry wood. To make this ring, a couple of accurately planed boards, of a uniform size and thickness, should be mounted upon the face-plate of a lathe, for each one to be furnished with a groove of a sufficient depth to take half the thickness of the iron ring, which is made to fit into these grooves in such a manner that the two surfaces of the wood can be closed over the ring and glued together. After the grooves have been cut, each ring is in turn detached from the board, and the two are glued together securely, with the grain of the wood crossing, and the metal ring between them, after which, when the glue has thoroughly set, the outside of the ring is carefully rounded off and smoothed with glass-paper.

A small, neat, pear-shaped boss must now be turned in a lathe and fitted on to the ring, just at its junction with the stem. This boss must of course be made in two halves, and furnished with a couple of grooves crossing the flat surface of the wood in the form of a T, the shorter groove of which should be of a suitable form and depth to admit that portion of the ring where it forms the junction with the stem.

Those of my readers who do not wish to have the trouble of making the Winter ring themselves can obtain a 12 in. ring ready prepared, and with the outer casing highly polished, at 8s. 6d., from Messrs. King, Mendham & Co., a firm resident in Bristol.

At this stage of the proceedings nothing remains to be done but to turn four ornamental supporting feet, similar in design to Fig. 18, and then glue and screw one of these at each corner of the base, after which the entire wood-work of the machine may be varnished or French polished, according to the taste of the maker. Those who are unable to French polish will do well to use a hard-drying ebony enamel: such, for instance, as is to be found in the cheap black enamel varnish supplied by Messrs. Palmer & Co., St. Luke's, London.

## HOW TO MAKE A WASH-TUB.

BY H. HINGE.

INTRODUCTION—QUALITY OF WOOD—SIZE, ETC.—CUTTING OUT WOOD — MAKING — PUTTING TOGETHER—FINISHING.

AMONG the many articles which amateur wood-workers make, perhaps there is none which will please the "guid wife" better than a wash-tub (Fig. 1), which, if properly made, will last a lifetime, and, besides having many other advantages over earthenware pans, it cannot get broken.

*Quality of Wood.*—As the tub has to hold water—or, in other words, be water-tight—the wood must be as sound and good as we can get it, either white or red deal—¾ in. or 1 in. thick will answer the purpose very well, if it is free from dead knots and shakes.

*Size, etc.*—We shall find a convenient size to make for use about 2 ft. 4 in. long, 15 in. wide on the top, and 9 in. deep.

*Cutting out Wood, etc.*—As the tub is on the taper all ways, the best way to cut out our wood from the board will be as shown in Fig. 2. A considerable saving of wood is effected in this way. A "bevel" would be a very useful tool to get the right angle to cut and true the ends up with, but if we have not got one, we can manage very well without. Square up a piece of thin deal or cardboard, 12 in. or 14 in. long and 9 in. broad, and then take it 2½ in. less on the bottom edge. We shall then have a templet, 2½ in. out of square, to which we must work all our ends.

*Making, etc.*—After truing up the sides and ends correctly to "templet," and in pairs of the same size, we must take the sides and mark up from the ends with a gauge a line 1 in. clear from the edge, and all four ends of the two sides must be marked with this gauge, and then another gauge-line run up parallel with the first at a distance from the first line of the thickness of the stuff at the thinnest place. This is for the grooves to receive the ends; and, as the ends must fit in tight, we had better have them a little too small than too large. These must now be grooved out to a depth of

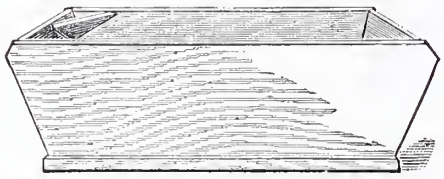


Fig. 1.—Wash-tub complete.

Fig. 2.—Diagram showing how to cut Sides and Ends from Single Board.

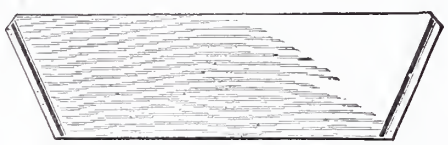


Fig. 3.—Side grooved to receive Ends.

about ¼ in., cutting down with a tenon-saw and cleaning out with a small chisel, taking care to get the grooves of an equal depth all the way through. The sides will then have the appearance of Fig. 3. By placing the sides and ends together, as they will be when together (not putting the ends in the grooves), it will be seen that the ends of the ends will want to be on the bevel a little to make a close joint. A shaving or two taken off with a sharp plane, where wanted, will remedy this, so that when the tub is put together all joints will be true and close. The ends must now be taken to a thickness on the ends, to fit in tight in the grooves, taking just the sharp edge off on the inside and planing away any surplus wood on the outside; but be sure and have them fit nice and tight (not too tight).

*Putting Together, etc.*—We shall now require some white-lead, which should be put in the grooves with a putty-knife or chisel—not too much, but covering the wood all over. The tub should now be nailed together with 1½ in. or 2 in. nails, put in about 2 in. apart. A fine 1½ in. screw, put in at each top corner instead of a nail, will make a much better job. The bottom edge of the tub should now be levelled off as true as possible, and then with a very dull iron chisel or the wrong end of a hammer, and using another hammer to strike with, bruise down a groove round the middle of the bottom edge; fill this groove with white lead, also a thin coat on the rest part of the bottom edge. The bottom should now be planed up true (we shall find a board 11 in. wide to be the right breadth without jointing), and nailed firmly down, taking care that none of the nails split or point out. A much better job is made by screwing the bottom down with fine 1½ in. or 2 in. screws. All surplus white-lead should now be cleaned off, and all interstices filled up with the same. We should now turn our attention to the top edge, and clean this off as nicely as possible with a sharp plane, cutting off the corners as in Fig. 1, and taking off all sharp edges with sand-paper. Two pieces of 1½ in. square stuff should now be screwed on from the inside to form handles on the ends. These will be much better if hollowed out a little on the underside (before screwing on) to catch hold of. We must now fit a piece in the corner to hold the soap, which should fit nicely, but not go down to the corner by ¾ of an inch, to allow the soap to drain. This should be nailed in from the outside. All nails and screws should be punched and screwed below the surface, and filled up with putty mixed with white-lead. The tub is now complete, and should be allowed to stand a few days before using to allow the white-lead to harden. The durability and appearance of the tub will be greatly increased by giving it a few coats of paint inside and out; but, of course, this must be left to the taste of the worker.

If the inside of the wash-tub is not painted—and there will be some, I dare say, who will think it unnecessary to do this—the joints of sides, ends, and bottom should receive a good coating of white or red lead.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LAUNCELOT L. HASLOPE.

### FANCY KNOTS.

WALL KNOTS—STOPPER KNOTS—MASONS' WHIPPING—CROWNING—MANROPE KNOTS—DOUBLE WALL KNOT, SINGLE CROWNED—TACK KNOT—MATTHEW WALKER—SINGLE DIAMOND—DOUBLE DIAMOND—SHROUD KNOT—FRENCH SHROUD KNOT—SPRITSAIL SHEET KNOT—BUOY ROPE KNOT—TURK'S HEAD.

WE come now to a perfectly different style of knot which, though they are termed fancy knots, are not necessarily used for ornamental purposes, but are often of considerable benefit; indeed, we could hardly do without some of them aboard ship. One of the most commonly used knot of this group is the "Wall Knot." Fig. 82 shows the knot ready for hauling taut. First unlay the strands at the end of a rope and make a bight with one strand, A; hold this to the standing part with the thumb of the left hand, then make a loop with the next strand, B, round the end of the first strand, and bring the remaining strand, C, round the end of the strand B and through the bight of A.

If the ends are taken round once more and brought up in the centre of the knot, it is called a "Stopper Knot." In this case the ends are whipped together and cut off level. How the "Wall Knot" acquired its name was always a puzzle to me until I once happened to meet with directions in a very old book on rigging, for making a basket which was

have "a small walnut knot crowned the end." A fancied resemblance to a alnut no doubt gave it its name originally, hich, for euphony's sake, was contracted wall knot.

Fig. 83 is the "Stopper Knot" finished. g. 84 shows the crowning commenced. pen the strands of a rope as before, but do ot put a seizing round the rope. Lay the rand A down over the centre of the rope, d bring strand B down over A and strand C er B and through the bight of A. Fig. 85 ows how the strands tie when they are In this case, after crowning as above, pass one end over the next strand in the standing part, and under the following one. Do the same to each of the other strands in succession. This may be repeated and the ends cut off. Masons, whose ropes have to stand a good deal of knocking about, generally use this plan; for this reason it is called "Masons' Whipping." Though very strong and standing hard usage well, this is not the neatest way of finishing the ends of a rope. Crowning may also be used in connection with other knots. For crown. A double-walled double-crowned, called a "Tack Knot," is made as the last knot—that is, double-walled and single-crowned. Now lay the ends by the sides of those in the single crown, and with the aid of a pricker bring them down through the double walling and they will be alongside the standing part of the rope. The knot is shown completed, with the ends cut off, in Fig. 88.

A Matthew Walker (Fig. 89) gives the knot open ready for being hauled taut. How this knot came by its curious name I

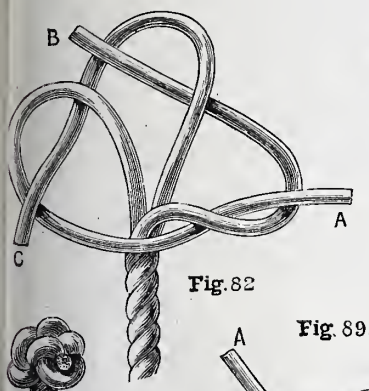


Fig. 82.

Fig. 83.

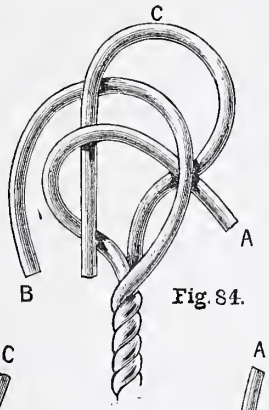


Fig. 84.

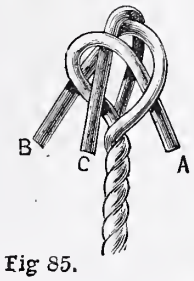


Fig 85.

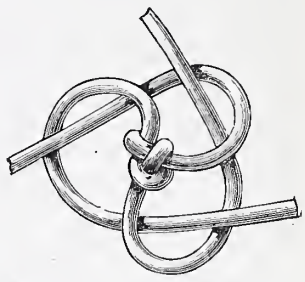


Fig. 86.

Fig. 87.

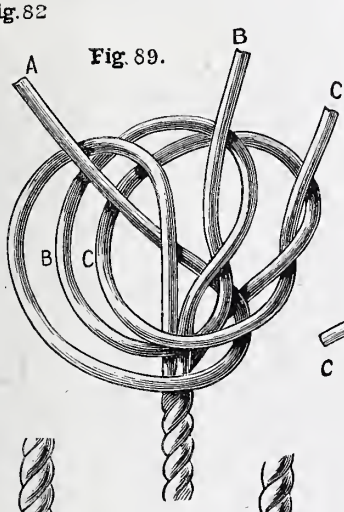


Fig. 89.

Fig 88.

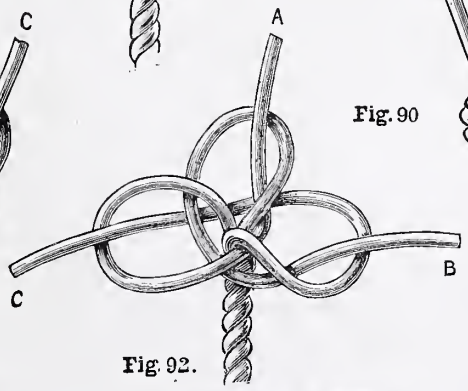


Fig. 92.

Fig. 90

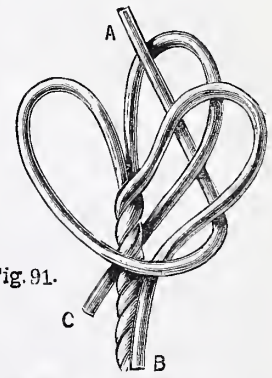


Fig. 91.

Fig 93.

Fig. 94.

Fig. 95.

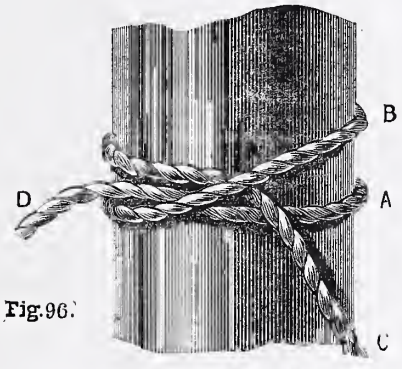


Fig. 96.

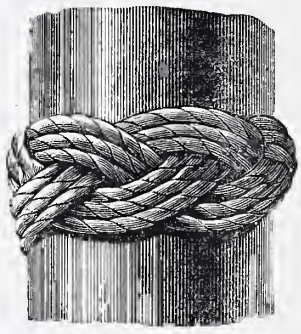


Fig. 97.

g. 82.—Wall Knot. Fig. 83.—Stopper Knot. Fig. 84.—Crowning commenced. Fig. 85.—Crowning. Fig. 86.—Manrope Knot commenced. Fig. 87.—Manrope Knot. Fig. 88.—Tack Knot. Fig. 89.—Matthew Walker Knot commenced. Fig. 90.—Matthew Walker Knot. Figs. 91, 92.—Single Diamond Knot commenced. Fig. 93.—Single Diamond Knot. Fig. 94.—Double Diamond Knot. Fig. 95.—Shroud Knot. Fig. 96.—Turk's Head commenced. Fig. 97.—Turk's Head.

early taut. The strands in Fig. 84 are ardly in the position which they occupy hen the knot is actually being made, as ey are then much snugger; but to show early their relative positions I was com-elled to draw them as they appear in the gure. In criticising the illustrations, and of ese knots in particular, I hope my readers ill take into consideration the extreme ifficulty of making them so as to show with ny clearness the method by which the sult was arrived at. Making a knot is ne thing: showing on paper the method of aking it is quite another. Crowning may e used by itself as a method of preventing ie strands of a rope unlaying while in use. instance, we may crown first and wall afterwards, as shown in Figs. 86 and 87. Fig. 86 shows the crowning in the centre of the knot hauled taut; this is made on the end of a rope as just described. We now make a single "Wall Knot" under the crowning. When the knot is tightened it will appear as in Fig. 87, and is called a "Manrope Knot." A single "Wall Knot" may be crowned after it is made; we then have a single wall and a single crown. If now we wall again by passing one end under the part of the first walling next to it and bring it up through the same bight, and do the same with the other two strands, the result is a knot with a double wall and a single believe is not known. I learnt it some forty years ago, and the captain, an elderly man, who taught me, had known it all his nautical life, so I think we may take it that its origin is lost in the mists of antiquity. After putting a seizing round the rope and unlaying the end as before, bring one strand, A, round the rope and put it through its own bight, the next strand, B, underneath, through the bight of A and through its own bight, and the last strand, C, underneath, through both the other bights, and lastly through its own bight. Fig. 90 is the knot completed. The "Diamond Knot" is an ornamental knot made some distance from the end of a rope; it is therefore necessary

to unlay the rope considerably more than is required for the preceding knots. To form a diamond, bring each of the three strands down alongside the standing part of the rope, thus forming three bights, and hold them thus with the left hand. Take the first strand, A (Fig. 91), and putting it over the next, B, bring it up through the bight of the third strand, C. Take the end of the second strand over the third and up through the bight of the first. The last strand is brought over the first and up through the bight of the second. Haul taut and lay the rope up again. Fig. 91 is the way the knot is begun, showing the manner of taking the first strand. Fig. 92 shows the loops in their places with the ends through them before they are hauled taut. Fig. 93 gives the knot finished. This is a difficult knot to illustrate and describe; but the key to the knot is to remember that, after the bights are formed down the standing part, each end successively goes over the strand next to it and up through the loop beyond. This knot is the "Single Diamond." For a "Double Diamond" (Fig. 94) we make a "Single Diamond," as above, without laying up the strands; the ends are then made to follow the lead of the single knot through two single bights, the ends coming out on the top of the knot. The last strand passes through two double bights. When the ends are hauled taut they are laid up as before. The last four knots are used for the ends of lanyards, man and ridge ropes, yoke lines, etc.

The "Shroud Knot" (Fig. 95) is a very valuable knot for joining two ropes together; it is used for joining a stay or shroud that has been carried away. The ends of each rope are unlaid, and they are then placed within one another as in splicing, the parts not unlaid being brought closely together. Make a "Wall Knot" with the strands of one rope round the standing part of the other rope; turn the ropes over, and do the same with the other set of ends, and they will appear as in the figure. Open the strands, and taper and serve them over if you wish to make a particularly neat job of the work. Two ropes of different sizes may be twisted in this way, and will be quite secure.

"French Shroud Knot." In making this knot, unlay the ends and place the two ropes with the strands intermixed as before; bring one set of ends back on their own rope, and make a single "Wall Knot" with the other set of strands round the bights of the first set and the standing part. They can then be tapered and served as in an ordinary "Shroud Knot."

"Spritsail Sheet Knot." Unlay the two ends of a rope and bring the two sets of strands together side by side; these have to be walled together in precisely the same manner as a common "Wall Knot." A bight is made with the first strand, the second is put over the first, the third over the second, the fourth over the third, the fifth over the fourth, the sixth over the fifth and through the bight of the first; they are then hauled taut. It may be crowned by laying two of the strands along the top of the knot and passing the other strands alternately over and under these two, and afterwards hauling them taut. It may be double-walled after crowning by putting the strands successively under the bights on the left of them and through the same bights, and the ends will then come up in the right position to be crowned again. This is done by following the lead of the first crowning and putting the ends through the walling as before.

"Buoy Rope Knot." This can only be made on a cable-laid rope. Unlay the main strands, and take out one of the smaller strands, of which they are composed, from each of the large strands, and then lay them up again. The small strands that have been taken out are now single and double-walled round the rope, and then laid along the divisions after the manner of weaving, and their thin ends stopped with spun-yarn. A stop should be put round the rope with the spun-yarn where the knot is to be made before it is commenced, and the walling should be made right-handed.

"Turk's Head" is a highly ornamental knot of quite a different character to the preceding ones, inasmuch as, instead of being made out of the rope itself, it is formed on the rope with a piece of small stuff worked round it. A "Clove Hitch" is first made on the rope (Fig. 96); this must be slack enough to allow of the extra strands which will form part of it. Put part A over strand B, thus twisting the two strands; pass the end C under and up through the bight that B now forms, then twist again by putting B over A and run the end under and up through the bight of A. Continue twisting the strands by alternately putting one over the other, and at each twist bring the end under and up through the bight which is underneath, A at the commencement going over B; the bight which B makes will be the under one, and therefore the one through which the end C must be passed. The end C must be very much longer than shown as the whole knot is made with this part, and as the knot when finished contains three groups of three strands each, it is obvious that the length of cord used must be more than nine times the circumference of the rope round which the knot is made. Having made a sufficient number of twists (the number depends on the size of the knot), lay the end C, with which you have been working, alongside D, where it comes out of the knot, and continue following its lead through all its turns as it goes through the knot until you come round to the commencement again. There will now be a "Turk's Head" of two parts. If the end is again passed through by the side of the same strand as before, a complete "Turk's Head" of three parts will be formed. Care must be taken to keep the strand with which we are working close to and on the same side of the strand we are following, or a perfect knot cannot be formed. The first time round is the most difficult, the second is easy enough. Of course, the knot may consist of more parts if required, but three are the usual number. Fig. 97 gives the finished knot. The ends do not require fastening in any way, as in the last round they finish in the middle of the knot under the coils, and are quite secure.

## A SADDLER'S CLAMP.

BY OPIFEX.

CLAMP NECESSARY—MATERIALS—CONSTRUCTION—STAVES—LOWER PIECE—PUTTING TOGETHER.

OF all amateur workers, the amateur saddler is most easily furnished with "a kit": a ball of hemp, a lump of cobbler's wax, a few needles, and an awl. With the aid of these and a bit of leather many odd jobs may be done; and if the "stitch in time" be seen to, not only will the proverbial "nine" be saved, but many a broken bone as well.

But although an odd job may be *done* with the appliances mentioned, it cannot be *well* done with these alone, and no good mend, etc., can be accomplished without the assistance of the article illustrated in Fig 1, which I have called "a clamp," but am not certain whether it should be styled a "*pair* of clamps," or, indeed, clamp at all, for in my country it is called a "clams." But "what's in a name?" The chief thing is to have it and know its use; and therefore deprecating the scorn of those who possess the article, or a better, I address myself to any of my readers who may desire to possess it, describing in as few words as possible how I made mine many years ago.

*Materials.*—The parts A and B (Fig. 1) are made from two oak barrel-staves—in my case part of an old sugar hogshead—but the staves of a petroleum cask will suit admirably, and I believe the old sugar hogshead is a thing of the past.

Should neither of these, however, be available, some friendly cooper may be found who will, for a small consideration, supply a couple of suitable staves.

The lower portion,

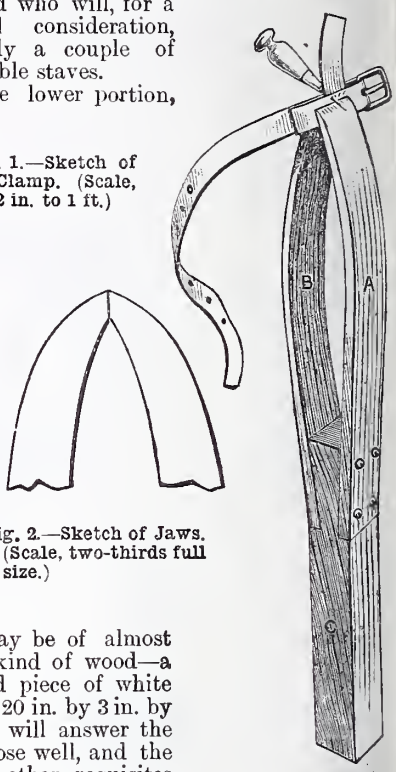



Fig. 1.—Sketch of Clamp. (Scale, 2 in. to 1 ft.)



Fig. 2.—Sketch of Jaws. (Scale, two-thirds full size.)

C, may be of almost any kind of wood—a sound piece of white deal, 20 in. by 3 in. by 3 in., will answer the purpose well, and the only other requisites will be eight stout 2¼ in. screws.

*Construction.*—Having selected two sound staves, they should be cut 2 ft. long by at least 3 in. wide, the points of greatest convexity being in the centre. And here I may mention that the more bent the staves are the more useful will the clamp be.

Clean up the outside with a spokeshave, leaving one end the full thickness of the staves, or about an inch, and thinning off gradually to about ¾ in. towards the upper ends, which are to form the jaws of the clamp. Round off the outer corners in their full length, bearing in mind that the clamp is firmly grasped between the legs when in use, and clean up the inside surface flat, smoothing both sides with glass-paper.

We now turn our attention to the lower part, C.

The dovetail-shaped tenon, which should be at least 6 in. in length, will require careful cutting, the depth of the shoulders and also the width of the upper end depending upon the amount of curve in the staves which are to be attached to it: but if the worker bears in mind that his object is to firmly embed the staves so that their upper ends, or the jaws of the tool, shall press

tightly together, no difficulty will be encountered.

With this object the tenon should be cut, so that energetic screwing will be required to bring the staves home into their final position.

The positions of the screws, which should be countersunk flush with the surface of the staves, are indicated in the drawing, and Fig. 2 (two-thirds size) shows the shape of the jaws.

## OVAL AND CYLINDRICAL VESSELS IN SHEET METAL WORK.

BY R. ALEXANDER.

WATER POTS—BOILER FILLERS AND TOILET CANS (*continued*)—HOW TO CUT OUT, MAKE AND FIT THE TOPS AND SMALL WORK, SPOUTS, ROSES, ETC.

*The Tops.*—Boiler fillers and water-pot tops are both made in the same manner. To make the pattern, Fig. 1, set the compasses to such a radius as will give a circle about $\frac{3}{8}$ larger all round than the outside of the wire of the tops.

Describe a circle, and from any part of its circumference, A, with the same radius describe the arc, B C. This is the geometrical pattern, but as is very often the case with patterns geometrically true, there has to be a little allowance made for hollowing up. It is found in hollowing up that the points B and C draw up, and if no extra allowance were made the top would be too small, or it would have to be pressed down very much at that part and would look "squatty," so a gentle curve can be drawn as shown by the dotted lines—about $\frac{3}{8}$ of an inch each side at the widest part will be sufficient. Allowance must also be made of $\frac{3}{8}$ inch inside the curve, B C (also shown by dotted lines), for wiring; notches must also be cut across the points B and C as shown. The tops are hollowed much the same as a saucepan cover, which they practically are, with a segment cut out; the large block hammer must be freely used along the cut-out part or it will pucker very much; they will be found rather more difficult to hollow than saucepan covers, but a little practice will overcome any difficulty that may be experienced. Crease the tops for wiring in a swage or on the crease iron with a creasing hammer, and wire with a small wire on the edge of the crease iron. I generally use a hammer for putting the wires in these tops, and after wiring, hammer the wiring through the same crease that the tops were creased in, using a rounding faced hammer. Swage or crease round the other part to fit the wiring of the bodies, and fit on. Take care to get the points of the top equidistant from the seams by making marks with the compasses the proper distances from each seam, and setting the points of the tops to them. Tack the top in three or four places and solder round.

*Tops of Toilet and Hot-water Cans.*—These are flat with a hinged cover; the top will require a little explanation. When wired and fitted to the can it covers somewhat more than half of the can (*see* Fig. 2). Mark out first a facsimile of the bottom pattern, draw a line across the middle, A B, and two inches from that draw a second line and cut across. The reason so much has to be allowed beyond the centre is because the bosses (shown by the shaded parts on line A B) will come $\frac{1}{2}$ to $\frac{5}{8}$ in. beyond the centre, and $1\frac{1}{4}$ in. has to be allowed for wiring and turning back, which I will now describe.

The top being cut out as Fig. 3, cut four slits at distances shown, and 1 in. in length (these $\frac{3}{4}$ wide pieces can, when wired, form the hinges); fold the edge and wire, sink the wire and make a mark with the compasses $\frac{1}{4}$ in. to $\frac{3}{8}$ in. clear of the wire, and double back on the hatchet and flatten down on the crease iron. Hold the tops in the vice, and, with a small file, file the $\frac{3}{4}$ pieces till they part from the top; they will then work on the wire and may be used as hinges, or they may be taken out and longer pieces put in, which is usually the case in best work where the covers are riveted on. Another way of forming the hinges is to notch the covers (Fig. 4), and make the hinges on them, and rivet or solder to the top. Fold the edge over to fit the cans; this is done partly with the jenny, and partly with the half-moon stake, and requires care.

The covers must next be made if they are to be riveted on, as that cannot be done after the tops are soldered on. It is not a hard matter to cut out a pattern for the covers. Place a top on a can temporarily and measure the distance between the wire and the edge of the can, as from X to X, Fig. 2. Mark out a top from the pattern you have and take a section of it, allowing $\frac{1}{2}$ in. more than the measure just alluded to, and about $\frac{1}{2}$ round the D part; this will allow for wiring. Cut a cover out by this, wire it all round and see how it fits, and correct pattern accordingly. The wire in the covers is sunk by running it through the jenny; tack the covers to the tops and rivet. The tops and covers can then be fitted to the cans. The handles can next be made and fitted. The back handles have already been mentioned, and I will now describe the cross handles. A good rule for the length to cut them is to take half the circumference of the body; thus, if two singles were used for the body, the handles would require to be cut the length of a single plate (14 in.). As to width, six out of a plate will do for water pots, and a little narrower for toilet cans; cut them the shape shown (Fig. 5); then cut off a good notch of the right shape, which is important, especially for toilet cans. Fig. 6 shows a full-size end of a cross handle, with A, a properly cut notch, and B, an improperly cut one. Anyone can see that when folded and wired the notch B would be practically gone, whereas A would then have as much left as there shows of B before wiring. The reason a long notch is wanted is so that the ends of the handle can be creased like the example (Fig. 7), which also shows the proper shape of the handle. They are fitted with a boss in the centre before being fixed to the can. Fig. 8 is the flat pattern drawn with compasses set to the sweep of the handle in the centre, which is the same as the ends of can. The handles can then be tacked on and the side bosses soldered on. Fig. 9 is the flat pattern of them; they are bent on the extinguisher stake, and should be soldered on strongly, as they are the principal stays of the can. Water-pot handles are fixed in a different manner. Mark on the top the place for the handle, and with a sharp chisel cut a slot the width of the handle just in the crease of the top; slip the handle down an inch each side and solder. The ends of the handle should be bent towards the body of the can before being put through (*see* Fig. 10, which is a section of handle and body, showing more clearly the method of fixing). Two stays which are made by turning narrow strips of tin on a piece of $\frac{1}{4}$ rod in the crease iron are next put on. Each end is flattened so that the seam comes underneath, and is soldered to handle and can, as shown at S, Fig. 10. Boiler filler handles the same way, except flat topped ones, which are put on like toilet cans and with side bosses; some hollow topped ones have side bosses, but most have the ordinary stays. The next consideration is the spouts. Fig. 11 shows the flat pattern for toilet cans and fillers; the top part, B, will form the nozzle, the seam of the spout will be uppermost, and the seam of the nozzle underneath; a little more lap must be given to the seam than to the nozzle, or it will not be large enough. It is as well to make a pattern slightly larger than the one derived by cutting the spout pattern as shown.* A water-pot spout would simply be a continuation of Fig. 11, and cut plain across at the end.

*Bosses and Stays.*—Toilet cans and boiler fillers have a boss between the spout and body. Fig. 12 is the pattern for it; it is bent on the bick iron across the dotted line; the straight part goes to the body, and the bevelled side down the sides of the spout. Water pots have simply a bridge and two stays similar to those for the cross handles. The bridge is a slightly tapering piece of tin turned half round and soldered, about 1 in. below the top and reaching to the spout; the stays are fixed level with it.

*Position of Spouts.*—Spouts should be made and fixed so that the bottom part of the outlet in toilet cans and fillers is a little above the level of the top of the can body, so that the water will not run out when they are filled; water pots some inches longer.

*Water-pot Roses.*—The ordinary rose is made in three pieces—socket, funnel or cone, and front. Two flat patterns only need be made—viz., the cone and the socket. The size of the front when ascertained by experiment can be marked on the cone pattern. The socket will of course require to be exactly the same degree of taper that the spout is; it can therefore be marked out from the top portion of the spout, varying in length according to the size of the can. The larger end of the socket is notched for folding; it is not wired, but simply flattened down. Turn round on the bick iron and fit on to the spouts, and solder the seams; fit them so that they slip on the spout about half their length. Care must be taken to get both spouts and sockets quite round, or the water will come out very much where the socket fits on. To assist in gaining a good fit the sockets should not be made of too stiff a material. The cone pattern (Fig. 13) next demands our attention. A look at the pattern will show that it is a circle with a portion cut away. On how much is cut out depends the shape of it. If only a small portion out of a circle of, say, 5 in. diameter is cut away, it will be a very flat cone, and if a large portion, say half, it would be a higher cone, but lessened in diameter. I shall give in a future paper full instructions for setting out cones of all shapes, but for the present example a very simple rule will suffice. Set the compasses to a radius of 1 in. less than the diameter of the rose required, describe a circle, and divide it into six parts. Mark two of them out by drawing lines from 1 and 5 to the centre, set the compasses to two-thirds the diameter of the sockets, and describe another small circle; allow $\frac{1}{4}$ in. on one side

* The ends of the nozzles of toilet cans and boiler fillers are either wired or false wired.

for soldering, and cut out. This gives the correct shape for water-pot roses. If wanted more conical, set the compasses the full diameter of the front required and take half of the circle so described; but this is what we term funnel shape, as it is almost an invariable rule to cut funnels a semicircle. There are several ways of fitting the front of the roses to the cones; two of the most used methods are shown in section the cone, and cut out the fronts, allowing a little for hollowing. Before hollowing, describe concentric circles as a guide to punching the holes (Fig. 15); hollow up like a tea-kettle cover. Next punch the holes with a round-pointed bradawl on a piece of wood. This is for ordinary water pots. For water pots requiring roses with fine holes a very small punch is used and the holes flattened down; the fronts of these are usually of the top of the cone on the seam side; solder round the socket and up the seam of the cone and the article is completed, with the exception of studs on the bottom, of which it is usual to put three on water pots and four on toilet cans. I omitted to state, though it was hardly necessary, that small handles must be put on the covers of toilet cans.

There are other varieties of cans, as I

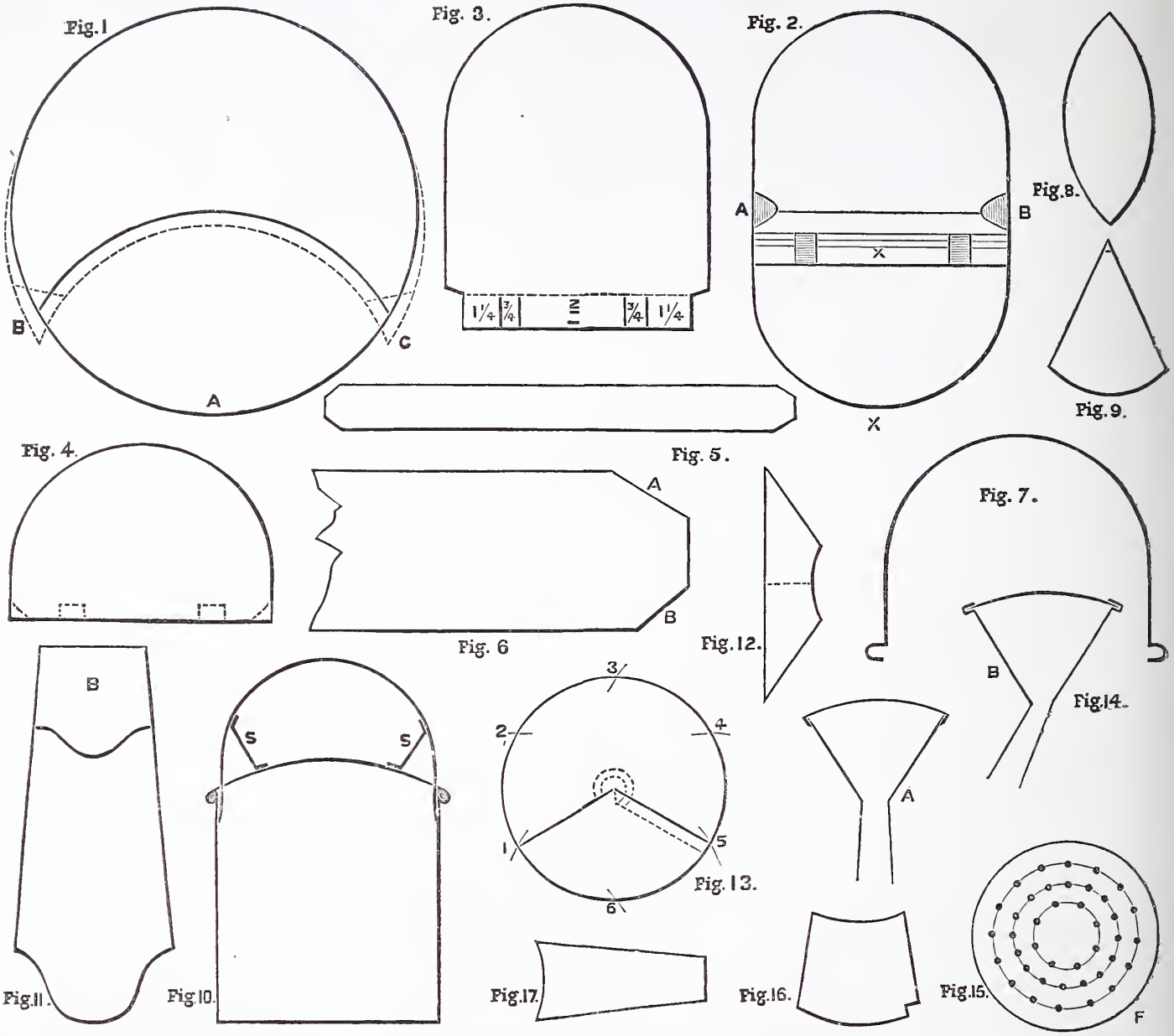



Fig. 1.—Pattern of Water Pot and Boiler Filler Top. Fig. 2.—Toilet and Hot-water Can Top. Fig. 3.—Details of Ditto. Fig. 4.—Toilet-can Cover. Fig. 5.—Cross Handle. Fig. 6.—Enlarged Section of Ditto, showing Notching, Correct (A) and Incorrect (B). Fig. 7.—Shape of Handle, showing Crease to fit Top. Fig. 8.—Boss Pattern. Fig. 9.—Side Boss Pattern. Fig. 10.—Section of Water Pot, showing Method of fixing Handle. Fig. 11.—Spout Pattern. Fig. 12.—Toilet-can Bridge. Fig. 13.—Cone Pattern of Rose of Water Pot. Fig. 14.—A and B, Sections of Roses. Fig. 15.—Rose Front, showing Holes. Fig. 16.—Pattern of Socket of Rose. Fig. 17.—Pattern of Bridge of Water Pot.

at Fig. 14, A and B. In method A the cone is soldered up and the front hollowed, pierced, and the edge "took up," slipped on, and soldered round. But the best and, I think, the most workmanlike way is method B, though it is a little more trouble. It is done as follows: instead of soldering the seam of cone all the way along, simply tack it with a dab of solder in the middle, and throw back an edge similar to the first edge thrown off on a saucepan cover (*see* article in Vol. II., page 661); then turn up a similar edge to lap over the front of the rose, measure across made of copper. Now untack the cones and slip the fronts in, and draw the cones together again and tack. If the fronts are too large they must be trimmed round. The edge is next flattened down by going round it on the half-moon stake with a hammer about twice; it need not be soldered round afterwards, except where the seam meets the front. The sockets can then be soldered in. They can be put in either upright, as A, Fig. 14, or at an angle, as B, Fig. 14, which is the most usual method. To allow this a little must be cut out before stated, but the reader will easily comprehend their make and shape on seeing them, and find that the instructions given for those that I have described will enable him to make them with very little difficulty. For instance, a strawberry pot is a very shallow can *without* a cross handle and with a very long spout, small at the end and without a rose. A beer can such as is taken out into the brickfields and hop gardens in Kent is made the same as a toilet can, with the exception that it is round instead of oval, and the spout is very small

at the nozzle. Thus each article described will show the intelligent workman how, by slight modification of pattern, etc., he can make other articles of a similar class, but differing slightly in detail.

I earnestly trust that the description I have given above, and in the preceding paper, of the method of dealing with oval and cylindrical vessels in sheet metal when making them will be intelligible to all who read it. That it will be so to the young professional reader I do not doubt, because it will be, if it is not so already, his every-day work, and he will have had opportunities of seeing it done by others, even if he has not done it himself. To such as these I hope my papers will be useful in showing them the why and the wherefore of the process to be followed in each stage of the making, from beginning to finish. If any amateur sheet metal worker finds anything that is not clear to him, I shall always be ready to help him through his difficulty in "Shop."

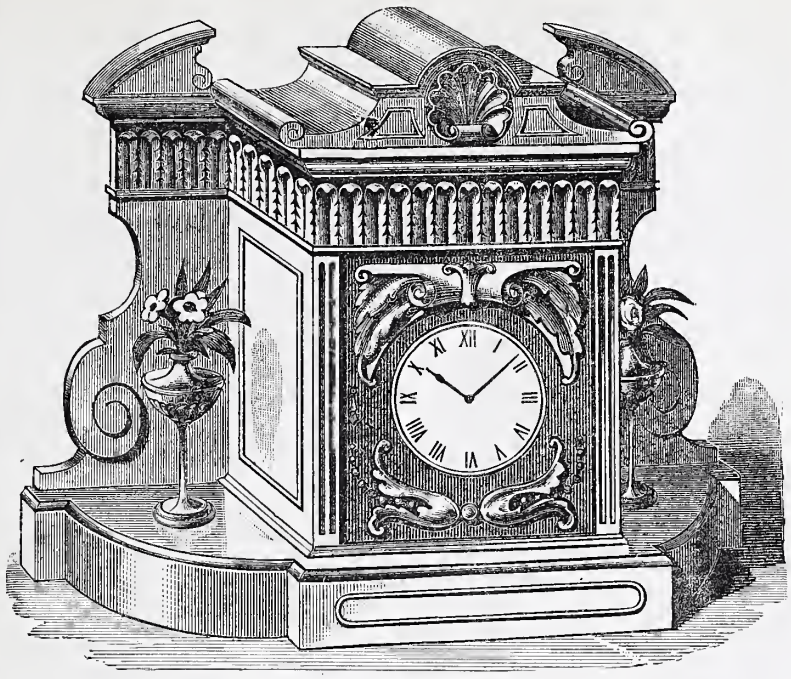


Fig. 1.—Perspective View of Case for Drum Clock.

## A CARVED CASE FOR A SMALL DRUM CLOCK.

DESIGNED BY F. FAULDING.

Remarks on Details—Front—Pediment—Plinth—Position of Clock—Clamping Door—Novelty of Design—Modifications of Design as given—Material and Ornamentation—Substitute for Pediments.

The accompanying design, exhibited in Fig. 1, is the perspective view of a carved case for a small drum clock. The details are shown on a somewhat larger scale in the remaining illustrations, of which Fig. 2 gives the carving for the front in which the drum is fitted, the half on the left-hand side of the centre line being shown; and in point of fact this is, or ought to be, sufficient for the wood carver, as the carving on the right-hand side is merely that on the left reversed. Fig. 3 supplies the details of the pediment placed on top of clock-case above the cornice, which is shown in Fig. 4. The plinth is shown in Fig. 5, and it will be noted that in this, as well as in Figs. 2, 3, 4, a section of the work is indicated. This is helpful in supplying a guide to the depth of the carving. The clock is placed in position in the circular opening cut in the front to receive it, through a small door attached to the case by hinges, and forming, indeed, the entire back of the case, framing excepted, which is formed by the case itself. The mode of carrying this out will be so obvious to anyone who is accustomed to do a little cabinet making, that it is unnecessary to go at length into the details of the construction. It will be sufficient to say that the back of the case should be flush with the outer surface of the door, and that the door itself should close against narrow strips placed within the case at sides, top, and bottom, at a distance from the edge of the opening exactly equal to the thickness of the door. If the workman be equal to the task, it will be better to clamp the door at the top and bottom, the grain running in a vertical direction, in order to prevent warping. If the door is not clamped, the better way will be to make it of two thicknesses of wood glued together, the grain of the outside piece running vertically and that of the inside piece horizontally. When made of a single thickness, even hard wood is apt to warp or buckle slightly, especially when the clock stands on a mantel-piece over the fire, and is thereby exposed to variations of temperature. When the door is made of a single thickness, the wood should be $\frac{3}{8}$ in. thick, but if of two thicknesses, each piece should be no more than $\frac{3}{16}$ in. thick.

Recurring for a moment to the design in Fig. 1, the novelty in it may be said to be the carved wings by which the case is flanked at the back, and the extension of the plinth in such a manner that it affords standing-room for two small glasses intended for the reception of single flowers, or, at the utmost, from two to four of the same kind, if not too large. Further, the plinth may be made sufficiently large to receive two tiny candlesticks, in the sockets of which may be placed two small petroleum lamps. This is frequently done now, lamps being made and sold for the purpose; and the effect produced is certainly pleasing, the candlestick and the lamp together forming a small pedestal lamp. The candlesticks may be of blue and white earthenware, silver, or brass; and if the maker of the case be a turner, he may make them of wood, or even of ivory if he cares to go to the expense.

The design may be carried out as drawn, or it may be modified in many particulars. For example, the wings and the extension of the plinth may be dispensed with, and the central part only be utilised as a case. Another modification may be effected by omitting the pediment above the cornice; but if this be done, it will be as well to make the top perfectly flat, so as to form a resting place for a small bronze figure. If this be done, it will be desirable to introduce another member in the form of a flat piece of wood with a moulded edge, between the top of the plinth and the bottom of the case proper of the clock; and, indeed, looking once more at the design in Fig. 1, it would be an improvement to add this feature, so that the ornamental vases, etc., at the side would stand on a lower

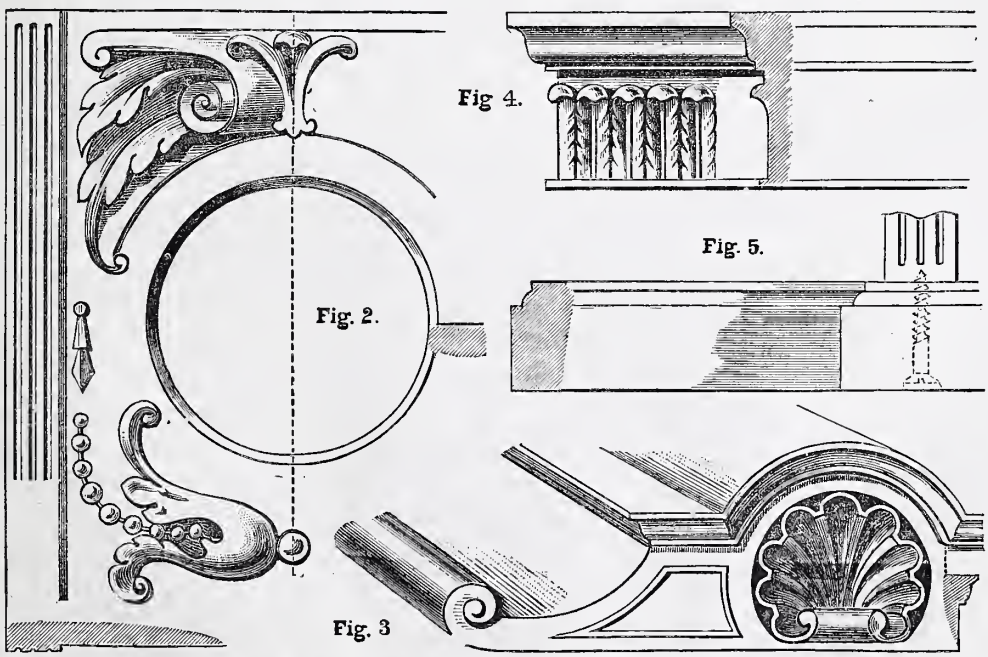



Fig. 2.—Details of Carving for Front, Left Side. Fig. 3.—Details of Pediment at Top of Clock-case. Fig. 4.—Enlarged View of Cornice at Top of Case. Fig. 5.—Plinth at Base of Case, showing Section.

level than the casing of the clock that is placed between them.

The material used may be walnut or any hard wood. If made in ebonised wood, with incised gold lines on the plinth, as shown in the design, and with the panels on the sides of the case defined in the same manner, a pleasing effect would be obtained. It may be suggested, too, that if the central case only were used, without the pediment, it would be as well to add a flat piece of wood on the top, with the edge moulded in the form of a quarter circle in section, and from ¼ in. to ½ in. less than the top of the clock-case on all sides, the back excepted.

## HOW TO SHARPEN A SCRAPER.

BY CHOPSTICK.

I AM often surprised to see a man taking a great deal of pains to plane up a cross-grained piece of wood, setting the plane as fine as possible, and turning the wood this way and that way; and after trying in vain to get a passable face on it, he tries first coarse glass-paper, then finer, until he does get a decent face on it—but by what a method? Decidedly amateurish, I think. Now, if that man would only use that very useful though simple tool, the scraper, he would do his work quicker and far better.

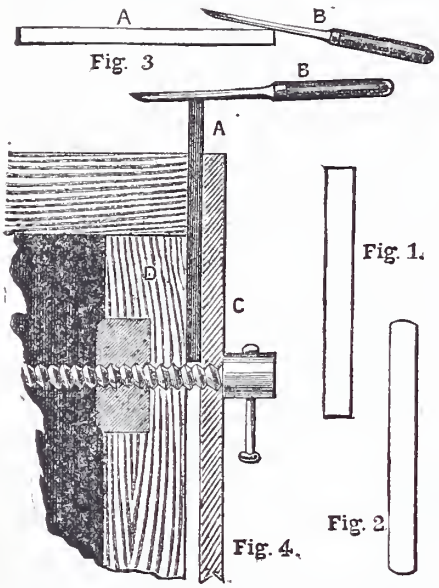



**Fig. 1.—Scraper properly filed. Fig. 2.—Scraper improperly filed. Fig. 3.—Scraper (A) and Gouge (B) in Position for Sharpening. Fig. 4.—Scraper in Vice for Finishing Touch. A, Scraper; B, Gouge; C, Vice; D, Bench. Drawings much exaggerated.**

In the first place, what is it? It is simply a piece of steel about 4 in. by 3 in.; a piece of saw-blade will make a good one, though the trouble of making would be more than it is worth, as they can be bought for 3d.

But now as to the proper way of sharpening it. First, screw it in your bench vice, edge up, and file the edge straight and square, being very particular to leave the corners sharp, as shown in Fig. 1, not rounded, as in Fig. 2. Then take a small gouge, and laying the scraper flat on the bench, rub the gouge (the back of it) to and fro along the flat of it, using as much pressure as can fairly be put on, and lubricating it with your spittle. Having done both sides like this, put it in the vice again the same as before, and taking gouge again, run it smoothly along the edge of the scraper with a hard, even pressure three or four times. You will then have two cutting edges, and if properly done you can take off shavings the whole width of the scraper and of a beautiful fine texture, leaving a splendid face on the most difficult working wood, which will only require a rub with the finest glass-paper to be ready for polishing.

In one shop where I was working a few months ago we made a great many first-class coffins, both oak and pitch pine, which all had to be French polished, and we scarcely used a smoothing-plane to any of them, simply taking out the saw-cuts with the jack-plane, and finishing with the scraper. Until that time I had been in the habit of planing, but I have altered my mind, and all the work I now do is finished with the scraper. One more word before I finish, and that is, do not attempt to scrape pine or deal, as it is too soft; but any hard wood it will do to perfection.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 68.—THE PERFECTED AUTOMATIC HAND CAMERA.

MESSRS. TALBOT & EAMER, manufacturers and dealers in all kinds of photographic apparatus, write to remind me that about eighteen months ago I noticed their Diamond camera in WORK, and that they have now "introduced a new camera, which has features not possessed, either together or separately, in any one of all the similar instruments in the market." Further, they enclose a few particulars and some specimens of its work, and express their willingness to forward fuller particulars. I would much rather that all inventors, patentees, and sellers who wish for a notice of their specialities in WORK would send a specimen of the camera or otherwise, as the case may be, for inspection. Publishers do not send particulars of their books when they wish for notices of them, but they send copies of the books themselves, and then the reviewer is able to judge of their value and how far the subject treated therein is handled in a suitable and useful manner. I cannot speak in positive and specific terms of any article unless I have had an opportunity of seeing it and handling it. As for the particulars and prices, they may be gathered from pages 4 and 5 of Messrs. Talbot and Eamer's "Price List of Photographic Apparatus," which, I presume, will be sent to any applicant who may choose to write for it. Further, it will undoubtedly be to the advantage of all persons who obtain mention of any speciality in WORK to keep that speciality well before the public by advertising in WORK. Many who receive notices are prone to say, "Yes, that's a very nice notice; that's just what I want. It gives publicity to my manufactured bantling, and it will save me the trouble and—well—expense of advertising." May I be permitted to remind my friends whose thoughts run in this direction that a notice is, in reality, but the insertion of the thin end of the wedge, and that it remains for those whose goods are noticed to drive it home by frequent advertising. Surely they must, one and all, be acquainted with the old saying, "Out of sight out of mind." The effect of any notice, be it as good as it may, is only ephemeral and evanescent, and its work is confined to little more than the week or month of issue. It is by regular and persistent advertising nowadays that a name or good repute for a speciality is gained and the support of the public secured. Here is a short story to the point, and very much to the purpose. I do not vouch for the truth of it, but I believe it to be perfectly true. A very well-known firm—I carefully abstain from mentioning names for obvious reasons—were accustomed, it is said, to spend as much as £10,000 per annum in advertising. Having done this for a long series of years, they were led to think that their name and specialities were as household words in every part of the inhabited and civilised world, and that they might as well lessen their outgoings by £10,000, under the idea that it would be useless to continue to spend so large a sum yearly in advertising. They did so, and the effect on their business was so marked that they were glad to spend as much as heretofore in advertising in the following year.

Let me say that it is not of the slightest benefit to me to cry up advertising, and add that I have only written as I have to explode the fallacy that when an individual or a firm has got a notice, he or they have got all they want, need, or require. I am simply telling the truth, the whole truth, and nothing but the truth, and I do it entirely on my own responsibility. I should have had much pleasure in giving an opinion of Messrs. Talbot & Eamer's Perfected Automatic Hand Camera if I had had an opportunity of examining it. Of the specimens of photos taken by its aid, which are now before me, I can only say that they are marvellously clear and distinct—so clear, in fact, that the features of persons in the middle distance are distinguishable. To judge from the photos themselves, the camera by whose instrumentality they were taken ought assuredly to be a good one.

### 69.—HOBDAY'S ILLUSTRATED CATALOGUE.

I have received from Mr. Henry A. Hobday, tool merchant, Chatham, a copy of his Illustrated Catalogue for 1891. As a list of the different kinds and sizes of tools on sale at his establishment, it will prove useful to all who obtain it. The cuts are clear and good—clearer, in fact, than those which appear in price lists usually are. It is well printed; the sheets are firmly held together by wire staples, and placed in a strong and neat gold-lettered cover. It is pierced at the upper left-hand corner, and a narrow tape is put through the hole, so that it may be readily hung up for reference in any workshop.

### 70.—"THE WOOD CARVER."

This is a new monthly publication issued by Messrs. Simpkin, Marshall, Hamilton, Kent and Co., Limited, at 1s. It contains full-size designs and working drawings for carved woodwork complete, with sections and description, selected and drawn by Mr. Henry K. Kuchemann. The designs, perhaps, may be regarded as fairly good, but there is nothing particularly striking in any of them, or calculated to excite particular admiration. The designs in Part I., for September, 1891, are a Renascence clock-case, a reading-desk, a bracket support, two cabinet photo frames, a two-leaf screen, a corner cupboard, and a friese pattern for hat-rail. But "Renaissance" is far more familiar and acceptable to the eye, at all events, than "Renascence," and more appropriate to the style of decoration that it is intended to describe; and I am not aware of any reliable authority for turning "frieze" into "friese." Yet, in common with the rest of mankind, I do not know everything, and there may be deeper depths in the etymology and rendering of these every-day words to which I am as yet a stranger. It is desirable that in all publications of this kind an attempt should be made to raise the designs that are given to the wood-carver, certainly above mediocrity, if it be not possible to render them unexceptionable. The great fault in those that are given in Part I. of *The Wood Carver* is that they are not graceful in conception, and when reproduced in wood are not likely to prove satisfactory, or in any way attractive. But possibly future parts may show an improvement in the direction indicated. Let us hope they may.

THE EDITOR.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Fret Machine.**—A. H. B. (*Belfast*) writes:—"There is only one fault I have to find with the fret machine described in answer to G. G. (*Abergavenny*) on p. 155, No. 114: and that is, it is too slow. Could J. H. W. give me a method by which I could gear it with fly-wheels to increase the speed?"

**Paste for Sharpening Razors.**—J. C. (*Belfast*) writes:—"I send the following, hoping you will insert it for the benefit of self-shavers. Take oxide of tin—in other words, prepared putty—1 oz., and a solution of oxalic acid in sufficient quantity to form a paste. This composition is to be rubbed over the strop, and when dry, a little water may be added. The oxalic acid having a great affinity for iron, a little friction with this powder gives a fine edge to the razor."

**Boiler Incrustation.**—INQUIRER writes:—"In WORK, p. 378, No. 128, you point out the want of a good incrustation preventer, and remark that a composition which will act in one place is frequently of no use in another—a result probably owing to the difference in the character of the water used. In Manchester the other day I came across a device which renders the use of so-called 'preventers' unnecessary. The Manchester Packing Company have had fitted an apparatus called the 'Gamgel Spouting Cowl,' and have been watching it for the past twelve months, with the result that they find it prevents incrustation absolutely, and—what is even of more importance—showed a saving of 13 per cent. in coal. I was not able to get a sight of the invention, but perhaps some of the readers of WORK can give us a description of it."

### II.—Questions Answered by Editor and Staff.

**Price's Lathe with Vertical Slide.**—G. H. (*St. Helens*).—R. Price's address is 125, Stratford Street, West Ham, E. The lathes will do turning, boring, milling, slotting, shaping, wheel-cutting. Ordinary lathes will do all these, but the vertical slide gives especial facilities for milling, boring, shaping, and wheel-cutting. For milling and boring with the bar, the vertical slide is so convenient, it is a wonder those who have no milling machine can be content to do without it. It is not pleasant to do much wood-turning on a lathe intended for metal, but if you wish to do this you might fit up wooden bars so as to continue the bed three or four feet, and take the poppet and hand-rest, but *not* the slide-rest, which you do not want for turning wood; it would only be in the way. Mr. Price says he has made one with a gap, so I suppose you can have one so if you wish. I think the watch lathe mandrel would not "jamb," but drive rather hard in drilling if made as you propose.—F. A. M.

**Pea-planting Machine.**—DEVON.—It can, I think, be easily done by fixing a cane on the axle of one pair of wheels—the cane, when in its highest position, to open a little trap-door in the bottom of a box. The door must open on the outside, otherwise it could not be closed against the peas. It should close smartly with a spring.—J.

**Oil Engines and Saw Benches.**—J. S. (*Beith*).—"Gas and Petroleum Engines," by Wm. Robinson, M.E., a practical treatise on the internal combustion engine (14s.). "Saw Mills," by M. Powis Bale (10s. 6d.). Nothing has appeared as yet in WORK on oil engines, and information is not as yet very easy to obtain.—F. A. M.

**Naphtha Engine.**—J. S. (*Pimlico*).—I believe Messrs. Yarrow are the makers of these engines, but they have not been perfected, and are still dangerous. I don't think anyone can tell you how to make one of these engines. The Priestman paraffin oil engine is, I believe, a success; and J. H. Knight, of Barfield, Farnham, also makes them. There is no oil engine at work that is not patented, to my knowledge.—F. A. M.

**Elementary Books on the Lathe.**—S. R. W. (*Saltburn-by-the-Sea*).—Why, certainly there are many suitable for an amateur; you will find them named in my papers on "Lathes and Turning Appliances," in Nos. 2, 4, 6, 8, 10, and 14 of the first Volume of WORK; and there, too, you will find such information as will enable you to choose for yourself the kind of lathe that will suit you best.—F. A. M.

**Speed of Drums, Pulleys, etc.**—AN INTERESTED READER OF "WORK."—Your inquiry is very vague. If you want to find the relative speeds of two drums geared together by a strap, or of two toothed wheels in gear together, you can get it from the fact that the numbers of their revolutions per minute will be inversely as their diameters; if one pulley or wheel is half the diameter of the other, it will make twice as many revolutions in a given time. If you want to calculate absolute speeds in connection with the transmission of power, the case is different. One horse-power is equal to 33,000 foot-pounds per minute. Suppose you want to transmit 20 horse-power from a drum 6 ft. in diameter, moving at 100 revolutions per minute, the circumference of the drum is $6 \times 3\frac{1}{2} = 18\frac{6}{7}$ ft., and the speed of the belt, therefore, $18\frac{6}{7} \times 100$ revolutions $= 1{,}886$ ft. per minute (nearly). The work of 20 horse-power is $33{,}000 \times 20 = 660{,}000$ foot-pounds; therefore the tension on the belt will be $660{,}000 \div 1886 = 350$ lbs. (nearly). If the power is transmitted by a toothed driving wheel, there will be this pressure on each tooth. If the hand tension is given, the necessary speed is found by dividing the work by it. Any of the standard text-books on millwork will instruct you in this matter; Rankine's is very complete, but it is expensive, and, perhaps, more mathematical than you may desire.—F. C.

**Platelayers.**—T. A. (*Bootle*).—This question is one of interest to boiler makers and engineers, as well as platelayers. The problem is one often dealt with in the shops, and I shall, therefore, answer it at length, without mathematics. First, you have a curve, A (Fig. 1), of 396 ft. 5 in. radius. Taking a chord line, B, of 10 ft. in length, you want to know the height of the rise, E, from the chord to the curve. E is termed the "versed sine," D, D are "semi-chords." To get the height of E, it is necessary to square the radius of the curve A, and also of the length, D; subtract the latter from the former, and take the square root of the remainder; then

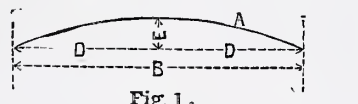


Fig. 1.

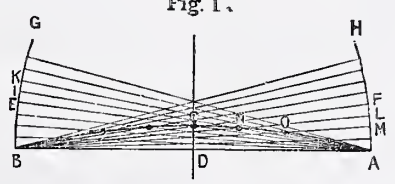


Fig. 2.

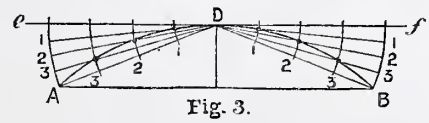


Fig. 3.

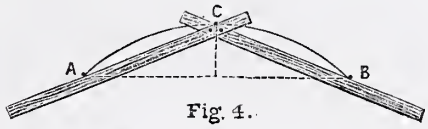


Fig. 4.

Diagrams illustrating Methods of Striking Curves.

subtract the square root so obtained from the radius of A. The formula is put thus: E = radius A minus

$\sqrt{\text{radius A}^2 - \text{D}^2}$. Reckoning it out:

| | |
|---|---|
| A squared | = 22,629,049 in. |
| D ,, | = 14,400 in. |
| $\text{D}^2$ minus $\text{A}^2$ | = 22,614,649 in. |

The square root of 22,614,649 in. is 4,755·48 in., and 4,755·48 in. subtracted from the radius of A = 1·52 in., and this is the height, E, which you require—say, $1\frac{1}{2}$ in. full. There are three ways employed in the shops for striking these very flat curves after the height, E, is known. In Fig. 2, A B is the chord, and C D the height of the versed sine, and the curve has to pass through the points A, B, C. From the extreme points, A, B, as centres, describe arcs, A H, B G. Through the third point, C, draw A E, B F, cutting the arcs. Divide A F and B E into any number of equal parts, and set off a series of equal parts of the same length on the upper portions of the arcs beyond the points E, F. Draw straight lines, B L, B M, etc., to the divisions in A, and A I, A K, etc., to the divisions in B. The successive intersections, N, O, etc., of these lines are points in the circle required, which may be filled in accordingly. Similarly the remaining part of the curve, B C, may be described. In Fig. 3 let A, D, B, be the given points. Draw A B, A D, D B, and also *e f*, parallel to A B. Divide D A, D B, into a number of equal parts at 1, 2, 3, and from D describe arcs through these points to meet *e f*. Divide the arcs A *e*, B *f*, into the same number of equal parts, and draw straight lines from D to the points of division. The intersections of these lines successively with the arcs 1, 2, 3, are points in the circle to be filled in. In Fig. 4 two straight-edges are screwed together, touching the ends, A, B, of the chord, and crossing at the point C, where the versed sine cuts the circle. A similar point is fixed at C, and pins are driven into the templet plate at A and B. When the straight-edges are slid around the pins, A, B, the pointer will mark the curve, A C B.—J.

**Watch Plates.**—AMATEUR WATCH JOBBER.—The reason of the watch plates looking so white after cleaning is that you, or someone before you, have brushed all the gilding off, and the only way I know of getting it to its original colour is to gild it anew. Send the plates by registered post, in a wooden box, to Messrs. Grimshaw & Co., 35, Goswell Road, Clerkenwell, or Haswell & Sons, 49, Spencer Street, Clerkenwell, and tell them to regild. The cost will only be a shilling or two, at most. There is no other remedy I know of.—A. B. C.

**Influence Machine.**—STUDENT (*Hull*).—You will find an illustrated description of an influence machine in WORK, No. 88, Vol. II., published Nov. 22nd, 1890, under the head of "A Cheap and Simple Electrical Induction Machine." Other forms might be described, but this will give you an idea how to make one.—G. E. B.

**Electro-plating Brass.**—T. C. W. (*Hull*).—I cannot advise you to attempt electro-plating at home a brass article having a superficial area of 4 ft. To do this job you will require a vessel capable of holding at least fifty gallons of silver solution, and this will cost from £2 to £3. The silver solution will cost about 15s. per gallon, or, say, £37. The silver sheet for anodes will cost £50, and the battery from £2 to £3 more. These are the chief items of expense likely to be incurred in plant alone, which will cost a total of at least £100. A professional plater will do the job for about £2, and do it better than you can possibly do it at home. If you do not know a professional plater, write again to us, or ask Mr. Hartley, 13, St. Paul's Square, Birmingham, to quote you a price for the job.—G. E. B.

**Medical Electricity.**—HÆREO (*Dover*).—Your medical adviser was quite right in warning you against the use of a coil for the cure of your nervous disorder. The current from a coil, and also from a shocking machine, is interrupted, intermittent, and alternating. It is a see-saw movement, most irritating and injurious to the nervous system. Such a current does not strengthen the nerves. Its tendency is toward an exhaustion of nerve-power. Unless your medical adviser instructed you how to use this potent remedy, you will do well to avoid it altogether. Replying to your other question, an *uninterrupted current* for medical purposes is obtained from a large number of small cells arranged in series, so as to get a high electromotive force capable of surmounting the enormous resistance of the human body. From 30 to 50 cells of the Leclanché type are usually employed. Mr. K. Seball, 55, Wigmore Street, London, W., will supply a 40-cell battery at the price of £5 15s.—G. E. B.

**Electro-magnets.**—W. G. (*Wandsworth, S.W.*).—You will find this subject fully treated in one of the Cantor lectures given by Professor Silvanus P. Thompson. You can get the lecture above mentioned. You may then study the principles of construction of electro-magnets, and apply these to your requirements. Had you stated these in your letter, I could have helped you over the stile. It is not enough to say you want electro-magnets and solenoids to work with a 100 volt current. This is a most important factor, and should have been stated; but one cannot design electro-magnets on this bare fact alone. I must know something about the volume of current as well as its voltage, and also know its source, whether from a dynamo or battery. I must also know what work is to be done with the magnets and solenoids.—G. E. B.

**Incandescent Gas Light.**—C. N. V. (*Aldershot*).—I do not know the address of the Incandescent Gas Light Company. I have a patent incandescent gas burner, obtained at 81, High Holborn. This address is embossed on the burner.—G. E. B.

**Carpenters' and Cabinet-makers' Wages.**—WORKSHOP PRESIDENT.—A letter addressed to the Editor of the *Trades Unionist* will bring you a list of the Trade Union rate of wages. Perhaps some of our readers can also oblige with the information.—G. E. B.

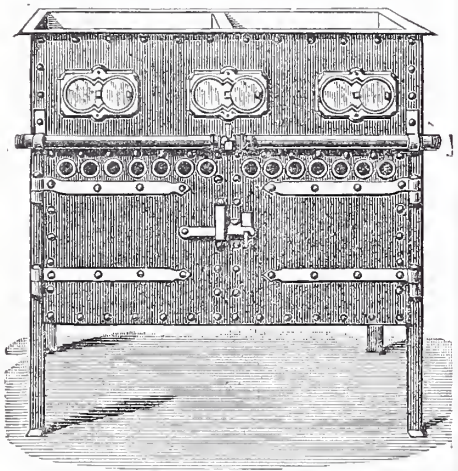
**Colouring Maps.**—C. N. V. (*Aldershot*).—The colours run when size is applied to maps for one or more of the following reasons: (1) The maps have not been properly prepared for colouring. (2) Bad colours have been employed. (3) Bad size has been used. (4) The size has not been rightly applied. (1) The maps must be sponged lightly with a solution of two teaspoonfuls of ox-gall in a pint of water, to remove grease before colouring. (2) The best moist water colours should be used, or Rowney and Co.'s cakes of colour. (3) Isinglass makes the best size; next to this comes gelatine. If these cannot be obtained, make your own size from parchment cuttings. (4) Apply the size hot, in a warm room free from dust and draught, with a broad 2 in. sable brush. Use this in one direction only. Don't brush the size to and fro, or it will lather and run the colour.—G. E. B.

**Accumulators.**—H. McM. (*Liverpool*).—(1) The full storage capacity of a storage battery can be ascertained by measuring the positive plates and reckoning six ampère hours to each square foot of positive surface. (2) The lead plates should be roughed or pierced with holes before applying the red lead or litharge paste, and this should be well pressed into the holes to ensure a good hold on the paste. If this is not done, the paste will peel off. (3) The storage qualities of the battery do not entirely depend upon the quantity of red lead put around the plates, but upon the quantity of lead oxide converted by the electric current into lead peroxide. There must be a practical limit to the

thickness of the coat of lead oxide we can get to hold on to the lead plate, even when this has been pierced with holes. When this has been converted into lead peroxide, it has a slate colour. (4) The size of the cells is determined by the volume of current to be obtained from them, together with the required pressure of the current. Large cells must be used if a large volume of current in ampères is required. As each cell gives a pressure of two volts, we must have enough cells in series to push the required current through the work to be done. (5) Cells may not be made of metal, because this would be destroyed by the acid, and would form a galvanic pair within the battery, thus short-circuiting and ruining the plates.—G. E. B.

**Worked Brass.**—BELFAST.—The proper "lacquering" of polished brass is a difficult matter, and requires considerable practice, but the best substitute is "Zapon," made by the Crane Chemical Co., Newhall Hill, Birmingham (directions for its use are supplied with it); or "Silico Enamel," purchasable at almost any cyclists' warehouse, will answer very well. All the articles should be slightly warmed, and then brushed over with the enamel or varnish. Gawthorp's (16, Long Acre, London) "Book of Designs for Repoussé," 1s. 1d. post free; or "Home Art Work" (Heywood, Paternoster Row), might suit you for designs; while, for the practical working, Haslope's "Repoussé Work," 2s. 6d. (Gill, 170, Strand), or Gawthorp's "Hints," 6½d. post free, are most likely to be useful.—J. G.

**Book on Electro-plating.**—WYNBERG.—The best work on electro-plating is "Electro-metallurgy," by A. Watt, price 9s. (Crosby Lockwood & Co.). The cheapest and best book, according to press notices and the testimony of practical platers, is the "Electro-platers' Handbook," price 3s., published by Messrs. Whittaker & Co., 2, White Hart Street, Paternoster Square, London, E.C. This is a book specially written to meet the wants of amateurs and those who wish to learn the art.—G. E. B.



Small Fryer for Fish and Potatoes.

**Fish and Potato Fryers.**—WEEKLY READER.—The illustration given above is taken from the list of Messrs. Fletcher & Co., 77, Queen Victoria Street, E.C. It is scarcely large enough for the purpose required, but they will quote prices for any size. You will not require the oven. The canopy should be of zinc; and if you will let me know the size of pans, I will give directions for making the canopy, and the probable cost.—T. W.

**Cork to use with Glass-paper.**—J. W. C. (*Tavistock*).—You must apply to a cork cutter. You will find one in Plymouth, or, at all events, in one of the "three towns."—ED.

**Single Stroke Electric Bells.**—J. H. (*Bedford Leigh*).—Almost any number of single stroke electric bells may be rung on one circuit, providing the battery power is proportioned to the number of bells to be rung. If the bells are arranged in series, the total pushing power of the battery, or its E.M.F., must be high enough to send the required current through all the bell coils, and this may mean one additional cell to each additional bell. If the bells are all arranged in parallel on one circuit, the cells of the battery must also be arranged in parallel, or the cells of the battery must be large. In this case we must increase the size of the cells with each additional bell, or increase the surface area of the battery elements by adding cells in parallel, because we require a larger volume of current to ring all the bells at once. If you will give me the number of bells you wish to ring, and the size of the bells, I will try to aid you with advice respecting the battery.—G. E. B.

**Electric Bell Fitting.**—G. F. B. (*Notting Hill Gate*).—You will find some information on electric bells in WORK, Vol. I., Nos. 12, 18, 20, 27, 31, and 32. These are all in print, and may be obtained through any newsagent for 6d. "Electric Bells and All about Them," by Mr. Bottone, price 3s. post free from the author, who lives at Wallington, Surrey; or "Practical Electric Bell Fitting," by Mr. F. C. Allsop, 165, Queen Victoria Street, London, E.C., are both good books on the subject. Both authors sell the "stuff to make the bells," and sell bells ready made, together with the materials for fixing them.—G. E. B.

**Canoe and Boat.**—A. G. (*Dublin*).—For particulars of these, see WORK, Nos. 71 and 80.

**Camera Making.**—W. J. H. T. (*Birmingham*).—For articles on cameras, see WORK, Nos. 13 and 23. You should consult the Indexes to WORK, Vols. I. and II.

**Slide Hinge Photograph.**—NO NAME.—The neatest method of hingeing a folding dark slide is to cut the lower part of the shutter into strips about half an inch wide, fitting into each other by a simple rebate. The strips must fit each other accurately,

Diagram illustrating Slide Hinge for Dark Slide.

and, being laid down on a flat surface in close contact, glue over them on one side some thin leather or other tough material, and let them dry, after which they can be blacked. The accompanying diagram will explain the matter.

**Safety Bicycle Construction.**—J. W. T. (*Manchester*).—If J. W. T. procures the back numbers of WORK, he will find articles already published, entitled "Safety Bicycle Construction," and the last treats of the blowpipe and foot-blower.—A. S. P.

**Pneumatic Tire.**—E. G. (*Salford*).—Your correspondent seems to hold a patent for *one more* pneumatic tire. Being quite ignorant as to the nature of the patent tire, I can say nothing about it, except that if the steel ribbon referred to is essential to complete the patent, and has been put down in the specification, then I should say that, without the ribbon, the patent would be incomplete, and would only be of value in so far as it was found to be a good thing—what was of it—minus the ribbon. As to the procuring of this steel ribbon, the form would be somewhat after that of a mud-guard, only thinner, and the Birmingham sheet steel workers will turn out thin steel to any shape and pattern, and for any purpose, under the sun. It is only a question of cost; in this case, the making of a special pair of rolls.—A. S. P.

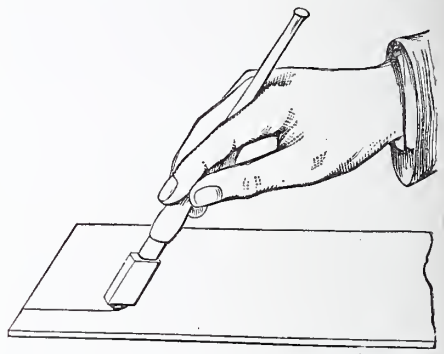
**Tandem Safety Bicycle.**—J. G. B. (*Clapham, S.W.*).—Without making a drawing of the machine, or having one to measure from, I could not give J. G. B. the relative dimensions. I could, however, give him this advice: "Don't make it." A tandem bicycle mounted by two young fellows, having no responsibilities, and somewhat reckless of life and limb, may be tolerated, but the idea of one of the riders being a lady should be given up, unless she has considerable acrobatic training. Let him go in for a tandem tricycle, which is in every way suitable for a lady. It is very little heavier, and nearly as fast. I should be glad to assist J. G. B. with sizes for a tandem bicycle, if he still thinks of going in for it, and will endeavour to procure dimensions, and give a drawing as well.—A. S. P.

**Staining and Polishing Cheap Furniture.**—J. E. B. (*Epworth*).—The processes of painting and polishing cheap furniture are entirely distinct trades, and are not usually done by the same person; but as you have, from instructions given in "Shop," succeeded in doing the former in a manner satisfactory to yourself, we may reasonably hope you may be successful with the latter process, if you will have confidence in yourself, for in this lies half the battle. The somewhat tedious process of French polishing—properly speaking—has to be dispensed with, the work being done mostly with a brush rather than a rubber. For mahogany or red-coloured furniture the work is given one or two coats of patent size and venetian red, applied hot; for walnut, umber is used. When this is dry, smooth with worn glass-paper; then give three or four coats of red varnish, applied with a brush. This should be done in a warm room. Some polishers, previous to applying the varnish, give the work a good wet rubber of polish. This is applied with wadding, omitting the rag covering. This plan, though not always adopted, has much to recommend it, the object being to seal, as it were, the pores of the wood, make the varnish take more kindly, and hold out smoother. Each coat of varnish should be allowed at least fifteen minutes to dry before the next is applied. When the last has stood this long, it is levelled by means of the rubber previously used, only with the rag covering. This rubber is used fairly wet with "half-and-half"—*i.e.*, half polish and half spirits. The rubber should present a quite level face, with the rag free from creases. This is best obtained by pressing its face on the palm of the hand or on the back of a worn piece of glass-paper, though you will see most polishers give it a tap on the underside or front of the work-bench. This rubber is now applied to the work with a light, swinging motion, lengthwise of the grain, never allowing it to remain still on the work an instant, the polish in the rubber being thinned out as required with methylated spirits only; though, if the work is not of the very cheapest class, its brilliancy will be enhanced by adding to the rubber a little glaze, on the use and composition of which you will find an article by Mr. Denning in WORK, No. 126, p. 338, August 15th issue. In the use of this rubber lies the want of confidence in one's own abilities. Just when to leave *off* is a happy knack that can only be acquired by practice and careful attention. Every care must be taken not to tear up the gums instead of levelling them. The varnish used is one in which resin plays an important part. A suitable varnish can be made as follows: Naphtha, 1 pint; shellac, 5 oz.; resin, 2 oz. (No. 2) Naphtha, 1 pint; shellac, 4 oz.; gum sandarach, 2 oz.; gum benzoin, 1 oz.; resin, ½ oz. The varnish should be carefully strained through fine muslin before using. For polish, use naphtha, 1 pint; shellac, 6 oz. To make the polish and varnish a red colour, use bismarck brown, first dissolving two-pennyworth in a ¼ pint of methylated spirits.—LIFEBOAT.

**Ebony Walking Stick.**—EBONY.—The fact of your stick showing so many white marks points to the conclusion that it is not an ebony one, but one made of some cheaper wood stained and varnished, the varnish being of a soft kind. The best thing I can advise you to do is to glass-paper it quite smooth, and send to Mr. Flack, Steam Works, 75, Blackman Street, London, S.E., for a small bottle of his ebonite French polish and spirit varnish, telling him the purpose for which you need it; or buy a small tin (about 5d.) of black enamel, Foo-Chow brand. Both these may be applied with a camel-hair brush, and will to you, with your inexperience of such matters, give a far more satisfactory result than trying to work it up with French polish.—LIFEBOAT.

**Optical Illusion for Use in Advertising.**—W. E. W. (*Wimbledon*).—The application of an old and well-known principle to advertising purposes could scarcely be made the subject either of a patent or of registration, and in this case we presume that W. E. W. will have to rely on the honour of the advertising firm to whom he offers his idea.—C. C. C.

**Cutting Glass.**—AMATEUR CUTTER.—The reason your glass does not break properly is that the diamond has not cut it all the way, and the fault lies in the holding of it. I suppose it is the top part that breaks properly, and not the bottom; this is generally the case. If so, you hold the diamond correctly when commencing the cut, but, in bringing it down, gradually get it too upright. The accompanying drawing will show you the correct way to hold it. You will notice the bottom, to which the diamond is affixed, is kept parallel with the glass. This must



Mode of holding Hand, etc., when cutting Glass.

be so all the way. The fingers should be kept stiff, and not moved as when holding a pen in writing. It will help you, when you have made the cut, to lay the glass on a board or table with a straight-edge, get the cut exactly over the edge of the board, hold one part of the glass firmly, and press the other downwards, when it should break clean, and follow the cut all the way. I shall be pleased to help you at any time. Glad you like the paper, and thank you for kind wishes.—W. E. D., JR.

**Making Improved Pipe-stem in Vulcanite.**—JACK PLANE.—Vulcanite is simply indiarubber combined with sulphur and colouring matter, and hardened by heat and pressure. But the heat has to be very great—some 315°; so has the pressure—some 80 lbs. to the square inch. The manufacture is not one to be carried on as a home industry; it needs special skill and costly appliances. As JACK PLANE has protected his invention, and fears no piracy, he is strongly recommended to arrange with some firm of manufacturers for the fabrication of his stems, rather than attempt to make them himself.—M. M.

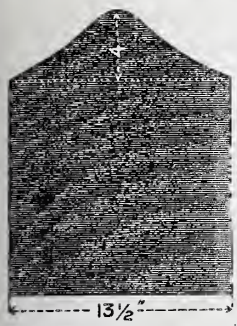
**New Combination Saucer.**—W. E. W. (*Wimbledon*).—To your query No. 1, we should say that undoubtedly your idea is a fit subject for a patent. To No. 2, whether it would be *worth* patenting, it is impossible to give a definite answer. If the trifling cost of provisional protection is not an object to you, we should say, get such protection, and then show your plan to some of the great pottery firms. If you do not care to risk any money, you might offer them the idea, trusting to their good faith. Such firms will be (query No. 3) the persons to purchase your patent rights or to pay a royalty on working them, if the idea should be thought to have commercial value. We do not question but that in this trade there would be a desire to produce novelties.—C. C. C.

**Plaster Casts.**—E. J. (*Yeovil*) wishes to procure large-sized plaster casts of the statesmen of the present day. Probably the largest assortment of casts in this country is at Messrs. D. Bruchiani and Co.'s, Russell St., Covent Garden, London, W.C.; and so far as the matters required are in the market, this firm will be likely to have them.—M. M.

**Greenhouse Boiler.**—J. B. (*Manchester*).—No; there is no danger in working your boiler if your

supply cistern is an open one, which it no doubt is. The worst that could happen, if the corroded plates gave out, would be the leakage of the water into the greenhouse, and even this would be gradual, unless your feed cistern is a considerable height, which is scarcely likely to be the case. I think, however, that you did wisely in asking the question. —R. A.

**Gas Generator for Brazing.**—A. J. (*London, N.*).—It will not answer for brazing or shop repairs. Messrs. Fletcher & Co. distinctly state that petroleum gas and producer gases, though satisfactory for furnaces, are *very difficult* to use with any open blowpipe for the above purposes (see p. 90 of their new catalogue).—R. A.



Marking Elbow Pipe.

**Elbow Pipe.**—F. H. (*Witcolmtee*).—Mark your sheet metal out as shown in sketch (seams are allowed for), and after rolling and seaming, trim the edges until level. If you cannot trust your eye to trim it, dip the half elbow in a shallow pan of water, and cut round by the water-line. It would require a full-page article in WORK to describe the geometrical method of marking out an elbow, but you will find this sufficient for all practical purposes.—T. W.

**Improved Watch-key.**—F. M. (*Portsea*).—I have carefully examined the model sent us by our correspondent, and I fail to see any novelty in the arrangement over one I used in 1834-6 (which was of French origin), except the little tightening screw. In these days of the extending use of keyless watches and their great convenience, it seems to me a waste of time and trouble to attempt to perpetuate the use of keys; and even assuming that it were, there does not seem to me to be sufficient advantage to be obtained to lead me to advise either its being patented or introduced, as there is great want of novelty.—C. E.

**Ornamental Designs in Cardboard.**—D. B. D. (*Glasgow*).—You are quite right in your views as to the want of novelty in the so-called card-cutting business to which the name of "castography" has been given, but it is far more ancient than the time you name. When a schoolboy in 1838 I was taught to cut these cards by a young Frenchman of my acquaintance. There is no douht that the judicious use of colour, as suggested by you, would be an improvement.—C. E.

**Incubator.**—INCUBATOR.—If not in your possession, order Nos. 41, 89, 99, and 109 from your bookseller, or the publishers will send them post free for 5d. In these you will find something about the subject, and in the course of a few weeks an article will be published dealing with a hot-air machine. There is plenty of time yet to prepare a machine for use next season.—LEGHORN.

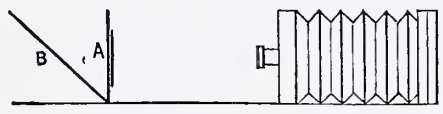
**Incubator.**—D. A. (*East Cambus*).—In page 75, Vol. III., No. 109, you will find a description of a regulator which will suit you.—LEGHORN.

**Tracing Patterns for Crewel-work.**—A LOVER OF "WORK" asks the nature of that composition which may be trausferred from the pattern paper to the material hy pressing with a warm flat-iron. It is simply white wax melted up with vermilion or some other colouring suhstanco. With this the pattern is *printed* upon the paper; but if A LOVER OF "WORK" is proposing to draw designs for crewel-work which are *not* to be printed, this will be of no use to him. His plan will bc to draw the design on paper—any white paper if the design is complete in itself, but if the pattern repeats, or has in any way to be joined accurately to other parts, he should use tracing-paper. He will prick holes along the lines of the design. If the fabric is of a light colour, he will pounce upon it through the holes with a vermilion or blue powder, and then with a camel-hair brush and water colour of the same hue, go over the line of dots. This is necessary; without it, the dry pounce colour would dust out in course of working, and the pattern be lost. If the fabric is dark, he will pounce with chalk or flake white, and line with Chinese white. —S. W.

**Expanding Envelopes.**—R. J. H. (*Penzance*).—I find that your envelope stands the test of cramming in a highly satisfaetory manner. When only moderately charged, it is scarcely less neat than the ordinary envelopes, but when the "expanding" and the ordinary envelope are alike charged with heavy budgets, the superior capacity and neatness of the former are evident. I see no reason why it should not be successful with the stationery trade, provided, after due search, you find that the idea has not been anticipated. It appears possible that the gussets may act as traps for the corners of other letters and cards when in the mail-bags, and that in transit such corners may he forced through your envelope. Whether this objection is of any weight can only be proved in practice; but should it be so, I would suggest a linen lining for the gussets.—C. C. C.

**Repairing Brass Wind Instruments.**—B. S. (*Kinsale*).—If our correspondent will provide himself with a soldering-iron, a blowpipe, some soft solder, and spirits of salts, there are many little repairs which he can do. Of course, he must have some sheet brass and a pair of metal cutters. I presume he has had some experience in the use of the soldering-iron; if not, a very little practice will make him sufficiently expert to solder a broken slide or stay. In patching, care should be taken to shape the piece to be soldered on to the curve of the tube on which it is to be fixed before attempting to solder it. After the soldering, the lead round the patch or stay can be removed by scraping, after which a ruh of emery-cloth and a little polishing with powdered rotten-stone and oil will make a clean and neat joh. In order to hold the two surfaces together whilst heing soldered, fine wire is used. In a previous number some hints were given upon the removal of hruises, etc., and these would he useful to our correspondent. In soldering any stays which are fixed to the valve boxes, care must be taken not tn overheat the latter, or expansion of the metal may prevent the proper working of the valves.—G.

**Daylight Camera.**—LIGHT.—A camera to be used by daylight is exactly the same as one used for artificial light. The only difference is in the illumination of the ohject to be copied. With artificial light it is necessary to use a condenser, but in daylight a reflector is used instead, placed at an angle of forty-five degrees; with regard to the transparency to be copied, all light but that passing through the transparency being carefullycut off. In case of only a portion of the transparency requiring to be copied, an opaque mask of paper should be affixed to the back of the transparency, cutting off all the subject not required. By this means a more brilliant copy is secured. It is an axiom never to use any more light than is absolutely required. The arrangement of camera and reflector is shown in diagram. The reflector must be considerably



Daylight Camera—A, Transparency; B, Reflector.

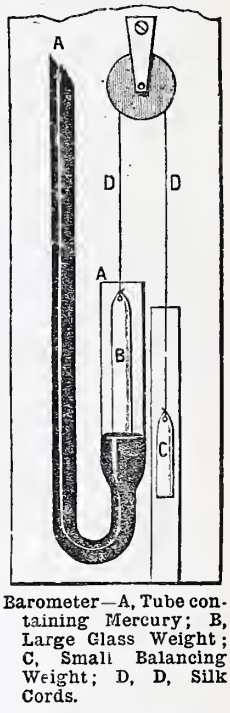
larger than the transparency, or the whole of it will not be evenly illuminated. The reflector may be a mirror or any dead white surface.—D.

**Transparent Varnish.**—DENIS.—I append a few rccipes for transparent spirit varnish, but for such a small quantity as you will require for your holly walking stick, I cannot advise you to make; the cost of the gums, buying in such small quantities, would make a dear varnish. I would rather advise you to go to a respectable oil and colour merchant, and buy a quarter of a pint of transparent spirit varnish or copal varnish. The latter is an oil varnish; and though it takes much longer to dry —say, twelve hours for each coat applied—it will stand hard wear much the best. (No. 1) White spirit varnish: one pint rectified spirits, 4 oz. white shellac, 2 oz. gum sandarach, 1 oz. gum henzoin, ½ oz. pale resin. (No. 2) Colourless varnish: half-pint turpentine, 4 oz. pale resin, 1 oz. gum sandarach. (No. 3) Quarter-pint of clear Venice turpentine, 4 oz. gum sandarach, 2 oz. gum mastic. (No. 4) One pint spirits of wine, gum copal 4 oz., camphor ½ oz., mastic 1 oz., Venice turpentine 1 oz. The gums should be finely crushed before adding to the spirits, then set in a warm place to dissolve. Carefully strain before using. Apply with a camel-hair brush in a warm room.—LIFEBOAT.

**Preserving Glue, Gum, and Paste.**—NORFOLK (*Norwich*) wishes to know "how to keep glue, gums, and paste in a liquid condition without fermenting or turning mouldy." Liquid glue is usually prepared by dissolving the glue in alcohol, or in a little water, and then thinning with alcohol; the spirit acts as a preservative. Gum may be kept in much the same manner: viz., by dissolving in water, and then adding spirit. Some, however, recommend the preservation of liquid gum hy the addition of strong vinegar or acetic acid instead of spirit. The preservatives which have been used for paste are mostly poisonous. Some recommend putting in a little sugar of lead, others corrosive sublimate; carbolic acid has also been employed. It will be seen to be so in the following recipe: Carbolic acid, ½ oz., mixed in a pint of water, and made into paste with 4 oz. of flour; it is said that paste thus made will keep good for years. Another formula is: finest flour three parts, fine white sugar one part, and a few drops of carbolic acid to he stirred in whilst the paste cools; this paste is also reputed to keep well, and to he of a superior colour. It is said that paste may be preserved from souring by alum alone if made as follows: dissolve a teaspoonful of powdered alum in a little boiling water, and with this mix a table-spoonful of flour, beat to a batter, and slowly pour in hoiling water till it turns.—S. W.

**Repairing Keeper-rings.**—AURORA.—The particulars asked for are "how to repair an ordinary keeper-ring when it has heen broken through in several places where deep hollows are either engraved, chased, or filed, thus making the ring too weak for ordinary wear." Of course, the evident answer is: solder the pieces together once more, and do not cut the hollows so deep again. Now, if soldering is the difficulty, it will be cleared up if AURORA refers to page 732, No. 46, Vol. I., and to page 388, No. 76, Vol. II., and there are several other replies in "Shop," which can be found on referring to the Index. If none of these clear up the difficulty, then AURORA must write again, taking care to give full particulars as far as possible of the part of the process where the difficulty arises. We that are connected with WORK are willing to help, but we should like to know the exact point on which advice is asked, for no human being can tell exactly where another will find his difficulties. It is most likely, though, that he does not know how to fix the pieces togetber while soldering, so I will give one or two methods. First tie the pieces together by passing a strand of medium (No. 24) iron hinding wire round the parts, cross the ends, and twist them up quite tight with a pair of pliers. That method may not do if the ring is in several pieces, so try No. 2—thus: Turn up a piece of thin iron plate the shape of a ring, and the exact size of the inside of the ring. To this iron ring tie all the pieces, so that each piece is clcse up to the next one, when they can be soldered all at once, or in two or three solderings, as you choose. Third method: Arrange the picces edgeways on a flat piece of charcoal or pumice. If they will not remain steady enough for soldering, press them slightly into the charcoal. If that is not sufficient, then steady them with pegs of iron wire, which can be driven into the charcoal or else try an original Indian method: viz., use small heaps of moist loam placed in two or three places inside and outside the ring; failing that, try moist whiting. One word of caution: do not let any of the last-mentioned materials get into the place where your solder is to go. And in soldering the gold ring with an iron plate inside, take care how the heat is applied, or the ring may get melted, if it be made of 9-ct. gold, as a great many keeper-rings are. There is not much to fear, though, if your solder is of a suitable quality, and your work and borax, etc., etc., is quite clean, and your heat is applied gently. —H. S. G.

**Repairing Barometer.**—LEWIS.—This is rather a difficult operation, and will require great care to make a good job of it. The mercury should be as pure as possihle. Try it by dropping a little on a white china plate; if it runs ahout and forms bright round drops without leaving a mark, it will do, hut should it form into pear-shaped drops, and show where it has been by dull metallic marks, it is impure—most likely by adulteration with lead—and should be rejected; any way, it is as well to filter it by making pinholes in a sheet of clean white paper, and passing the mercury through; it should afterwards be boiled, to expel the air, and is then ready to bc poured into the tube. This should be done as gently as possible, so as not to take any more air into the tube than can be helped. Even with the greatest care some air-buhbles will, no douht, form, and to ensure correct working these must be got rid of. The proper way to do this is to boil the mercury in the tube by passing it over the flame of a spirit-lamp, commencing at the top. You must be very careful not to crack the tube. Should you not care to risk it, you may try shaking the mercury in the tube, and so cause the air-bubhles to come to the open end. This is a long and troublesome operation, but, on the whole, safer for a novice than the first, although the best results cannot be obtained by this method. In regard to the other part of your letter, I send a small sketch, showing how the weights ought to be fixed, so that you need make no mistake. You will observe that the largest should be in the mercury. The small glass tuhe certainly ought not to have any mercury in it; its use is simply to contain the small balancing weight, so that it may work freely. Regulate the height of the mercury and position of the hands by another one.—W. E. D., JR.



Barometer—A, Tube containing Mercury; B, Large Glass Weight; C, Small Balancing Weight; D, D, Silk Cords.

**Castings for ¼ H.-P. Steam Engine.**—E. S. F. (*Charlton*).—Arrangements are heing made for the speedy productiou of these.—ED.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Jewel-case Making.**—WOODWORKER writes:—"I should like to know how to go about to make a cast from tho outset for a silver tea-set, consisting of a sugar-hasin, cream-jug, and tongs, the two

former articles to be fitted in a canted position: which, I think, is the way they are most generally done. This question concerns only how to make out pattern and the woodwork, including 'fitting.' Supposing the articles are before you, what is the first step to take in planning out pattern for a shaped morocco tea-set case?"

**Locks.**—J. G. (*Bloomsbury*) writes:—"Will any reader kindly tell me where I can get letter locks made wholesale? I believe it is somewhere abroad."

**Punt.**—H. (*Tunbridge*) writes:—"Can any reader give me the sizes, etc., for constructing a punt to hold, say, six persons comfortably?"

**Saw.**—TOP SAWYER writes:—"With regard to saw sketched by W. W. (*Caverton*) (see p. 347, No. 126), it will simplify the work of fitting up for me and many another reader if W. W. would kindly give following measurements and particulars from his: (1) What are the length and thickness of wood spring? (2) What wood did he use for his spring? (3) How long is the saw? (4) What length is treadle? and where is weight placed, and for what purpose?"

**Firewood.**—F. B. (*Rochdale*) writes:—"Will any of our brother readers inform me how to make a firewood bundling machine—that is, to hold the wood firm when being tied? the wood to be cut in lengths of 7 in., and each bundle to be 6 in. in diameter. A description of the above machine will oblige."

**Brass Scraps.**—J. J. J. (*Morriston*) writes:—"Will any reader kindly give me the address of some brass founders who would buy yellow metal scraps and turnings, etc.?"

**Harp.**—TELYN writes:—"I should be pleased if some of our numerous kind musical friends could give me the dimensions of a pedal harp, either single or double. Any information I should be glad of."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Chair Cane.**—G. H. (*Shaftesbury*) writes, in reply to J. T. (*Shadwell, E.*) (see p. 350, Vol. III.):—"I can supply him with dressed chair cane at 2s. 8d. per lb. for fine, and 2s. 3d. per lb. for coarse."—[G. H. should advertise in our cheap "Sale and Exchange" column; but if J. T. (*Shadwell*) sends a prepaid letter, it shall be forwarded.—ED.]

**Egyptian Trellis Work.**—H. C. T. (*Newcastle-on-Tyne*) writes to T. E. P. (*Cambridge*):—"I see in WORK for October 26, page 508 (Vol. I.), that C. H. O. invites me to communicate with you on the above class of work. I shall be very pleased to do what I can for you or any other reader of WORK; having had a good deal of practical experience of this work, I can give advice in detail. Any reader wanting any of this work done or any further particulars, I have no doubt the Editor will kindly give them my address, when I will do my best to oblige any correspondent."

**Artist's Easel.**—H. J. M. (*Bristol*) writes, in reply to S. A. W. (*Wallasey*):—"Seeing in my monthly part of WORK a question by S. A. W. (*Wallasey*), *re* an artist's easel, perhaps the following sketch and explanation may be useful to him. It is very light and portable, and one I made for myself about eighteen months ago, and I have found it answer its purpose very well. It consists of three legs hinged to head-piece, and connected by a loose cross-piece made of beech wood. The hinges I have found answer best for this particular easel are made of two little brass plates and a piece of leather (Fig. 2); the ordinary hinges I found broke off after a little use. The legs and head-piece are ¾ in. square, and the cross-piece as shown. To secure the cross-piece, I have utilised the ordinary window screws and plates (brass). The first plate has a free hole, the second is tapped to take the screw, and, of course, is put on the side of the easel leg farthest away from the thumb-piece of screw; the guide-plate is fitted to the cross-piece of easel. There are three sets of holes, each hole having a plate fitted to it. To hold my painting firm, I use a small clamp over the head-piece. Although at first sight this may seem to some a very flimsy structure, I can assure them it is far from being flimsy, and is exceedingly rigid when set up, considering the bareness of its mechanical construction. I have found it extremely useful for out-of-doors sketching. That is the reason of the pointed ends to the legs; they are useful for sticking into the ground. The cost of the whole would be about 3s., and if S. A. W. desires any further particulars or explanation, I shall be most happy to oblige him. The only tools he would want to use would be a plane, bradawl, screwdriver, and saw. The rebate he could manage with the tenon saw, securing the cross-piece at sides and either end, and then sawing first one way and then the other."

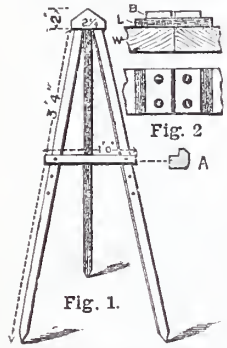



Fig. 2

Fig. 1.

**Fig. 1.—Artist's Easel complete — A, Enlarged Section of Cross-piece. Fig. 2.—Mode of Hingeing in Plan and Section — B, Brass Hinge; L, Leather; W, Wood.**

**Fret Machine Parts.**—NORTH JACK writes, in reply to LANCASHIRE (see p. 334, No. 125):—"I beg to enclose rough sketch of the back part of the saw-frame. In Fig. 1 will be seen back view of arm-piece, showing four plates bent at right angles, and screwed on at back. A small iron pin, ¼ in. diameter, is run through as shown. Fig. 2 illustrates side view, with part in section to show the mortise

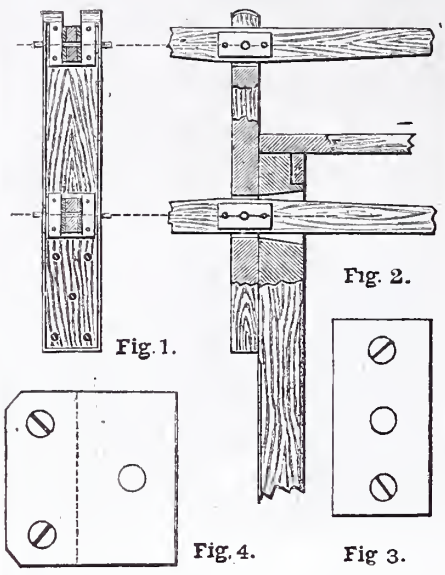


Fig. 2.

Fig. 1.



Fig. 4.

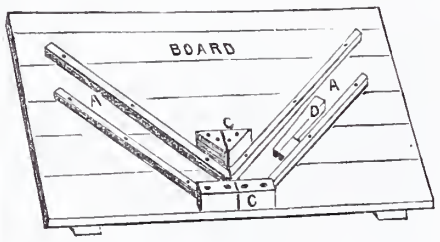


Fig 3.

**Fig. 1.—Back View of Arm-piece. Fig. 2.—Side View of Arm-piece. Fig. 3.—Brass Plate for Arms. Fig. 4.—Brass Plate bent at Right Angles.**

through the upright, and the plates let into the arms. Fig. 3 indicates brass plate for arms, 2 in. long, 1 in. wide. Fig. 4 shows plate which is bent at right angles (see Fig. 1) through the dotted line. The stroke is not quite perpendicular, but the difference is so small that it cannot be noticed while cutting."

**Mitre Cutting.**—R. T. B. (*Holbeck*) writes:—"In WORK, No. 72, page 323, POST OFFICE BOX asks for experience concerning mitre cutting. When I first began picture framing, I tried mitre boxes, blocks, and shooting-boards, but could get none of them perfect. I set to and invented a mitre-cutting board for myself. After the second attempt I got one together which is very simple. I submit a sketch of it which, I think, explains itself. It is on




**Board for Mitre Cutting.**

a stout board, 2 ft. by 3 ft.; so anyone can form an idea of the size. A is where you put your moulding; C, saw cut; D is an ordinary compositor's sidestick and a quoin, to hold the moulding in its place. I have an ordinary mitre-cramp, which can be bought at any ironmonger's or tool shop. With these I can get a mitre true and clean enough for anything, cut with a very fine saw."—[Back numbers of WORK can be obtained of the publishers, Cassell & Co., Ld., Ludgate Hill, London, E.C.—ED.]

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. C. (*Belfast*); EXPECTANT; B. B. (*Bradford*); G. M. H. (*Derbyshire*); C. G. M. (*Truro*); W. A. R. (*Queen's Co.*); R. D. O. (*Elgin*); S. S. (*Stockton*); T. D. (*Halifax*); F. H. B. (*Essex*); G. P. (*Elgin*); CYLTINE MANIFOLD COPYING MACHINE CO.; M. & C. (*Grimsby*); A CONSTANT SUBSCRIBER; G. F. C. (*Southampton*); R. R. (*Wigan*); T. A. D. (*Royton*); CHOPSTICK; C. H. (*Stroud*); A CONSTANT READER; D. B. D. (*Glasgow*); AMATEUR; W. B. (*York*); F. G. (*Kettering*); G. P. (*Elgin*); W. G. C. (*West Africa*); IGNORANT; J. H. (*Stockport*); L. B. (*Wells*); J. S. (*London*); E. R. (*Bermondsey*); MUSIC; F. G. S. (*Reading*); W. E. H. (*Deptford*); J. D. (*Annan*); H. W. (*Heston*); NOT A WRITER; G. R. (*London*); H. G. (*Westminster*); W. W. (*Ripon*); A. R. (*Scorrier*); DOUBTFUL; J. H. (*Smethwick*); W. J. H. (*Reading*); A NEW READER; PICTURE-FRAME MAKER; A. C. (*Blackfriars*); W. C. (*Paddington*); A BEGINNER; W. K. G. (*Nairn*); S. A. C. (*Brackley*); R. A. C. (*Glasgow*); INCUBATOR; W. J. C. P. (*Jersey*); J. E. (*Cardiff*); X. Y. Z.; J. S. (*Keighley*); WORKING MAN; J. B. (*Clapham*); J. G. (*Bradford*); DOUBLE GLOSTER; J. D. (*Clitheroe*); G. R. (*Swinton*); E. T. (*Sherborne*); J. S. (*Longsight*); READER OF "WORK."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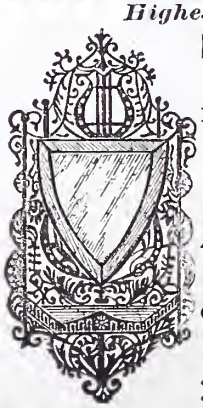

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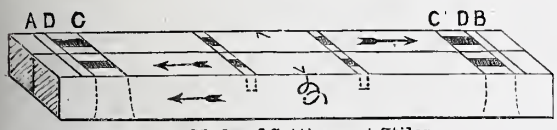



Fig. 2.—Mode of Setting out Stiles.

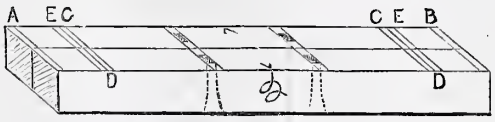



Fig. 3.—Mode of Setting out Rails.

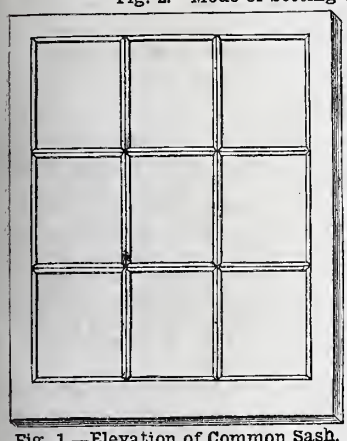


Fig. 1.—Elevation of Common Sash.

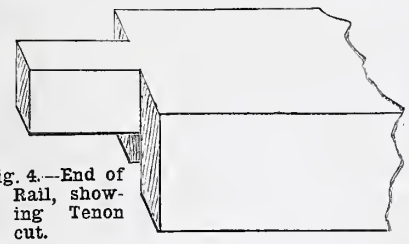


Fig. 4.—End of Rail, showing Tenon cut.

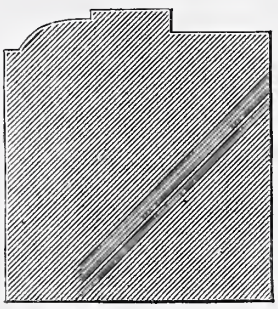


Fig. 14.—Section of Sash Framing.

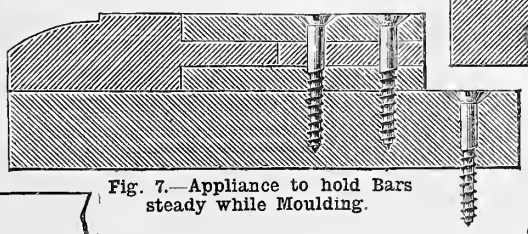


Fig. 7.—Appliance to hold Bars steady while Moulding.

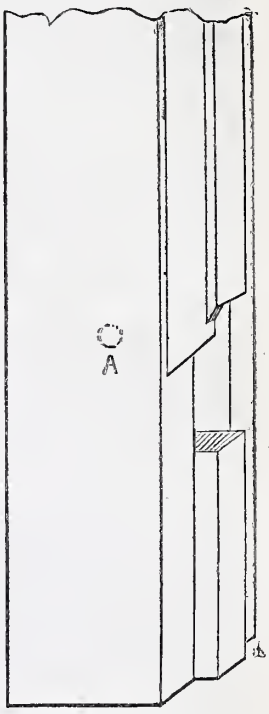



Fig. 9.—End of Stile, showing Mitre and Cutting.

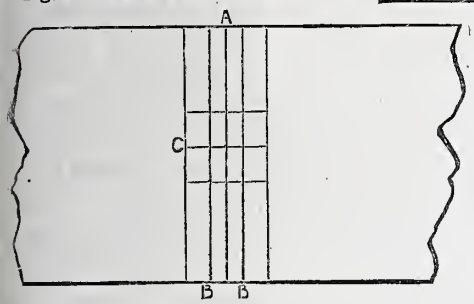



Fig. 5.—Mode of Setting out Mortises, etc., of Cross-bars.

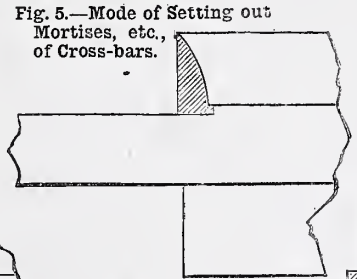


Fig. 11.—Mitre and Tenon of Bars (Ends).

Fig. 15.—Section of Sash-bar.

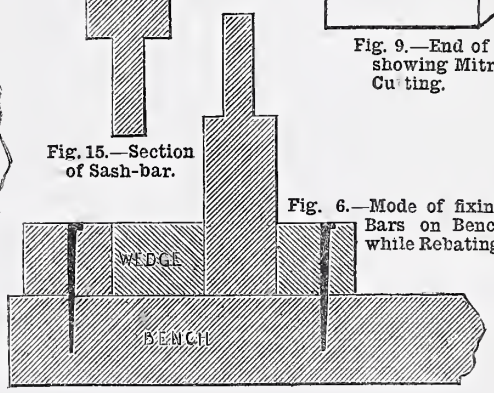



Fig. 6.—Mode of fixing Bars on Bench while Rebating.

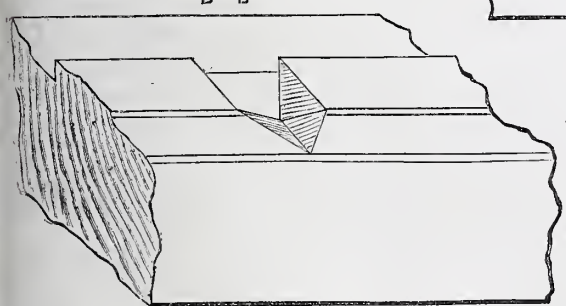


Fig. 16.—Mortise and Mitre for Bar in Framing.

Fig. 13.—Shape of Wedge.

Fig. 10.—Mitre and Mortise of Vertical Bars.

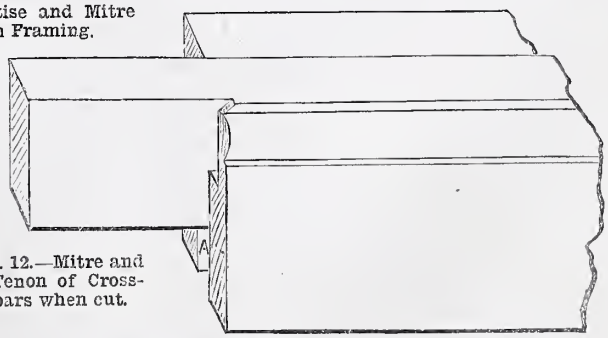



Fig. 12.—Mitre and Tenon of Cross-bars when cut.

Fig. 8.—End of Rail, showing Mitre, Rebate, etc.

SOME LESSONS IN WINDOW MAKING—GREENHOUSE SASHES.

## SOME LESSONS IN WINDOW MAKING.

BY G. LE BRUN.

### Greenhouse Sashes or Dead Lights.

Among the many and varied jobs undertaken by the average worker in wood, that of sash making seems at first sight to present the most difficulties, and very few amateurs in the art of carpentry ever attempt the putting together of even a simple form of window-sash; while the young professional, during his apprenticeship, considers himself almost fully fledged when he has mastered the subtleties of setting out a hung window and fitting together the cross-bars thereof.

Now, there is very little mystery in the matter, and no reason why the worker whose head is clear enough to overcome the difficulties attaching to dovetailing, mitring, mortising, and tenoning, should not grasp, by the aid of a few plain instructions and drawings, the art of putting together a window-sash. To those amateurs who go in for greenhouse building or for the making of forcing-frames, the knowledge of how to construct their own sashes will be of much service, for it is within my own knowledge that many clever workers in wood are deterred from working in this direction from their inability to put together the requisite framing.

Premising, then, that the aspiring sash maker has already overcome the difficulties of mortising and tenoning, and can use his tools fairly well, I will endeavour to clear his path for the making of his first sash, which shall be of a simple form, and of the appearance shown at Fig. 1. The wood used for the first attempt should be clean yellow pine. This wood is not in general use for sashes that are to stand much wear and tear—red pine, pitch pine, oak, and sometimes mahogany and teak, are used—but for ease in working, if the worker can choose his wood, by all means let it be yellow pine.

For the window before us, which measures, over all, 3 ft. in height by 2 ft. 6 in. in width, there will be required two stiles, 3 ft. 3 in. by $2\frac{1}{4}$ in. by 2 in.; one top rail, 2 ft. 7 in. by $2\frac{1}{4}$ in. by 2 in.; one sole rail, 2 ft. 7 in. by $3\frac{1}{2}$ in. by 2 in.; two sash-bars, 3 ft. 1 in. by 2 in. by $\frac{5}{8}$ in.; and two sash-bars, 2 ft. 4 in. by 2 in. by $\frac{5}{8}$ in. Plane up all the stuff very accurately, and gauge the width and thickness of each piece to a shaving, as upon the accuracy of the preparing of the stuff much of the success of the finished sash depends; especially is this so in the thicknessing of the sash-bars, and to get them right you should run the double template, supplied with your sash-planes, along the edges of each; when the template will fit tightly all along the length of the bar, the thickness is correct.

In planing up the stiles and rails, the face and edge of each must be planed so that the grain of the wood runs in the same direction (this is illustrated by the arrows in Fig. 2), and marked with pencil, so that they can be easily recognised. The object of getting the grain of the wood to run thus is that the glass check and sash-plane may work freely and clean along the framing, as, if either side or edge ran the wrong way, the wood would be almost certain to tear up in splinters when working these planes.

Having got the wood all prepared, you can now proceed to "set out" your sash. To do this, lay the two stiles on the bench, the marked sides outwards and the marked edges uppermost (Fig. 2). See that the ends are flush, and with a small square draw a line across the top edges of the stiles $1\frac{1}{2}$ in. from the left-hand end (A, Fig. 2). Measure off from this line 3 ft., and square across as before (B); these two marks are the exact height of the finished window; the $1\frac{1}{2}$ in. of over-wood at each end is not cut off until the sash is finished and ready to fit in its place. Technically, they are called "stumps," and they serve to prevent the splitting of the stile when mortising and wedging up. From the marks which you have just made measure inwards the thickness of your rails, which will be at the top $2\frac{1}{4}$ in., and at the bottom $3\frac{1}{2}$ in. (C, C). Again, measure from the outer top mark, $\frac{7}{8}$ in., and from the outer lower mark, $1\frac{1}{4}$ in., and draw lines across (D, D). Square across the marks D, D, C, C, and draw them on the under edges of the stiles, drawing additional lines $\frac{1}{4}$ in. to the outside of each; these outer lines are those you work to at the back of the mortise, which is tapered towards the front edge, as shown by the dotted lines in the figure. This taper is to allow for the insertion of the wedges that hold the framing together when completed. Before turning over the stiles to draw these marks on the back, you will require to set out the mortises for the sash-bars on the upper edge. To do this, divide the distance between C, C, into three equal parts, drawing your lines across for a mortise $\frac{5}{8}$ in. long; these mortises do not go through the stile, but are 1 in. deep, and in making them, if you have not got a mortising machine at hand, the best way is to bore a $\frac{1}{2}$ in. hole with a centre-bit, and then square the mortise up with a $\frac{1}{2}$ in. chisel. Work accurately to your marks, as if these mortises are too wide, the sash-bars will fit in a loose and shaky manner. And here I would remark that in setting out sashes, or other work requiring accuracy of workmanship, you must avoid using a pencil to square off your marks, and use a drawing-knife instead; otherwise, your work will never be satisfactory or workmanlike.

Having set out the stiles, the rails will now occupy your attention. Lay them on the bench in the same way as before, putting a piece of wood under the narrow one to bring its edge level with the wider one. Draw a line across, $\frac{1}{2}$ in. from left-hand end, as A, in Fig. 3. Measure off 2 ft. 6 in., and draw the line B; draw the lines C, C, $2\frac{1}{4}$ in. inside of the outer marks, the lines D, D, $\frac{3}{16}$ in., and E, E, $\frac{5}{16}$ in. from C, C. Square D, D, across the back of each rail, and E, E, across the face; these marks are cut in for the shoulders when you come to tenon. (See Fig. 4, which shows the end of the rail with tenons cut.) Divide the length between E, C, into three equal spaces, and set out sash-bar mortises as in the stiles, but with this difference: that instead of only going into the wood 1 in., they go right through, and are tapered for the wedge-grip in a similar manner to the rail mortises.

To set out the sash-bars, you have only to lay them on the stiles and rails, and mark them off, squaring your marks across on both sides, and taking particular care to allow for the fitting to the moulding and glass check of the upright bars by squaring off the end tenons $\frac{3}{16}$ in. and $\frac{5}{16}$ in., respectively, longer than the daylight marks at C, C, on the stiles. Of course, in doing this you will bear in mind that the ends of the horizontal bars go right through the stiles, while the ends of the upright ones only go into the rails one inch. Where the sash-bars cross each other is likely to prove the most trying part of the job to the novice, and is very difficult to explain on paper, but by the aid of an illustration I will endeavour to make it plain. When you have marked the mortises on the sash-bars, and squared them across on both sides, divide them *exactly* in the centre, draw a line (A) across, then $\frac{3}{16}$ in. from the outer marks, draw other two lines (B, B). You must draw these lines on both sides of the bar, and a glance at Fig. 5 will show you their position; this diagram is full size, and also shows the markings of the mortise gauge. Your framing is now all set out, and requires gauging off for mortising. Fix upon the chisel you are going to use—it must be a $\frac{1}{2}$ in. one—and set the two cutters so that when they mark they just fit the width of the chisel; then set the head of the gauge $\frac{11}{16}$ in. from the inner cutter, and run it over the positions of the mortises and tenons, on the stiles and rails, and also on the bars. Be careful in running the gauge to work from the marked face of your framing, as if, by any chance, you mark off a mortise or tenon from the back, it will cause you some vexation when you come to put the window together. Take an ordinary marking gauge; set it so that it will mark *exactly* in the centre of the mortise on the bars, and mark off each with it; this centre mark is shown at C in Fig. 5. You have now to take a $\frac{1}{4}$ in. chisel and cut out these mortises with it, but carefully observe that in the upright bars it is the mortise next the front edge that is taken out, while in the cross-bars it is that next the back edge.

This may seem a little mystifying, but it will become quite plain to you when you come to put the framing together. The stiles and rails you will have no difficulty about, as they are mortised and tenoned in the usual way, which I assume that you have already mastered.

So far only the ordinary tools that are in daily use have been required for the work; now you have reached a stage when tools of a special nature must be brought into play (or shall we call it "work?"). These tools are a pair of sash-planes and templates; various shapes of mouldings are run on sashes, but the commonest, if not the easiest, is the "Gothic," and I will suppose that to be the style used in the present case. The templates supplied with the planes are two in number, and are used to guide the chisel in mitring and fitting the mouldings of the sash, the single template being used for the framing, and the double one, previously referred to, for the sash-bars. A $\frac{5}{8}$ in. sash gouge is also requisite for this fitting work. Besides these planes, you require a "sash fillister" for making the glass check or rebate on the framing, and a "sash-bar," or "astragal fillister," for that on the bars. These tools having been procured, and well sharpened and accurately set, you are ready to commence work with them. But before you start I think I had better describe a little arrangement that will be of the greatest service in holding the pieces of wood steady while you are working upon them. Take two strips of $\frac{5}{8}$ in. wood, about 2 in. wide and 3 ft. long, place one of your stiles on the bench with the end against the stop, nail down one of the strips of wood close to the back of the stile, then nail down the other piece at the front, but in such a way that a third piece of a wedge shape may be driven between it and the stile, and so hold it firmly in position.

Take a stile, lay it on the bench, drive the wedge home, set your sash fillister so that it will just clear the back edge of the mortise, and run down until the rebate is *exactly* $\frac{3}{16}$ in. deep. On looking at the sash-planes, you will find them marked 1 and 2. No. 1 is used to run down with, and No. 2 takes off

a shaving or two more, and puts a finish to the moulding; thus you will see that you may let No. 1 take off a moderately thick shaving, but No. 2 should be set very fine, and kept as sharp as possible. It is best, before running No. 1, to take off a shaving or two with the jack-plane from the sharp angle of the wood, otherwise No. 1 plane is apt to wear too much in the centre. Do the rails in the same manner as the stiles, and then take the bars in hand. For the bars you will require to make a wider wedge, so that you can secure them firmly on the bench, *back* edge uppermost; set your bar fillister so that it will form a rebate of equal depth on both sides of the bars, and run it down till it is of the same depth as the rebates on the framing. Fig. 6 shows the sash-bar, in section, fixed on the bench and rebated.

To run the moulding on the sash-bar you will require to make a special apparatus of the nature shown in Fig. 7, where it is shown in full size. The easiest way of making the back or grooved piece is to form it of three thicknesses of wood and fix it to the lower board, which should be of 1 in. wood, with screws. The back piece should be put on so that when the bar is in its place its front edge will be flush with the front edge of the board, along which the fence or guide of the plane has to work. Fix this "running board" to the bench with a screw nail at each end, place the bars on it, and run the planes, first on one side, then on the other, taking particular care in running down the second side to hold your planes very steady, as when you run down without caution you are almost sure to spoil the front edge of the moulding where it merges into that of the other side.

All the rebating and moulding being done, you can begin to mitre and fit together. Take the rails first, and with the single template mitre the moulding at each end, keeping the template to the innermost of the three marks (C), which is still visible on the top edge. After mitring, take the sash, gouge and cut down about 1 in., clearing the corner next the tenon with a narrow chisel; turn over the rail, and with a $\frac{1}{2}$ in. chisel cut down a groove $\frac{5}{16}$ in. deep on the end of the rail till it meets the tenon (A, Fig. 8). This groove is to allow of the fitting in of a corresponding projection on the stile which serves to steady the joint. Fig. 8 is a drawing of the end of a rail, showing the way in which the fitting as described is done.

The stiles are then taken, and with the template the "list," or small piece that is between the mortise and the moulding, is cut down to where it touches the top part of the moulding, and $\frac{1}{4}$ in. from that the moulding is cut down on the bevel, and the piece taken clear out to the end of the stile. It is almost impossible to describe in writing the mode of doing this, but a study of Fig. 9 will show how it is done, and in practice you will easily comprehend the way to do it.

The two upright sash-bars are now mitred, using the double template. Let the mitre come clear to the outer edge of the moulding, and if correctly done from both sides of the mitre the cuts should meet exactly at a point, but leave a little wood towards the inner side, to prevent the bar breaking (Fig. 10). Mitre the ends as in Fig. 11. Take the cross-bars, cut each of them into three pieces exactly through the centre mark (A) on the mortise, and mitre the ends, as in the other bars. Fig. 12 is the end of a bar cut and mitred for the crossing.

Run a fine hand-plane along the flat piece between the mouldings and rebates on each of the pieces of your sash. One shaving is enough, as it is merely to give a clean appearance to the job, which, no doubt, will have a few finger-marks about it; and nothing looks worse on a piece of new woodwork than finger-marks—in fact, they stamp the worker as a sloven; and I have been in shops where, if a finger-mark was found on a job when it left the bench, a severe wigging from the foreman was the result, with perhaps the sack, if the workman persisted in leaving the "marks of the beast," as they were called, on his work.

Plane up a piece of wood, $\frac{1}{2}$ in. thick, and cut out of it some wedges. You only want sixteen, but you had better cut a few more, in case of breaking any in the driving. These wedges should be about 3 in. long, $\frac{1}{2}$ in. wide at one end, tapering to $\frac{1}{8}$ in. Put a point on them with a chisel (Fig. 13). Be careful to cut your wedges square, as if they are not cut fair, they are apt to twist in driving, and will split the framing. Make also four round pins, $\frac{5}{16}$ in. diameter, and you are ready for cramping up the sash, for which purpose clear everything off your bench, and lay two pieces of wood across it. The size of these pieces is immaterial, but of course they must be longer than the sash is wide—about 3 in. by $1\frac{1}{2}$ in. stuff is a suitable size. See that they are out of twist with each other when lying on the bench; if they are not, you must level them up until they are, by putting pieces of wood under the ends where required. If these bars were lying twisted, your sash would be twisted when cramped up.

Put the long sash-bars into their places in the rails, then put on the stiles, not driving them close up until you insert the pieces of the cross-bars. When they are in place, knock the stiles close, and lay the window on the pieces of wood on the bench, cramping up the joints with a joiners' bench cramp, and using thick white lead on the tenons and wedges instead of glue, which is unsuitable for work that is exposed to the influences of the weather. The stiles should be cramped up and wedged, and holes bored through stiles and tenons about the position marked A on Fig. 9. Into these holes the pins should be driven, after dipping the points in white lead. Now turn the sash and cramp up and wedge the bars—they do not require pinning. In doing this, you must be careful not to squeeze too tightly with the cramp, or you may bend or break some of the bars. Just put on enough pressure to bring the joints well together, and drive the wedges in evenly at each side, to avoid twisting the bars.

Two things must be attended to in the operation of cramping up. One is that the cramp must be applied in such a way that the stiles are not twisted up or down from the rails. If you apply the cramp too low you will twist them downwards; if too high, upwards. To avoid this, try a straight-edge, or the back of a square, across stile and rail, and raise or lower your cramp as required. The other matter is the keeping of the sash perfectly square while cramping. This is best done by trying it across from corner to corner (diagonally) with a rod. When the distance between the opposite corners is exactly the same, the sash is square, and care should be taken to keep it so while cramping.

Cut off the projecting ends of the wedges and pins, and plane up neatly on each side, being careful when doing the outside not to break away the thin piece between the rebates on the bars. Your sash is now finished and ready for fitting into its place, until which operation it is best to leave on the stumps of the stiles, and cut them off when doing the fitting.

When you have made a sash similar to that described, and mastered the little difficulties and intricacies of the various joints and mitres, you will have learned a valuable lesson, and one that will enable you to attempt with a greater chance of success the more intricate forms of windows.

The greenhouse builder, whose requirements in the way of sashes do not often include those with cross-bars, can, by following these instructions, and leaving out the horizontal bars, construct his side-lights to whatever dimensions he may choose; while in another paper I will endeavour to show him how to make his roof-lights, they requiring a different treatment in the matter of the sole, to allow of the water running off.

In common greenhouse work the use of the sash-planes may be dispensed with, and the inner edge left square, or chamfered. Of course, in leaving square edges you will have to allow for them in cutting the shoulders of the tenons, so that the marks C, C, in Fig. 3 will be those to square over on the face side of the rails for the shoulder.

When a number of sashes of the same size are to be made at one time, all the stiles may be laid on the bench, and set out at once by squaring across your marks on the top edge, then turning over and squaring them across on the back. While setting them out in this way, a sash cramp is generally employed to hold them together and prevent slipping, and also to aid in turning them over. The top edges of the rails are squared over in the same way, and the bars, if any, are held by two sash-cramps, and not only marked off, but shouldered and tenoned at one operation, after which the cramps are taken off, and the mortises squared over and worked out. This method saves much time in dealing with the various pieces singly.

In closing these brief instructions, I would again urge upon the worker the necessity for exactitude in all his manipulations—let him go slow until he is sure of his ground, and has quite mastered the details of the work. Applying the words of an old joiner I once knew, let him "First learn how to do a thing thoroughly, then—but not till then—how to do it quickly."

## HOW TO MAKE A WEATHER GLASS.

BY J. GEO. LISTER.

INTRODUCTION, REMARKS ON MERCURIAL BAROMETERS—PRINCIPLE OF THE GLYCERINE BAROMETER — APPARATUS REQUIRED — DETAILS OF CONSTRUCTION—FITTING UP—USES.

THE mercurial barometer, though the most perfect instrument of its kind, and therefore the one deservedly used as a standard instrument for measuring variations of atmospheric pressure, is by no means an instrument easy of construction by an amateur. In the first place it is very difficult to procure glass tubing, which, whilst being of the requisite cheapness, shall be at the same time both strong enough and of sufficient equality of bore throughout. Again, it is one thing to fill a tube with mercury in an ordinary way, it is quite another to so fill a barometer tube with pure mercury that it shall contain no

air ; and, finally, no one but an expert knows what it means to make a glass tube "chemically" clean. The majority of persons who use a barometer do so for one purpose only—viz., to ascertain probable changes of weather in this very uncertain climate of ours. It will therefore be our purpose in this article to show how a "weather glass," but not a barometer, can be made which shall serve all the general purposes of the more expeusive instruments.

It was discovered by Boyle and formulated by Mariotte, that when a gas is subjected to pressure, the volume occupied is exactly inversely proportionate to the pressure upon it—*i.e.*, if we increase the pressure we decrease the volume, and *vice versâ*. Now this law has been applied to obtain a knowledge of the state of the atmosphere by observing the changes of volume of a gas—*e.g.*, air in a closed vessel.

Now as to apparatus. We shall require the following, and appended will be found the average costs. Glass tube about 4 ft. long, and what is known as No. 3 cane, which is the size shown in Fig. 1. It has an external diameter of $\frac{3}{16}$ in. ; cost, about 3d. A glass bottle of about 8 oz. capacity, cost, about 1d. ; a composite candle, $\frac{1}{2}$d. ; cork for bottle ; a piece of paper, about 4 ft. long. This can be obtained at any draper's, gratis—it should be about 1 in. wide ; a few magenta crystals, cost, 1d. ; wood charcoal, 1d. ; about one quarter of a yard of flannel, cost, 3d. ; one piece of wood, 4 ft. by 1 in. by $\frac{3}{8}$ in., cost, 2d. ; and about 2 ft. of $\frac{3}{8}$ in. by 4 in. timber, cost, 2d. ; and, finally, 2 oz. of best glycerine, cost, 2d. Total cost, 1s. 3½d. For this amount we can make an instrument which will be of far more use as an indicator of coming weather than many a barometer costing more than twice as many shillings as ours does halfpence.

Now as to details of construction. Fill the bottle with glycerine about one-quarter to one-third, which has had one or two crystals of the magenta dissolved in it. This is to render the glycerine more readily visible. Next, thoroughly clean the glass tube. This can most readily be done by taking a small wad of cotton-wool and tying it in the middle of a string about 9 ft. long. Pass one end of the string through the tube and pull the wad through after it. Then reverse the operation. Do this two or three times and the tube will be found bright, clean, and *dry*, which is a great consideration. Next bore the cork, making the hole much less than the outside diameter of the tube. This can be done either by the careful use of a gimlet or a hot knitting-needle. The hole must then be enlarged until it is just smaller than the tube. Now push the cork carefully into the neck of the bottle, and having rubbed down the end of the glass tube on a little emery-paper, pass it with a gentle spiral motion through the cork and down into the bottle till the bottom end dips under the surface of the glycerine about $\frac{1}{2}$ in. Take next the candle, and, having lighted it, allow drops of the "wax" to fall all over the cork, and having heated a wire in the fire, pass it all over the cork so as to thoroughly melt the wax and allow it to run into the holes in the cork. Repeat, and when the cork will absorb no more, completely cover the whole lower end of the tube, the cork and the neck of the bottle with droppings from the candle. If this be properly and carefully done the tube will fit into the bottle quite air-tight. Now place the bottle on the floor, taking great care not to break the joint, and, having filled the *mouth* with air, blow a *few* bubbles into the bottle (see Fig. 2). Remove the mouth, and the air which has been compressed within the bottle will, to equalise the pressure, drive the glycerine about half-way* up the tube (Fig. 3). To make the scale, take a piece of the ribbon paper as long as the tube and divide it into 100 equal divisions, and gum this on to the strip of board of the same size, plus a small piece at the lower end where the wood scale is to fit into the box containing the bottle.

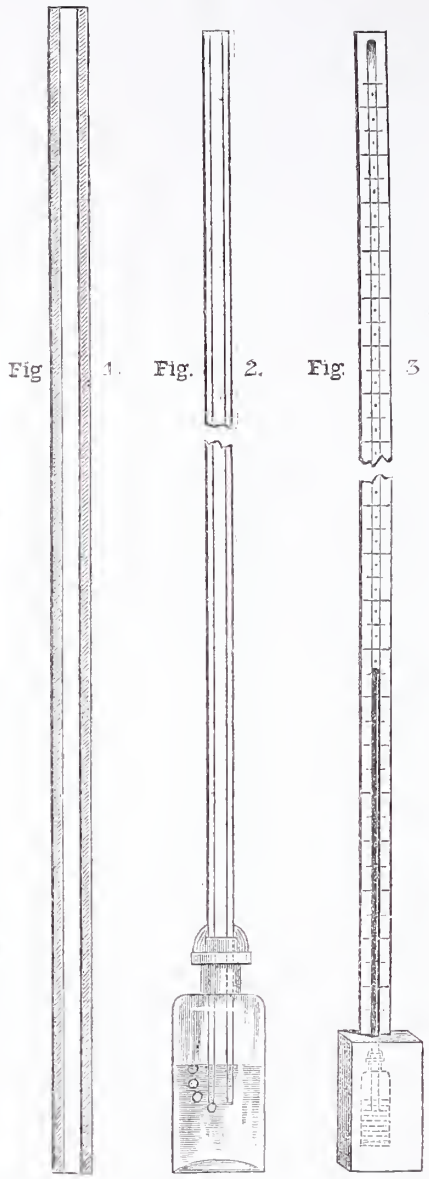



Fig. 1.—Glass Tube : ¼th of Actual Length, but showing Actual Diameter of Tube. Fig. 2.—Illustration showing Compression of Air and Method of filling Tube. Fig. 3.—Instrument Complete with Scale and Box.

Our next proceeding will be to arrange for the protection of the bottle from atmospheric changes of temperature. This is done by cutting the flannel into strips about 1 in. wide, stitching these into one long strip and binding this closely round the bottle spirally from top to bottom. Now make of the remaining timber a small box about 3 in. square and 2 in. longer than the bottle. Place in the bottom of this a mixture of coarse sawdust and broke charcoal in a layer about 1 in. deep, and c this place the bottle. Fill up the box wit the same mixture, completely covering th cork. Fix the scale with its back into th lid and slip this over the end of the tub and secure the top with screws—not nails, a these might cause the joint to "spring Secure the tube to the scale by one or tw small staples or pieces of wire.

Finally place on the top of the glycerin in the tube a drop or two of paraffin oil this will effectually prevent the glycerin absorbing water from the air, which it very liable to do, and loosely close the en of the tube with cotton wool, and o weather glass is complete.

To USE.—Place the "glass" on a brack (in some place where the sun does not shin and where the temperature is fairly co stant) about 3 ft. from the floor, and car fully observe its behaviour for a few day It will be found on the approach of a chang in the weather, and hours before a me curial barometer show any indication, tha the glycerine begins to rise, often seven inches, indicating wet or wind ; or fall, ind cating fair weather. After a few day comparison with itself the glass will b found one of the most faithful of "weath prognosticators."

* When "setting" the glass it will be advisable to consult a mercurial barometer—one of the many public ones suffices, or the weather reports in any newspaper—and if the mercury stand very high, the glycerine should be made to stand low, and *vice versâ*.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### RAT-TRAPS.

No one will feel inclined to deny that of a the pests, the torments, and depredation of which we are frequently exposed to, ra must be classed as the most formidabl Man's ingenuity has been called into exe cise to endeavour to eradicate this nu sance, and the devices, passing under th general name of rat-traps, are numerous an various. The commonest pattern is the on which I have taken for our consideration, an is shown in Fig. 94 (see page 485). Som may say that this kind of article is fallin into disuse, because the vermin which it most desirable should lose their liberty b its aid are possessed of sufficient intelligenc or reason (although some would try t assure us that it is but instinct) to foresee the calamitous results of their entering th "freehold" construction, and endeavourin to extract the delicate (?) morsel from th interior thereof. But, withal, it is an ex ceedingly useful trap ; and, in addition, is comparatively cheap to purchase, and will not be found difficult to construct b anyone desirous of so doing, who will giv his attention thoroughly to my detailed description of it.

Referring to my above remarks on it usefulness, I must say that when introduced for the first time among a colony of thes detestable creatures, it may safely be relied upon that a few at least will be captured This is decidedly most advantageous ; fo rats are, I am given to understand, ver prolific, and consequently increase immensely in numbers in a comparatively short period I will now press forward to the particular of their manufacture—not of the rats, bu of the traps.

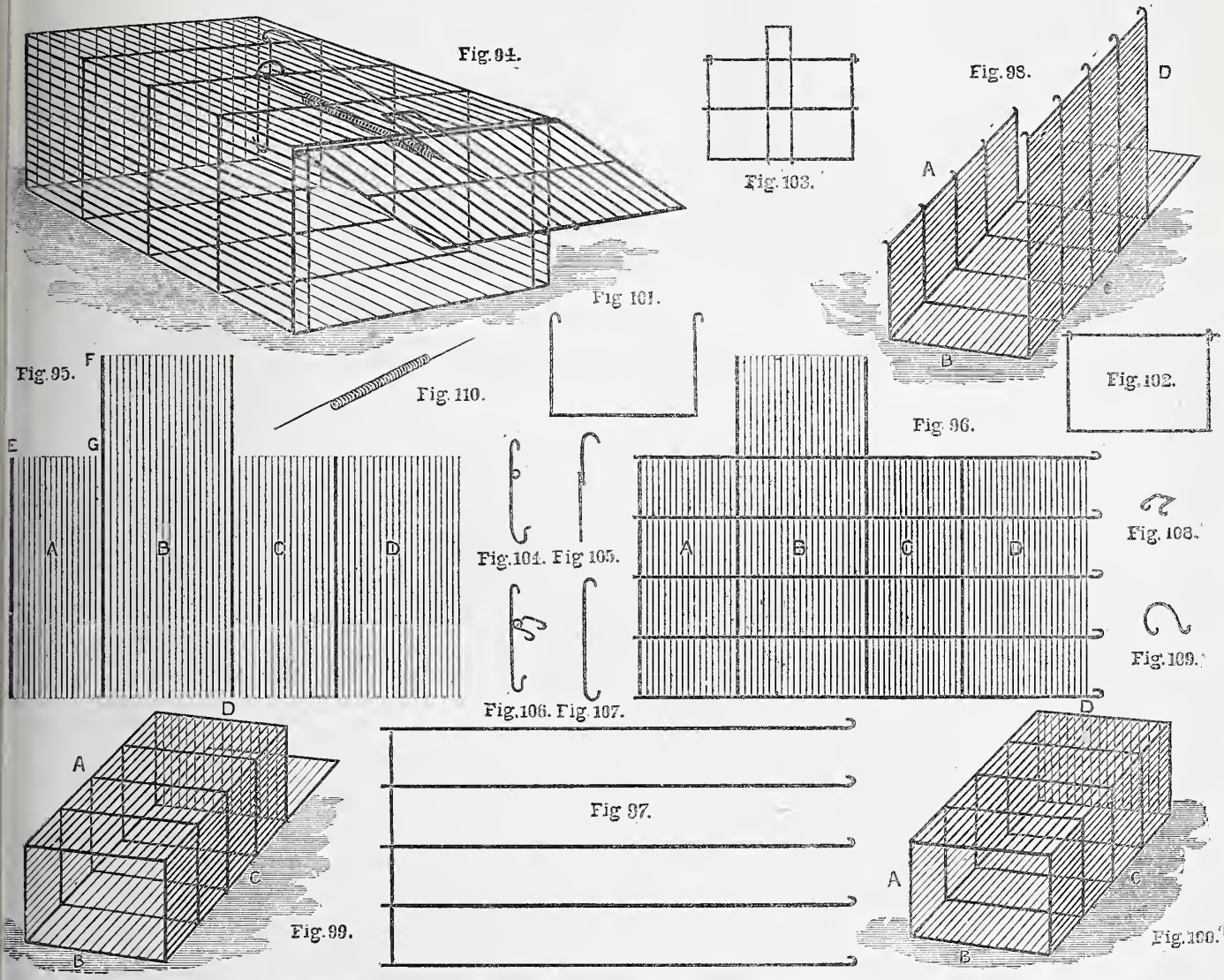
A long strip of tin, or other metal, has a number of holes through it. It is fixed t the bench by being stapled, or secured in some other manner, one end of it being on the left-hand side of the worker, and th other end at the right-hand side. Three of the holes are rather larger than th

mainder, for certain reasons which will be ade clear to the reader in my future re-arks. This simple appliance is called a de, and I have spoken of it in a previous per.

In beginning a trap of the size noted in g. 94, the wires are laid as shown in Fig. . These are supposed to be laying hori-ntally. The front end of each of them is nt into the form of a hook. The tenth, enty-fifth, and thirty-fifth wires, counting m the left-hand side, must be of a stouter uge than the remainder. They are after-portion of the wires adjacent to the latter to project in front of the slide. Upon them is afterwards placed the frame. I will proceed to describe this. It is shown in Fig. 97, and consists of five wires of sufficient length each to cover the whole of the wires in portions A, B, C, D (Fig. 96), and each parallel to the others and at equal distances apart, with hooks at their right-hand ends. They are turned over on to a bar at the left-hand side.

The lower wire of this frame is laced to the whole of the wires upon which it rests frame within a short distance of the ends of the wires in portions A, C, and D (Fig. 96), which latter are then turned over on to it in the usual way.

Thus far, the work appears as in Fig. 96. The bending now takes place. It is still supposed that the work is laying flat upon the bench. Portion A (Fig. 96) is then bent upwards into a perpendicular position, and portions C and D are also bent thus both together (Fig. 98). Portion D is still further bent, in a horizontal direction this time, bringing its exposed side against the exposed




**g. 94.—Rat-trap Complete. Figs. 95, 96, 98, 99, 100.—Progressive Diagrams, illustrating the laying out of the Wires, fixing of the Frame, and Ultimate Bending. Fig. 97.—The Frame. Figs. 101, 102, 103.—Progressive Diagrams, illustrating the Construction of the Door. Fig. 104.—The Bait-hook (Side View). Fig. 105.—The Bait-hook (Front View). Fig. 106.—Bait-hook with Link Wire (Fig. 108) attached. Fig. 107.—One of a Pair of Drop Wire Runners for Front of Cage. Fig. 108.—The Link Wire for Bait-hook. Fig. 109.—Handle. Fig. 110.—Spring.**

ards bent in certain ways; but I must rst name their parts. A and C will be the des; D will be the top; the larger part of will be the bottom, while the smaller por-on of it (that which is above the remainder f the wires contained within the space F G -Fig. 95) will form one end. One end will e left open to receive the door. All these ires are then placed through the respective oles in the slide. I do not show this stage f the process in any of my diagrams, as a rawing would appear but a confused mass f lines; therefore I must ask the reader to ollow my description as closely as he can.

These wires, then, are pushed through he holes, allowing but the hooks and a (Fig. 96) at a point just above the hooks. It, when this is completed, is drawn exactly underneath the front hooks, naturally carrying frontwards the other four wires composing the frame, and the front hooks are then squeezed over on to it. Of course, it will be seen that it cannot conveniently be fixed under the hooks, and there laced, in the first instance.

The work at this stage is drawn further frontwards through the slide, and the second wire of the frame laced in its position. The third, fourth, and last wires are similarly treated, care being taken that they are laced exactly parallel to each other. These operations should bring the last wire of the side of portion A (Fig. 99). It will be now understood for what reason the hooks are upon the right-hand end of the frame (Fig. 97). They are, of course, brought, by this bending process, close up against what was the exposed side of portion A, over which they are then turned and squeezed down. The final procedure to complete the skeleton of the trap is the bending upwards of the wires in the further part of the portion B, which have all the while been laying horizontally, bringing their ends in direct contact with the end of portion D, over which they are then turned. Therefore, the wires composing this part of portion B must be in length, when they are turned over, equal

to the width of each of the portions A and C separately. What I mean can be seen by a glance at Fig. 95; the part F G must be a trifle longer than the part E G, the extra length being for purposes of turning over. To strengthen the end when thus far finished, a single bar is laced or tied upon the outside of it, across the middle.

The door is the next thing to attend to. For this a frame is made. I will deal with it as with the other parts—progressively. First there is a bent wire, as in Fig. 101, the hooks of it being supposed to be bent *away* from the reader, which can hardly be properly shown in a small sketch. Immediately underneath the hooks is a cross-bar, turned over from the front on to the sides of the first wire (Fig. 102).

In the middle, when thus far complete, is an upright wire, bent in a similar, but reverse, manner to that in Fig. 101, but being much narrower and a little longer than that wire when so bent. Previously, the required number of wires must have been placed in the slide in the same manner as the larger piece of work, having, likewise, hooks in the front. My foregoing instructions will apply equally to this part of the trap, the wires being laced and turned over on to the frame. I must mention, however, that two or three wires in the middle must be somewhat longer than the remainder, and be turned over on to the longer part of the frame. This last part is laced on to the rest when the lacing takes place, and a double stitch is usually given for purposes of strength, where the longer part of the frame comes in contact with the cross-pieces.

The fixing of a middle bar is the final performance to complete the body of the job. It is laced securely across the front of the door, and tends to strengthen it. The door, thus ready, is attached to the body of the trap by having its top hooks squeezed down over the front top wire of the body in such a manner that the door may work freely up and down. I will leave the fixing of the spring until last.

The bait-hook is the next part added. This is shown in Fig. 104. The top hook upon it is bent at right angles to the lower hook (Fig. 105). Through the eyehole is passed a small bent wire (Fig. 106), which latter has a hook at each end of it. The hook is then passed through the top of the cage, and the small wire (Fig. 108) secured to the middle cross-wire of it by means of its hooks being squeezed down upon it, and further by its being tied to the various wires it touches.

The handle is fastened to the same wire as that to which the bait-hook supporter is attached, but the latter holds the hook at a distance from the handle, and therefore in no way interferes with it. The handle is merely a bent wire with a hook at each end (Fig. 109), by which it is secured to the wire above-mentioned across the cage.

A single wire is bent over the long top wire of the door, outside, so that it may work freely, the further end of it being quite straight, as most people know. This wire, when its loose end is fixed under the bait-hook, retains the door as in Fig. 94, and the slightest movement of the hook displaces it, and consequently releases the door.

A drop wire is attached to the front of the cage, with the view of preventing any unpleasant rodent who may have been unfortunate enough to be entrapped from making his escape. Wires, shaped as shown in Fig. 107, are secured, one at each end, to the front of the body, in a direction continuous with the latter. Over these is slipped a wire, in length the same as the width of the cage, having an eyehole at each end, so that it may be easily moved upwards and downwards. When the trap is set with the desire of catching a victim, the drop wire is drawn to the top of the cage; and the reader will see clearly how, when the door has closed, the wire will drop to the bottom, over the front of the door, and preclude any possibility of its being opened from the interior by an occupant.

The process of springing is now reached. I have elsewhere described how to form a spring. A good strong one will be necessary for this work. One end is fixed to the second or third wire of the top of the cage, and the other end fastened to the cross-wire of the door. It must be in an unstretched state when this is done. Two springs, one at each side, might be fixed; but it is usually quite sufficient for purposes of strength to have but one.

Particulars as to sizes and gauges of wire used in connection with various articles I intend to describe will be given in another number. This will prove more convenient for the reader.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

THE WORKING OF STEEL—DIFFERENCE BETWEEN WROUGHT IRON AND STEEL — HEAT FOR WORKING — DIFFICULTIES OF WORKING — OVERHEATING — MODE OF HEATING — BLUE HEAT.

I AM now going to devote two or three papers to a very important and difficult section of the smith's art—namely, the manipulation of steel. There are larger quantities of this material used now than formerly. A good many questions appear from time to time in WORK relative to the subject. It is one that embraces a very wide range of operations; I shall therefore devote this article to the general consideration of the working of steel, and afterwards write in some detail on the special processes of welding, hardening, and tempering.

*Wrought Iron and Steel Contrasted.*—There is, as regards chemical composition, very little difference between wrought iron and some of the Bessemer and Siemens mild steels. But there is a very essential distinction between them when brought to the test of working. Wrought iron is not perfectly homogeneous; mild steel, like the crucible or tool steel, is of the same character throughout. This difference is due to the difference in the processes of manufacture. Wrought iron is never at any time during the process of its puddling in a state of absolute fusion. It is simply brought into a pasty condition, like a lump of dough. The fluidity of cast iron is mainly due to the presence of its carbon, and in a lesser degree to its sulphur. These are removed from the iron in the processes of puddling; and one important result is this of non-fusibility at the temperature at which it is found best to work it. In order to render this material, therefore, as homogeneous as possible, the pasty mass is hammered under steam hammers or tilt hammers, and is passed beneath squeezers of different types, is cut up again and reheated, and the operation of hammering, squeezing, and rolling repeated, the quality of the iron improving with each repetition of these operations. These sets of operations will be repeated three or four times in the case of good merchantable iron, and it is the cost of fuel and labour involved therein which renders wrought iron so much more costly than cast iron. After the last piling, re-heating, and hammering processes have been gone through, the iron is run between grooved rollers of diminishing sizes, to impart the final sectional forms to the bars or plates required for the use of the smith and boiler-maker. But it is because of the absence of fusion that even in the best wrought iron some of the oxide or scale, and some of the mechanical impurities originally present in the iron, or taken up in the process of puddling, become inextricably entangled with the bars, and remain therein, causing the iron to become spilly, and to develop incipient fracture when wrought into structures.

*Lamination absent from Steel.*—From this lamination the Bessemer and Siemens steels are free, for the simple reason that during the process of fusion all scale or oxide has been eliminated. And this is one reason why the mild steels have superseded wrought iron largely in boiler-makers' work, and in some smiths' work, especially cranks and similar structures, where lamination would be fatal to strength and durability. The best wrought iron can never be entirely depended on for absolute homogeneity. But for the average work of the smith it holds and must long hold its own, because of its ductility, weldability, and the general ease with which it can be fashioned into intricate forms.

*Homogeneity of Steel.*—Steel being homogeneous—that is, having no grain—is eminently adapted for the forging of light and delicate work, where strength, rigidity, and lightness are required in combination. It is therefore specially adapted for model work and for the finer portions of mechanism, and for those where strength is essential.

*Heat for Working.*—After the absence of fibre, the next cardinal difference between the working of wrought iron and of steel is this: that while wrought iron can be worked almost at the fusing point, steel cannot be worked beyond a full red heat. Moreover, each different sample of steel seems to work best at a particular temperature, differing from that of other samples.

*Polish.* — Another point in favour of steel is that it takes a much higher polish than wrought iron, and is therefore better suited to work where good finish is necessary.

*Capacity for Hardening.*—Steel owes its chief value, however, to its capacity for hardening and tempering. A regular gradation in hardness is thus obtainable, rendering it suitable for every possible requirement.

*Capability of Working.*—Whether steel is more troublesome to work than iron depends partly on the nature of the forging and partly on the quality of metal. For small model work, steel is by far the best, because there is no grain to open out, besides the facts before mentioned of superior rigidity, and so forth. In large and heavy forgings, on the other hand, there is no advantage to be gained on this score. In forgings, again, of moderate size and thin sections, on which a good deal of work has to be done, forging in steel becomes more expensive than forging in iron. For as steel has to be worked at a lower temperature than iron, a larger number of heats must be taken in the former than in the latter. For the same reason the various operations should be

performed more rapidly while the steel retains its heat.

*Capability of Welding.*—There is more difficulty in welding steel than iron. But the difficulty is largely of an initial character, being due to the differences in separate samples of steel. Once the best welding heat for any bar of steel is known, then there is no more trouble experienced in welding pieces from that bar. Sand alone is used as a flux for welding iron; for steel a mixture of sand and common salt is better.

*Opinions re Working of Steel.*—There is not so much unanimity of opinion among workmen as to the working of steel as there is in regard to the working of iron. The practice of allowing steel to soak in the fire, approved by some, is denounced by others. The temperature to which steel can be raised without burning it is a matter of dispute. The practice of hardening and tempering opens up a vast and unlimited field for discussion. The reasons are not far to seek; steels vary much more in quality than wrought iron, and since the peculiar value of steel is due to most minute chemical and molecular composition, and as slight and sudden alterations in temperature are sufficient to entirely change their arrangement, it is easy to understand why, though not how, they should influence the practical working of the material. Partly, too, because of these differences and consequent differences in treatment demanded, are some makes of steel considered superior to others. Thus, a man may have been accustomed to work in one quality mainly, and having adopted certain modes of treatment of that with the best results, and finding the same modes do not give equally good results with another quality, he too hastily condemns the latter, when in reality the fault lies at his own door. It cannot be too strongly insisted on that every new bar of steel should be first worked tentatively, in order to discover the best heat and the best way to work that particular bar. Unless this is done, frequent failure to obtain the best results will follow.

*Upsetting Steel.*—The practice of upsetting steel is deprecated by some. But if the steel is of good quality it will upset just as well as iron.

*Overheating.*—Steel must not be overheated, or it will become burnt. But it should be made as hot as the metal will safely bear. A higher temperature can be used on steel required for large forgings than for steel used for cutting tools, and for light work generally. A piece of burnt steel will crumble to pieces under the hammer as though it were cast iron, and will show a coarse granulated fracture. There are, however, degrees in burning—it may be burnt slightly on the surface, so slightly that it does not fracture, or, if fractured, does not show this coarsely crystalline structure. Yet its quality for cutting instruments will, nevertheless, be sensibly impaired. The temperature at which overheating occurs varies, of course, with different qualities. If scales form and fall off, the steel is, as a rule, overheated. It is then almost impossible to restore it to its pristine quality. If not burnt very badly, a good hammering on the anvil will improve it considerably. There are also various physics employed by tool smiths. They mix various ingredients, and keep these by them for use. The following is one:—Mix together two parts of pitch, two of train oil, one of tallow, and a little salt. Plunge the metal at red heat into this two or three times in succession.

*Mode of Heating Steel.*—The smith uses the forge-fire for heating any steel for forging. For hardening and tempering he only uses the fire in the case of large work; small work is heated on a bar of iron first made white-hot in the fire, or special furnaces are used. The temperature of small pieces of work can be regulated better on a bar of iron than in the fire. When steel is heated in the fire the blast is put on very sparingly, and the heat also is kept as low as it is possible to forge at. Moreover, the steel is allowed to remain in the fire sufficiently long to become of the same temperature throughout, but "soaking," as the saying is, beyond this is dangerous.

*Uniform Heating.*—Steel, even more than iron, should be turned around in the fire to keep the heat uniform. The blast should be slackened after the edges have become red-hot. A full "cherry-red" is usually considered the proper heat for forging. But this expression is rather vague, and the temperature, as we said before, will vary with different qualities. Hammering should not be continued after the steel has lost its redness. It is injured by hammering at a blue or blue-black heat.

*Blue Heat.*—Smiths and boiler-makers know that there is a temperature in steel corresponding with what they term a "black heat"—a heat at which it is not safe to work it. A number of experiments have been made by the Steel Company of Scotland, and by Mr. Strohmeyer, upon steel in this condition, and they fully bear out and emphasise the rule-of-thumb knowledge of the practical man. At the works of the Steel Company of Scotland forty-eight plates were taken, and strips cut from each. Half the strips were bent cold to an angle of 180° round a bar of a diameter equal to twice their thickness, and all stood the test. Corresponding strips were heated in boiling tallow, and bent at that temperature, and everyone cracked before the bending reached 180°. Other experiments showed that a plate heated, and allowed to cool, suffers no diminution of strength, but that if while cooling, and during the period while it is at a blue heat, any hammering or bending is done, it will be found when cold to be seriously injured. Mr. Strohmeyer found that while a test strip bent cold would stand from twenty to twenty-six bendings before cracking, if it was bent once while at a blue heat, and allowed to cool, it broke afterwards with very few bendings. The blue heat corresponds with any temperature between about 470° and 600°.

In my next paper I shall write of the various classes of commercial steel, and of the art of welding the mild steels. A subsequent paper will be devoted to the hardening and tempering of the high carbon steels.

## IMPROVEMENTS IN HARNESS.

BY J. C. KING.

### Top Hame Fastenings.

There is plenty of room for improvements in harness, but they must come from users who know what is an improvement. Harness-makers, especially wholesale firms, stick to old devices and methods, so that their feeling is against anything that requires any extra supervision of work in a factory.

Doubtless it is the piece-work system of fixed prices and methods that has prevented many essential improvements being offered to the public in harness.

The present method of fastening the hames to horse-collars is by a strap, top and bottom, into two eyes to each hame, which hames may be described as the yokes of the collar to which the traces are fixed.

For pair-horse harness, chains are used at the lower ends of the hames, and a strap at the top of the collar to draw together and secure the hames in their places.

This seems to have been the plan for ages, and serves the purpose well.

In farm-cart harness it is a leather thong, which laces through holes in wooden hames. In waggon or van and town-cart harness, a buckle is used for the strap.

The same plan of a buckle is used in all pleasure vehicle harness, from the State carriage harness down to the costermonger's barrow harness.

In one essential particular it is unsatisfactory. The tail end of the strap is a loose

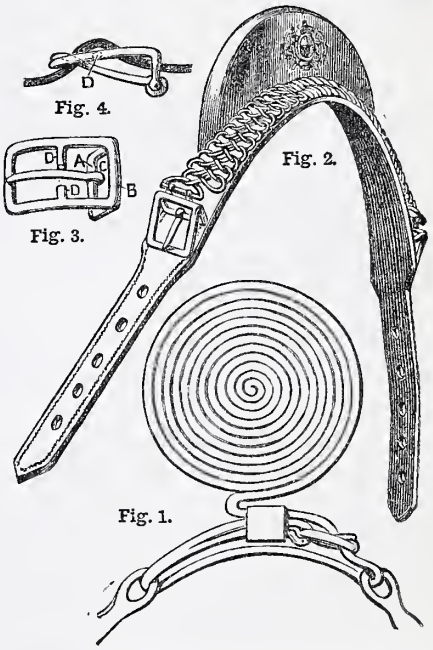



**Fig. 1.—Four-in-hand Top Hame Strap. Fig. 2.—Read's Arrangement of Top Hame Strap. Fig. 3.—Improved Buckle seen from above. Fig. 4.—Ditto, Side View.**

flapping point, that makes the harness look as if coming apart here.

The four-in-hand coachmen have tried to give a decorative turn to this point by winding the end of the strap into a miniature target, but it is apt to come uncoiled on a journey: it cannot be considered an ornamental device, as represented by Fig. 1.

The only successful plan yet adopted was patented by the late Mr. Thomas Read. This method in a simple way changed the upper strap into a combination of chain and strap, with two buckles instead of one; and the buckles were made in a peculiar form, with double heel-bars, by which the points of the ends of the straps were put out of sight under the chain when buckled up. Fig. 2 gives an idea of the buckles and the highly ornamental strap, with "housing" for monogram or crest. Although the article "Buckle" is not treated in some encyclopædias—and in one it is said that the buckle was introduced by Charles II.—discoveries in the ruins of Silchester have brought to light a buckle closely resembling the double-heeled one of the patent hame fastening. To ensure the

effectiveness of this highly ornamental hame-chain, a special buckle had to be invented; without this useful security the hame-chain would be useless.

No form of buckle out of some 150 different sorts now made would serve the special purpose of holding at once a chain and a strap, and allowing the point of the strap to be hidden away somewhere; for, useful as is the point of a strap, it is not ornamental either coiled up or dangling up and down with the motion of a horse's shoulders.

Some old and prehistoric buckles were looked over in the museums of England and the Continent. They yielded interesting treasures for survey, but perhaps the most interesting were those excavated from buried cities and tombs, showing the advance in metal working ages ago: notwithstanding the absence of the word "Buckle" in some encyclopædias, and the assertion of one that they were brought into England as fastenings for shoes by Charles II.

The buckle-makers seemed to know less about the uses of buckles than anyone else. The difficulty was got over by having two heel-bars, as shown in Fig. 3, A, for the chain, and B for the strap, with a space, C, between to receive the strap point. How was the lower heel-bar, A, to be fixed to the strap without wrapping the leather round the bar, or sewing on an overlay piece, which would have limited the space for the strap point to enter? A sewing of fine copper wire through the strap and round the bar A made a secure job of it, and only took from the space the thickness of the copper wire.

All went together admirably, looked handsome, and realised the inventor's most sanguine hopes, till the hame-chain had to be unbuckled from the collar for putting away the hames and traces; then it was found difficult to get the strap point out of the bars of the buckle, as it was sunk below the buckle-frame, and could only be raised by the point of a knife, or a nail or hook.

The strap must be kept up in the frame high enough to allow the fingers to draw out the point easily. A middle bar is used in many buckles, and the tongue fixed on that bar, but in this instance it would not answer, so the device of a middle bar to uphold the strap point, with a gap in the middle to allow the tongue to lie down in the frame without taking the strap with it, was the plan devised. This is shown by D, D; and in Fig. 4 the buckle tongue is seen below the strap, and the strap above the frame at D, and answers well.

## DESIGN FOR A VILLAGE SCHOOL TO ACCOMMODATE 180 CHILDREN.

BY J. HALL.

*Introduction.*—The school is intended for a large village; it comprises one large school-room and one class-room for the senior boys and girls, infants' school-room, with a gallery, master's room, cloak-rooms, and two sets of latrines (one to each sex), and boys' and girls' playground.

The school and class-room would be fitted up with dual desks on raised platforms, a dado of salt-glazed bricks four feet high, with a moulded capping in same materials, to run round all the rooms, etc.

The master's room, class-room, and infants' school-room would be fitted with cupboards for books, etc.

The cloak-rooms to be fitted up with post and rail divisions, and hat and coat hooks. The lavatory basins to be 13 in. diameter, and the sinks 2 ft. 6 in. by 1 ft. for washing slates.

The heating of the rooms, except master's room, would be by stoves. The master's room would have an open fire-grate.

### SPECIFICATION OF WORKS (BRICKLAYER, ETC.).

*Bricks for Facing.*—The bricks for external facing to be the best hard, well-burnt, pressed red-facing bricks, laid in English bond; no bats to be used, flushed up each course, and to be neatly weather-joint pointed.

*Common Bricks.*—The bricks for internal facing to be the best hard, well-burnt common bricks from an approved yard, and to be finished with a rough surface to afford key for plaster.

*Glazed Bricks.*—The glazed bricks to be the best dipped salt-glazed bricks of approved brown tint, and to be set in fine mortar and pointed with Parian cement, and to have a cut joint.

*Ditto for Urinals.*—The glazed bricks for urinals to be best "seconds," as last.

*Mortar.*—The mortar to be composed of well-burnt stone lime and clean, sharp (river or pit) sand: proportions—three of sand to one of lime, to be well mixed and kept clean.

*Concrete.*—The concrete to be composed of an aggregate of five parts clean, broken bricks or stone, broken to pass through a 2 in. ring, and one part clean, sharp sand or fine gravel, and one part of ground lias lime from an approved maker, to be mixed by measure.

The floors of cloak-rooms to have a layer of broken brick or stone 6 in. thick, well rammed, and to have a layer of 2 in. thick of cement and fine gravel, two of gravel to one of cement; to be finished smooth with a coating 1 in. thick of fine crushed granite and cement, one coat to follow the other without allowing time to dry.

*Drains.*—The drains to be formed of best earthenware socketed drain pipe, jointed in cement, and to be properly disconnected with small chambers, with stone covers and grates in same.

*Gauged Arches.*—The arches of windows, doors, etc., to be formed of best red pressed wire-cut bricks, formed and set in cement on proper centering.

*Arch Bars.*—All fireplaces to have Gibbs' patent wrought-iron lintels, $2\frac{1}{2}$ in. by $\frac{3}{8}$ in., built 9 in. into the wall at each end.

*Ventilation.*—Fix Boyle's wall panel ventilators in all main rooms.

*Flues.*—All flues to be 14 in. by 9 in., and to be properly pargeted with cow-dung and hair mortar, a blank flue to be carried up each chimney-stack for ventilation.

Finish flues with a 1 ft. high strong fire-clay chimney-pot set in cement.

*Latrines.*—All the latrines to be fitted with automatic flushing closets.

*Stonework.*—All stone dressings to be of best quality, free from all defects, to be laid on its natural or quarry bed, and from an approved quarry.

Steps to be of Pateley Bridge or Bradford stone, sawn on top and edge and slightly chamfered.

Hearths to be of Bradford stone, sawn on one side and rubbed fine, laid solid on bed of mortar.

All stone to be worked in the best manner in every respect.

Sills to be checked, weathered, and throated.

TILER.—The roofs to be laid with best Broseley tiles to a 3 in. lap on 1 in. by $\frac{3}{4}$ in. sawn redwood battens, and each tile to be bedded in hair mortar, and nailed with two copper nails $1\frac{1}{2}$ in. long.

*Ridge.*—To be of approved pattern bedded in mortar, and to match tiles in colour. All valleys to have purpose-made tiles to pitch of roof. All tiles to be laid double at eaves. Do all cutting, etc., required.

PLASTERER.—Plastering to be three-coat work. First coat of two of sand and one lime, with 5 lb. of cow-hair to one cubic yard of stuff; second coat to be three of sand and one lime, and to be finished with a coat of fine putty, trowelled smooth and left perfect.

*Ceilings.*—Laths to be "lath and a half" of riven Baltic fir, and to break joints every four feet; to be nailed with wire nails to ceiling joists; to have coat of hair and lime as before to walls, and floated smooth and skimmed with fine putty, which has been made at least one month.

*Distemper.*—All walls to have two coats, and finished to approved tint.

CARPENTER AND JOINER.—Best Dantzic Riga or Memel fir to be used for carpenters' work of an approved brand, to be full-grown and well-seasoned, free from sap, shakes, large, loose, or dead knots, and all defects.

The joiners' work to be constructed of best Quebec yellow pine.

*Lintels.*—Put lintels to all openings with 9 in. wall hold at each end and as many inches in thickness as feet in bearing.

*Roofs to be framed as follows:*—11 in. by 6 in. principal rafters, 10 in. by 6 in. tie beam, 9 in. by 3 in. purlins, $4\frac{1}{2}$ in. by 3 in. spars, all framed in the most approved manner, with wrought-iron straps, bolts, etc.

*Spars.*—To be $4\frac{1}{2}$ in. by 3 in., and not to exceed 12 in. apart.

*Wall Plates.*—To be $4\frac{1}{2}$ in. by 3 in., and lapped and spiked at joints.

*Platforms for Dual Desks.*—To be formed of 11 in. by 2 in. joists (stepped), notched and spiked to plates.

*Roof Boarding.*—All the roofs to be covered with 1 in. thick boarding laid diagonally with shot edges and spiked to spars.

Fix stout feather-edge tilting fillet to eaves.

*Gallery Floors.*—Lay the floors of gallery with $1\frac{1}{2}$ in. thick tongued and grooved flooring, laid very close and cramped, puttied and dressed off, and with rounded nosing and $1\frac{1}{2}$ in. tongued risers.

*Seat Backs to Infants' Gallery.*—The seat backs to be formed of $1\frac{1}{2}$ in. stuff with rounded edge, held down to seat with angle irons, and to be grooved and tongued to seat.

*Wood Floors.*—9 in. by 3 in. by 2 in. tongued and grooved best St. Petersburg redwood or pitch pine blocks, set herring-bone pattern in approved asphalte composition.

*Doors.*—The internal doors to be 2 in. thick framed and panelled doors, and to be fixed with three 4 in. butt hinges to 2 in. thick rebated casings; fix a lock and furniture on each door, and put 4 in. moulded architraves round both sides.

*Doors to Latrines.*—To be 1 in. ledged and braced batten doors, each door to have two strong wrought-iron cross garnets to $4\frac{1}{2}$ in. by 3 in. beaded and rebated frames. Fix on each door a good barrel bolt and strong wrought-iron thumb latch.

*Front Doors.*—The front doors to be $2\frac{1}{2}$ in. thick, panelled and stuck moulded, fixed to $4\frac{1}{2}$ in. by 3 in. rebated frames, upper panel prepared for glass, and each to have good barrel bolts and lock and furniture.

*Windows.*—Fix up the windows with 2 in. double hung sashes with 1 in. moulded bars,

and in stout deal-cased frames, with 3 in. sunk and weathered English oak sills, to be fitted with brass axle pulleys, woven twine lines, metal weights, and approved strong brass sash fastener.

The windows above the transoms of large window and cloak-rooms, etc., to be fitted with pivot-hung sashes on stout pins, and fitted with iron stays.

Line all windows, etc., with 1 in. lining and window boards and 4 in. moulded architraves.

*Book Cupboards.*—The cupboards to be framed of 1½ in. stuff, panelled and stuck moulded fronts, with 4 in. plinths; doors to be hung with 3 in. butt hinges, and fitted with ¾ in. shelves.

All work to be of best quality and left perfect.

PLUMBER.—The eaves gutter to be formed of 5 in. half-round iron gutter, with ½ in. thick wrought-iron straps, fixed to spars. All lead to be best Newcastle milled sheet lead.

*Flashings.*—All flashings to be of 5 lb. lead, to be tucked and plugged into brick joints, not less than 1½ in., and pointed in oil mastic, and to be 6 in. under tiles with a small concealed gutter.

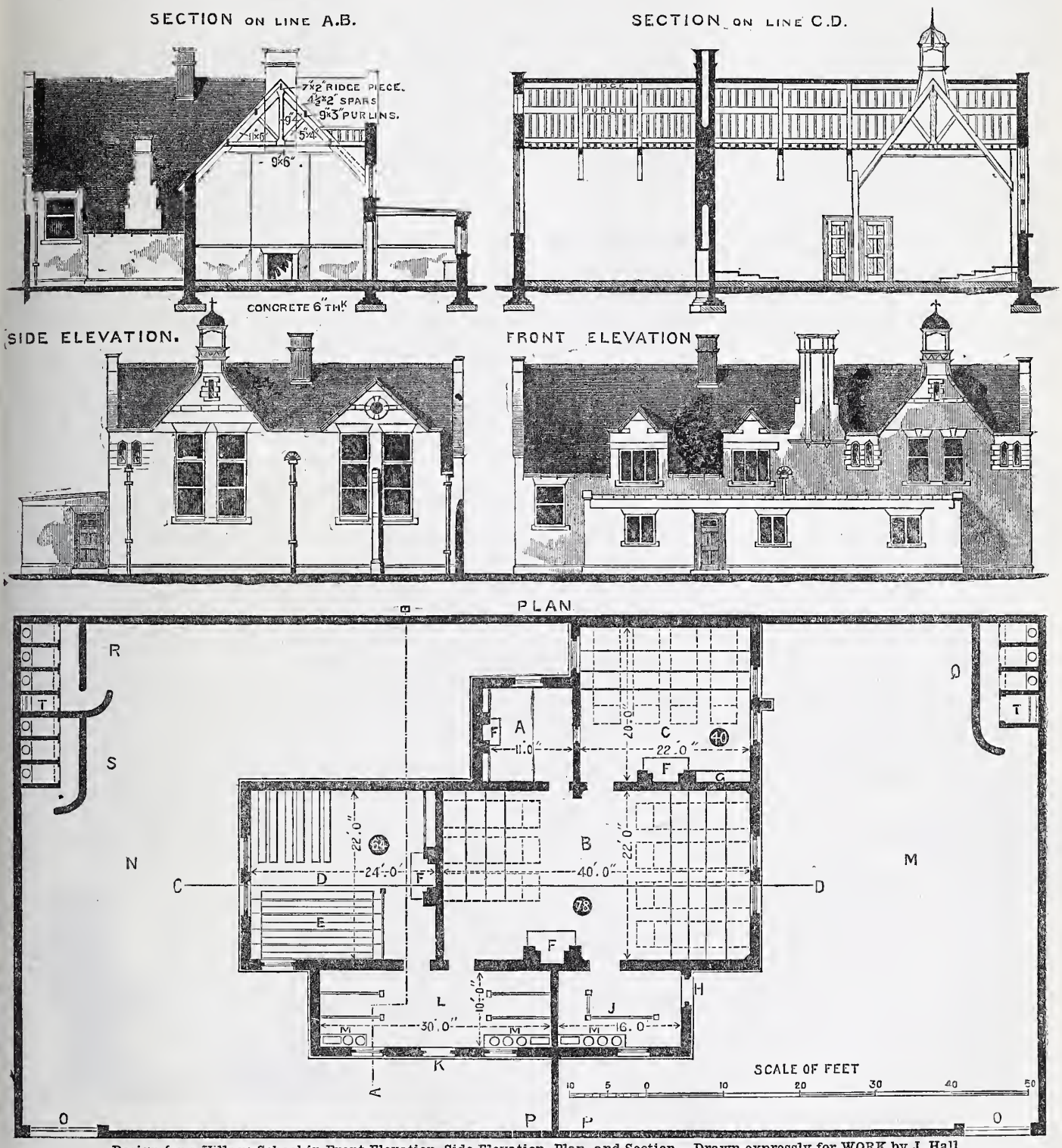
*Cloak-room Roofs.*—The cloak-room roofs to be covered with 7 lb. lead, neatly dressed over rolls and close copper nailed.

*Latrine Cisterns.*—The latrine ranges to have each a fifty-gallon flushing cistern, with proper connections.

*Turret Roof.*—To be covered with 7 lb. lead, and neatly dressed over rolls, and close copper nailed over edge of moulding.

PAINTER.—All materials to be of best quality, and painting to be finished to approved tints.

All white lead to be of the best quality of old white lead, and properly mixed with boiled raw linseed oil and turps, with colours ground in.




Design for a Village School in Front Elevation, Side Elevation, Plan, and Section. Drawn expressly for WORK by J. Hall.

*Wood and Ironwork.*—All wood and ironwork to be painted four coats good oil colours.

The sashes to be painted cream white, and doors, window-frames, etc., sage green.

All ironwork to be painted dead black.

The whole of the work to be carried out to the true intent and meaning of these plans and specifications, as may be reasonably inferred therefrom, and to be carried out in every respect in the most workmanlike manner, all omissions to the contrary notwithstanding.

The recent introduction of Free Education, and the probability of the establishment of village schools in localities where at present none, or mere apologies for them, are to be found, have induced the proprietors of Work to place at the disposal of any who may be disposed to avail themselves of them the Design and Specification above given. The proprietors have much pleasure in calling the attention of School Managers and Teachers to these helps to School Building, which are placed at their disposal for the mere cost of the present number of Work.—Ed.

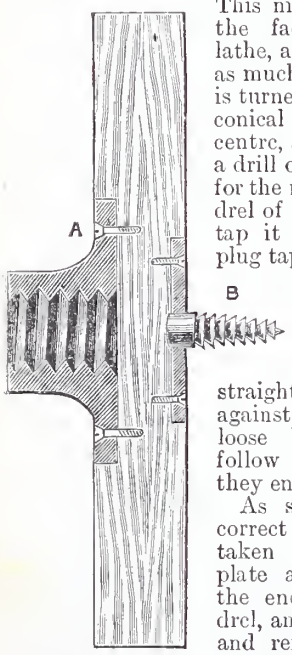
## A CHEAP LATHE CHUCK.

BY T. R. BLACKETT.

The accompanying drawing represents a section of a flange chuck with taper screw, the cost of which, if purchased, would be at least 5s. I made one a short time ago similar to the sketch, which cost about 2s.

The drawing is half full size, but the size may be varied to suit any lathe.

A brass casting, A, must be procured. This must be fixed on the face-plate of the lathe, and the back, or as much of it as can be, is turned true. Turn a conical hole in the centre, and drill it with a drill of a suitable size for the nose of the mandrel of the lathe; then tap it with taper and plug taps till it is a fit for the screw on the end of the mandrel. In order to keep the taps straight, fix their ends against the point of the loose headstock, and follow up the taps as they enter the chuck.



Section of Cheap Lathe Chuck.

As soon as it is a correct fit, it may be taken from the face-plate and screwed on the end of the mandrel, and the face, edge, and remainder of the back turned true; also drill four holes in the flange for counter-sunk-headed screws.

A piece of dry mahogany, 6 in. diameter and 1 in. thick, must be fixed on the face-plate and faced up, and a recess formed in the centre, which must be an exact fit for the brass casting already turned. The casting must be fixed to the mahogany by four screws, as shown at A. It is then fixed on the screw of the lathe mandrel, and the face and edge of the wood turned true.

A steel taper screw, about 1 in. long and ⅜ in. diameter, must be procured and fixed in a circular plate of brass 2 in. diameter, and which has been turned true; four countersunk holes for screws are drilled in the brass plate. The screw I used cost me 1s. complete, fixed in the plate.

A recess is turned in the centre of the wooden disc already prepared, into which the plate and screw are fixed by screws, as shown at B; the plate must be carefully fitted in, so that the screw runs perfectly true, before the screws are put in. This chuck will be found very useful for turning flat discs and short pieces of wood, which do not require the support of the loose headstock. There is also no fear of damaging the point of the tools in cutting out a ring, as when the flange is of metal.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

### 71.—Niedling's "Romanesque and Gothic Church Decoration."

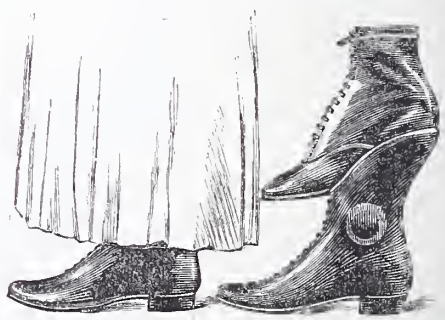
This publication is one of the finest samples of modern chromo-lithography that I have had the pleasure of inspecting. When the late Owen Jones—away back among "the sixties"—in one of his Marlborough House lectures on decoration, spoke of the glorious colourings of Gothic ecclesiastical decoration, "in which each and every moulding has its applied colour," he must have had in his mind some of the ancient works which A. Niedling has here re-drawn and coloured with so much skill and art for the benefit of our own times. The six plates contained in the first part show some clever drawing and handling of the figure, besides a wealth of purely conventional ornament of an ecclesiastial character, for bosses, ashlar work, side aisles, groined roof, and perpendicular and horizontal borders, with sacred emblems introduced therein. For the better appreciation of the professional utility of this publication, I am pleased to give a place to the opinion of a skilled and experienced contributor. He says:—"Niedling's 'Church Decoration' should be in the hands of every man who professes to design and execute Gothic decoration. The whole of the designs are very judiciously selected, and contain much that is entirely fresh in form and treatment. The colouring is very charming, and scholarly in every example; and coming, as the work does, at a period when the High Church revival of ecclesiastical art is beginning to make itself felt in all directions, I consider it a valuable acquisition to every architect and decorator who can appreciate the æsthetic and phonetic beauties of pure Gothic decoration." The price of this publication, consisting of twenty-four sheets, each 18 in. by 12 in., is 48s., or 12s. each four-part division. To those of the artistic cult amongst the friends of Work who are acquainted with the "Art Decorator," no further evidence of the monetary value of this production will be required. A specimen plate costs 2s.

### 72.—Zander's "Modern Decoration."

I have heard it stated, by one who was very competent to express an authoritative opinion on the subject, that the practice and art of house and church decoration is but in its infancy in this country. Judging by the number of costly books upon the subject which have recently been placed upon the market, there are apparently many publishers who have a like opinion and faith. The above-named work appeals chiefly to professional painters and decorators, and consists of thirty large designs, in chromo-lithography, for the decoration of ceilings, walls of dining- and drawing-rooms, boudoirs, studios, vestibules, staircases, etc. Although the entire work, in its original German edition, is now completed, the first part only of the English reprint is yet in the publisher's hands; the remaining parts will quickly follow. Each part-issue contains six sheets or sets, for wall and ceiling treatment, printed in the finest possible manner, and mounted upon grey-tinted cards. Although the decorative treatments are more characteristic of Continental decoration than of modern British work, they are full of suggestion and instruction to the decorator who strives to display some freshness and originality in his designs. To the practical master-decorator, especially of the provinces, the work would prove of considerable value, and a set of plates, suitably framed, would materially conduce to the artistic tone of his show-room. The work may be obtained complete, in a suitable portfolio, the thirty plates—size about 18 in. by 12 in.—for £3. The price of a single sample plate is 2s. post free; each part, containing six plates in colours and gilding, being published at 12s. I may further mention, as evidence of their artistic excellence, that sample plates may be seen at the German Exhibition.

### 73.—Improved Boot for Shortened Leg.

"One-half the world is occupied in thinking what the other half is thinking of it," is an aphorism which is constantly manifest, in the affairs of life, in appearances that one-half present to the other in general civilised society; and, perhaps, in no aspect more critically than personal appearances. "The knightly man, though obscure," was the aspiration of a princess. The gentleman, the athlete, is the beau ideal of many who are not princesses. If men or women are afflicted by deformity, they wish to conceal it from the world. It is a laudable feeling, and if art or science, tact or talent, can honestly spare the sensitive feelings of the afflicted, it serves humanity sometimes where nature fails. The deformity to feet of men and women is an affliction which is keenly felt by the afflicted when others regard them pityingly. If the deformity is unseen by others, a sense of relief is felt, and feelings spared. Many feet now encased in hideous frames of cork, iron, or leather, of awkward contrivance for pedomotion, are practically perfect feet, the human ill being either in the knee or hip, which has contracted a leg at one of those parts, and to make the legs even in length the club-boot is put on a perfectly healthy normal foot. This has been done almost up to the present time, till a Mr. Tyrrell was called upon to make a club-boot for a perfect foot of a distinguished man. He refused to do



so. "I will make you a pair of boots alike for even tread on the ground, and a boot to fit your foot at its present height from the ground, so that when you stand there will be no difference of boots you rest on, and your trousers will hide the upper boot on your shorter leg." This was common sense, and delighted the afflicted one, and soon led to orders from all parts for double-storey boots for those with hip and knee contractions. Of course, the lady's skirt effectively conceals the upper boot, as do the trousers of a gentleman. The illustration speaks for itself

The Editor

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Rate of Circular Saws.**—CHOPSTICK writes, in reply to A. R. (*Scorrier Saw Mills*) (see No. 128, p. 379):—"I beg to say that I am still of the opinion that it would be extremely difficult to find a joiner who would be willing to saw 3 in. deal with a rip saw. A. R. seems to think that I am a master, but I am only a journeyman, and I should certainly refuse to do so; and if I were a master, I should refuse to allow my men to do so if they would, as the game would decidedly not be worth the candle. I suppose from his letter that A. R. is the proprietor of the Scorrier Saw Mills. If so, of course it is to his interest to sneer at home-made machinery; but I have made and used a saw-bench which not only cut any thickness up to 3 in., but did tenoning and grooving on it, and I intend sending a description of the machine to WORK, and, if it is accepted, others will have the chance of proving my words correct. It is scarcely possible to find a joiners' shop without a mortising machine, but I think the circular saw is of far more benefit. A. R. says that he sharpened a joiners' rip-saw, and cut 3 in. pine for two days, and it went grand. I never yet saw one which would cut for two days without sharpening, and I must say that A. R.'s statements will hardly hold water. However, he may think what he likes. I have had experience both ways, which I do not think he has, and I will guarantee that I can saw out as much 3 in. deal in one day, with a labourer to turn, as six joiners can with the rip saw in the same time, and both the labourer and myself work comfortably."

**Rate of Circular Saws.**—A. R. (*Scorrier*) writes:—"I was not only surprised, but amused, when I read CHOPSTICK'S reply to CONSTANT READER on p. 398, No. 129. In No. 120, p. 251, CHOPSTICK wrote strongly condemning my argument in No. 116, p. 187, *re* 'Rate of Circular Saws,' and tried to convince the readers of WORK that it was an easy matter to cut 3 in. deep with a circular saw driven by hand. In his reply to CONSTANT READER (see p. 398), he said you must not expect to cut 3 in. stuff without some hard work, and it is best to have two men to turn the wheel. Now, I ask, what notice is there to be taken of a man that will support a thing in one number and in another condemn the same? It is like a child getting a rod with which his own back is to be beaten. I hope, when CHOPSTICK gives his promised information to CONSTANT READER, that it will not be misleading: that he will not try to open one's eyes in one number, and blind them in another. I understand that the object of WORK is to enlighten its readers; and those that write letters and replies should write with that intention, and not for the mere sake of argument."

**Cost of Patents.**—The following is a cutting from the "Inventors' Column" of the Melbourne *Daily Telegraph* of August 8th, by Mr. G. G. Turri, F.S.C.I. I make no apology for reproducing it, as I am sure it will be of interest to many readers of WORK:—

"There are so few books on patent law adapted to the taste of the average inventor, that the one now before me is very welcome. It is highly essential the inventor should know certain facts before he takes out patents, otherwise loss ensues. One important point is, 'What do patents cost?' I find the following table in a work entitled 'Patents for Inventions, and How to Procure Them,' by G. G. M. Hardingham, a well-known consulting engineer and patent agent of London:

| Country. | Patent Office Charges and Terms. |
|---|---|
| Great Britain ... ... ... ... | £154 in 14 years |
| Germany ... ... ... ... ... | £226 in 15 years |
| France and Colonies ... ... | £60 in 15 years |
| India ... ... ... ... ... ... | £52 in 14 years |
| United States ... ... ... ... | £7 in 17 years |
| Canada ... ... ... ... ... | £12 in 15 years. |

"To this I add the figures for Australasia:—

| | | |
|---|---|---|
| Victoria ... ... ... ... ... | £8 | in 14 years |
| New South Wales ... ... | £5 | ,, |
| Queensland ... ... ... ... | £20 | ,, |
| South Australia ... ... ... | £9 | ,, |
| Tasmania ... ... ... ... ... | £45½ | ,, |
| New Zealand ... ... ... ... | £17½ | ,, |
| West Australia (L.R.) ... | £15 | ,, |
| Total for Australasia ... ... | £120. | |

"These do not include the varying charges of patent agents, and further it will be understood that in most cases the fees are payable in small instalments at intervals, so that any patentee, finding the invention unremunerative, can let the patent lapse, and so avoid paying the great bulk of the above charges. Thus in England only £4 is payable during the first four years. But taking the above table and noting the average annual cost, and bearing in mind the present population of each country, I get the following startling results:—

| | | | |
|---|---|---|---|
| In United States | The expenditure of 1d. in Patent Office fees gives a monopoly right for a year over | 670,000 | persons |
| France ... ... | | 73,000 | ,, |
| Canada ... ... | | 26,000 | ,, |
| Great Britain | | 14,000 | ,, |
| Germany ... | | 12,000 | ,, |
| Australasia ... | | 2,000 | ,, |

"This table is of some value. When federation takes place the Australasian colonies will cease to occupy the miserable position above shown, and will jump to the level of Canada. At present, New South Wales shows 13,000 and Victoria 8,000 to the 1d.; but the other colonies rank terribly low. Let us hope that the rights conceded to patentees in Australia will soon (like the kiss which the lady returned to Rodolph) be *revu corrigé et considérablement augmenté*.

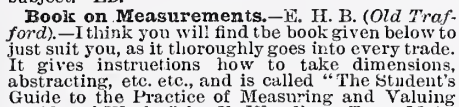
**Carpentry Classes.**—R. A. P. writes:—"About two years ago I saw a paragraph in the columns of 'Shop,' recommending for 'Tuition in Carpentry,' Mr. S. Robertson, 14, Augustus Road, Hammersmith, who holds evening classes at that address. I at once went to him and joined his classes, finding them of great benefit, so much so that I joined them again the following winter (1890-91), and I fully intend to do so again this winter. They will commence about the end of this month (September) or beginning of next (October), and I should advise your numerous readers—some of whom, like myself, may live in the vicinity, and to whom it might be a convenience and a great benefit—to take advantage of the opportunity. I cannot speak too highly of his merit as a teacher."

### II.—Questions Answered by Editor and Staff.

**Ash-pan Making.**—J. W. (*York*). **Netting.**—J. H. (*West Bromwich*). **Lamp for Lantern.**—PEDAGOGUE. **Door.**—COWL.—*** The replies to queries on the above subjects must necessarily be given at considerable length to be of any practical utility and value to those who are seeking information on them. The answers are far too long to be included in "Shop," and will therefore appear as short articles in the body of the magazine. "Shop," it should be remembered, is intended to meet the wants of those who are in need of information on any single point connected with any particular subject, and not to deal with subjects themselves from the commencing Alpha to the ending Omega. For the future, contributors must bear in mind that those questions which involve over-long replies cannot be entertained, or must wait to be dealt with by a special paper on the subject.—ED.

**Book on Measurements.**—E. H. B. (*Old Trafford*).—I think you will find the book given below to just suit you, as it thoroughly goes into every trade. It gives instructions how to take dimensions, abstracting, etc. etc., and is called "The Student's Guide to the Practice of Measuring and Valuing Artificers' Works," by E. Wyndham Tarn, M.A., price 10s. 6d. Published by Crosby Lockwood and Co., London.—E. D.

**Electric Light.**—N. M. (*Dundee*).—Your 20 volt 10 c.-p. lamp will require a battery of ten or eleven such cells as you propose to light it efficiently, and the cells will need re-charging every three or four hours. If the zinc plates touch the bottoms of the cells, you may have a layer of mercury in each cell to keep the zincs amalgamated, but the carbon plates must not touch the layer of mercury. If the zincs do not touch the bottoms of the cells, the mercury will be useless. The carbons must have lead heads, but it is not necessary to cast the carbons in a ring of lead. You may employ a set of carbon plates, each furnished with a separate head of lead, as in the carbon plates used in Leclanché cells, or those shown in your sketch. A wood support of teak or of mahogany, well soaked in paraffin wax (as suggested), may be employed to support the plates. Strips of brass or of copper may be fastened to the upper surface of this support, to form connections for the carbon plates. These should be arranged in




as shown in your sketch. In your arrangement the two outside carbons would be almost useless, as their surfaces would be out of range of action. The large round cells, each with a central plate of zinc, 6½ in. × 4 in. × ⅜ in., flanked by carbons 7 in. × 2 in. × 1/16 in., as shown above, will be preferable to cells of a smaller size. See that the tang of the zinc plate is well insulated from the connecting strip of brass on the wood support. This strip on one cell must be connected to the zinc of the next cell, and so on through the series. Charge the cells with bichromate of potash or chromic acid, 3 oz. in each pint of water, acidulated with 3 fluid oz. of sulphuric acid (common oil of vitriol). Use No. 16 B.W.G. copper wire to connect the cells in forming the battery, and No. 18 B.W.G. wire to connect the battery with the lamp. I shall have much pleasure in giving you further advice if you require it; but please understand that we do not answer letters by post. Replies must be made in "Shop," and will appear in due course, as space can be found for them.—G. E. B.

**Simplex Dynamo.**—W. D. (*Belfast*).—Mr. S. Bottone, Electrical Engineer, Wallington, Surrey, can supply you with castings and other materials for making a dynamo of the Simplex pattern. A set of castings, with east annealed ring armature 3⅜ in. in diameter, and wrought-iron core 4 in. in length by 2 in. in diameter, will cost 12s. 6d.; or with thin iron plates 3 in. in diameter for a laminated armature, at 24s. the set. He does not recommend the H girder armatures for these machines, as they get too hot; but the price would be the same as that of the ring armature. The wire required will be 1 lb. of No. 20 d.-c.-c. on the armature, and 5 lbs. of No. 20 d.-c.-c. copper wire on the field-magnet core. This machine will develop a current of 2 ampères at a pressure of 25 volts, or enough to supply 20 candle-power. I am glad you find WORK so useful. The captain of our ship decides on the cargo to be carried, and he alone can say when induction coils will be placed aboard.—G. E. B.

**Safety Fuse for Electric Light.**—R. C. J. (*Staffordshire*).—Your lamp may be protected from injury by an accidental rush of current by means of a safety fuse, a safety magnetic cut-out, or a suitable resistance placed in circuit with the lamp. Arrange a Cockburn fuse in circuit with the lamp, to melt at, say, twice the normal current taken by the lamp. This will be, for a 100 volt 16 c.-p. lamp, about 1 ampère. Now, No. 36 B.W.G. fusible tin wire will melt with a current of 1 ampère. Arrange, therefore, a short length of this wire as a loop in the lamp circuit with a small weight (such as a ring or a pellet of lead) depending from the loop. Should the current exceed in strength 1 ampère, the fuse will melt and the weight fall, thus cutting the lamp out of circuit. A fresh piece of wire must be put in after each such accident, and this may form the cause of an objection to a safety fuse of this kind. This being so, I should advise the use of a Cunnyngham's or other magnetic cut-out instead of a safety fuse. Magnetic cut-outs are merely electro-magnets placed in circuit with the lamp, together with a make and brake arrangement controlled by an iron armature placed within the influence of the electro-magnet. The armature can be set so as to cut out the lamp when more than 1 ampère is passing through the magnet coil. You can easily devise the necessary arrangements to do this. If this cut-out is used in conjunction with an adjustable resistance, you can alter this at will, and thus effectually guard the lamp. One of the best adjustable resistances for such a purpose is that of a carbon rod dipping into a metal cylinder filled with water. The cylinder and the rod-holder are connected in circuit with the lamp, and the rod is immersed more or less in the water until the desired resistance is secured. A metal pail will do instead of a cylinder. The carbon resistance may also take the form of two strips of carbon resting on a slate base and on each other; the resistance varying with the surface of carbon in contact. As arcs are liable to be formed between the two surfaces, this is not so good as the former form of carbon resistance. In conclusion, I must point out that you cannot (as you suppose) reduce the voltage of the current by means of a resistance. It is the strength of the current as expressed in ampères by an ammeter—not voltage, as shown on a voltmeter—that will be reduced. I am pleased to hear of your success in following instructions given in WORK.—G. E. B.

**Soldering Zinc to Brass.**—SOLDER.—Scrape the surfaces which are to be soldered quite clean and bright. Moisten the cleaned surface of the brass with a little ordinary soldering fluid (chloride of zinc or killed spirits), and tin it in the usual way by rubbing the hot soldering bolt on the prepared surface of the intended joint. Get the soldering bolt moderately hot, moisten the cleaned zinc surface with a little crude spirits of salts (muriatic acid), and press the zinc with the hot bolt on the tinned surface of brass. This will cause the two surfaces to adhere. The edges of the seam must now be moistened with spirits of salts, a bead of solder applied, and drawn along by the hot soldering bolt to make the joint neat and secure.—G. E. B.

**Nickel-plating Steel.**—C. V. (*Bath*).—The cause of your failure in attempts at nickel-plating steel is simply want of experience. No book contains definite instructions calculated to meet every difficulty likely to be experienced by amateurs. General laws can only be laid down in books, and these must be applied to by intending experimenters. As you have the "Electro-platers' Handbook," I will quote from it to show you that the general law applicable to your case is there given. On p. 171 you will find: "A successful result largely depends upon the regulation of the current. If this is too intense, the nickel will be thrown on in small hard grains, which will not present any surface capable of being polished; or the deposit will be ragged: that is, specked with tiny blisters, which will cause the metal to strip and leave a ragged appearance on the coat. Both of these defects are due to excessive evolution of hydrogen at the cathode. When small steel articles are placed in the nickeling solution by themselves, this tendency to blister and cast off the coat of nickel is sometimes very troublesome. This fault may be remedied by placing each steel article between two of brass or some other metal, and thus divert part of the current on each side by easier paths." The strength of current must

be regulated to the strength of your solution. When both are balanced, the deposit will go on all right. Alter the battery, reduce or increase the anode surface, or place this nearer to or farther from the article, until the proper conditions have been found by experience. Your arrangement of vat, rods, battery, etc., are all right. The solution might be denser with advantage. I should advise you to get an experience in depositing nickel on brass and on wrought iron before you attempt depositing on steel. I think you will concede that you are serving an apprenticeship to this trade, and should, therefore, try the easier jobs before attempting such difficult ones as those stated in your letter. Brass and iron may be plated together in one solution after you have mastered their peculiarities by experience.—G. E. B.

**Shocking Coil.**—T. W. (*Bolton*).—We endeavour to oblige all our readers with replies to their questions, but cannot see our way clear to give you instructions how to make a shocking coil to send a shock through thirty or forty persons at the same time. You have not, evidently, given this question serious consideration in all its bearings, and specially in those relating to the possible consequences following a shock from such a coil. A shock from such a coil might cause death to one or two persons in the ring, should they be suffering from heart disease, or might cause permanent injury to the health of others. Such shocks can do no good; and the practical jokes played with coils are of such a questionable character as to merit severe denunciation.—G. E. B.

**Cases for Binding Vol. I. of WORK** are on sale by Messrs. Cassell & Co., the publishers of WORK, at 1s. 6d. each. The cause of delay rests entirely with the newsagent.—G. E. B.

**Brass Savings Bank.**—D. S. (*Glasgow*).—You leave the design to me, but you ought to have said whether you desired one of a geometrical pattern, villa or house, figures, or some fancy object. I give this one, hoping you will find it suggestive. It will be advantageous to have five separate compartments, as then they could be allotted for the use of five different members of a family, or could be disposed for the saving of copper, silver, and gold

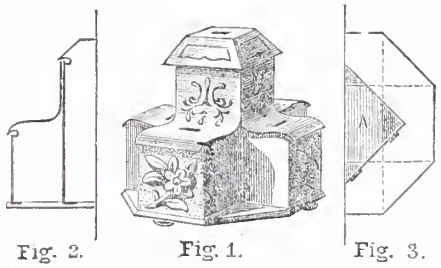


Fig. 2. Fig. 1. Fig. 3.

**Fig. 1.—Perspective Sketch of Bank. Fig. 2.—Cross Section (half). Fig. 3.—Plan (half).**

coins individually in lots, distinct from each other. I cannot enter into details of constructing this box, beyond saying that I should put it together as in section, Fig. 2; but I believe you will find many useful hints in Mr. Alexander's papers on "Sheet Metal Work," given from time to time. A small square door in the bottom, as in plan, Fig. 3, would, when opened, expose the interiors of all the five compartments, and facilitate easy extraction of the coins within.—J. S.

**Wooden Mole-traps.**—J. J. (*Cumberland*).—I have made inquiries for a firm who supplies the above wholesale, but am sorry to tell you that I have not succeeded in finding one. Perhaps some of our readers may know, and will oblige us with the information. They have wire springs attached to them, says our correspondent.—J. S.

**Improved Watch Key.**—D. B. D. (*Glasgow*).—I have examined the sketch sent us, and think it novel, but fail to see that it would pay for the trouble and expense of patenting and introducing to the public, especially as the use of keyless watches is extending, and they are found so much more convenient. It may be urged, in reply, that there are still a great number of key-winding watches in existence, and that, therefore, there must be a good field for the improved key. This is a question more fitted for our correspondent to decide, and must be entirely decided by him.—C. E.

**Hydrostatic Clock.**—R. F. (*Newcastle*).—I am afraid I do not quite make out what you mean by a "hydrostatic" clock. I do not know of anything by that name; and on turning to the dictionary, I find "Hydrostatics—science which treats of properties and pressure of fluids at rest." And under the circumstances, I do not know how to assist you. No doubt it may be ignorance on my part, for which I apologise. But would the clock illustrated and explained in WORK, No. 125, under the heading "Sand Clock?" If so, I shall be glad to give you any further assistance in my power. It would be easy to make, and would simply require the bottom vessel emptied, say, once a day.—A. B. C.

**The Horizontal Position of Drawers.**—D. B. D. (*Glasgow*).—A person making an improvement for any purpose which is a novelty, is useful, clearly and properly described, with the claims sufficiently and properly drawn, may obtain a valid patent; but he must distinctly point out in what the novelty consists, and not claim as new anything that has been published or known before. If the inventor our correspondent alludes to has done something in a better way than any known up to that time, he can, of course, go for a patent; but then, it must be so drawn as to be in conformity with the legal requirements in a patent as to enable the law to support; otherwise, such a patent is of no good, and it is waste of time and money to obtain such; and this, it is needless to say, cannot be done unaided by any of the ordinary run of inventors.—C. E.

**Provisional Protection.**—A CONSTANT READER.—Any inventor who has obtained the grant of a provisional protection for a given thing cannot be considered safe in making it known whilst there is an earlier provisional protection for the same kind of thing open. If the writer is in the hands of a competent agent, or engineer of experience in patent matters, he would be able to carry him through, and advise him as to his best course; but if he—as too many are so fond of doing—has prepared and put in his own documents, he must fight his battle himself, the results of which he will find neither economical, or beneficial, or encouraging. An invention, if good for anything, and intended to be made a property, requires the aid and assistance of one properly qualified to do the required work in a suitable manner; and though a patent is nearly sure to be granted in response to the application, it may be no more a "property" after than before. Inventors and the extensive class who want skilled work and experience to be obtained for nothing will soon find out their folly and ignorance.—C. E.

**Perpetual Motion.**—F. T. (*Dundee*).—By the above term is usually understood an arrangement and combination of parts of inanimate matter in such a way that, when put together, they shall contain within themselves the power of motion, and keep in motion until the wear and tear of the parts prevent them from continuing to do so. Such an idea, practically, is an utter absurdity; and were it practicable, man would then be endued with the power of *creation*, which is one of the greatest attributes of the Almighty. That some very useful and ingenious movements and combinations have been obtained by the search is very true; but in order that our correspondent may thoroughly understand the subject, he should read "Perpetuum Mobile," by our old friend the late Henry Direks, C.E., which contains much valuable information on the subject.—C. E.

**Sizes of Tapping Drills.**—AXLE.—The sizes given in the list below are those I use, and are approximately correct for both cast and wrought iron; though, of course, to be exact the drill should be rather larger for wrought iron than cast, especially in the larger sizes.

| *Diameter of Screw.* | *Diameter at Bottom of Thread.* | *Approximate Size of Tapping Drill.* |
|---|---|---|
| $\frac{1}{4}$ | ·1859 | $\frac{3}{16}$ bare |
| $\frac{5}{32}$ | ·2413 | $\frac{1}{4}$ |
| $\frac{3}{16}$ | ·2949 | $\frac{5}{16}$ full |
| $\frac{7}{32}$ | ·346 | $\frac{11}{32}$ |
| $\frac{1}{4}$ | ·3932 | $\frac{25}{64}$ ($\frac{1}{8}$ + $\frac{1}{64}$) |
| $\frac{9}{32}$ | ·4557 | $\frac{29}{64}$ ($\frac{7}{16}$ + $\frac{1}{64}$) |
| $\frac{5}{16}$ | ·5085 | $\frac{1}{2}$ |
| $\frac{11}{32}$ | ·571 | $\frac{9}{16}$ |
| $\frac{3}{8}$ | ·6219 | $\frac{5}{8}$ |
| $\frac{13}{32}$ | ·6844 | $\frac{11}{16}$ |
| $\frac{7}{16}$ | ·7327 | $\frac{3}{4}$ less $\frac{1}{64}$ |
| $\frac{15}{32}$ | ·7952 | $\frac{25}{32}$ |
| 1 | ·8399 | $\frac{13}{16}$ + $\frac{1}{64}$ |

**Circular Saw.**—A. T. (*No Address*).—You have worked out the speed of your saw spindle correctly; but I cannot say whether it is too fast, as, in speeding a circular saw, the diameter has to be taken into consideration, which you have not given. If the saw is not above 12 in. in. diameter, the speed is not too fast in cutting soft wood. But for cutting hard wood, the pulley should be about 1 in. larger, which would bring it to about the right speed. A. T. should write again, stating gauge and diameter of his saw, also number of teeth, and what the trouble is, and he may expect a definite reply.—A. R.

**Dulcimer.**—H. J. C. (*London*).—I am very pleased that you have been so successful with your F dulcimer. If you want to make an instrument "suitable to play at a social concert," I should advise you to make one of the D or concert size, the dimensions of which would be: Length, front, 2 ft. 10 in., back, 1 ft. 4 in., depth from front to back, 1 ft. 4 in. Such an instrument is suitable for any work, and stands in a convenient key, but, of course, you could make one to any size you like. If you make one, as you suggest, 3 ft. 2 in. at bottom, and with additional semitones in the bass, that would necessitate the provision of three more bridges on the bass side, and a depth from front to back of 1 ft. 7 in. (The treble is already chromatic.) The additional notes would entirely alter the scale of the instrument, and render it much more difficult to play, on account of the "dodgy" character of the beating which would be necessary. If you build one 3 ft. 2 in. at bottom with the ordinary scale, then the top should be 1 ft. 7 in., and the depth 1 ft. 6 in. To get a full volume of tone out of an instrument of this size, I should advise you to make it with five strings to each note, and to string it with Nos. 11, 10, and 9 brass and Nos. 8 and 9 steel wire. The same width of blocks would do as for an F, as there would be ample room for an additional row of pins on each. Your idea of increasing the sound by replacing the inner bridges with stays similar to those on the back of the sound-board of a piano would have the opposite effect, as these bridges act as sound-posts between back and belly as well as supporting the latter, which, without them, would pucker or swamp as soon as the pressure of the strings was brought to bear upon it. Your question regarding a portable harmonium shall have consideration. In conclusion, allow me to say that if all our correspondents were as explicit as you are they would earn the lasting gratitude of those whose duty it is to reply to them.—R. F.

**Patent Drawings.** — VERAX. — It is in the interests of patentees that the Patent Office requires the drawings to be clear, black, and well lettered—first, that the photographs taken therefrom for the published specifications may be clear and intelligible; and secondly, that when they come before the courts at a trial, the legal mind can readily follow and understand them. C. C. C. is very much in the habit of dogmatising on Patent matters, and putting himself forward as an authority on a subject of which he has shown and proved himself grossly ignorant—witness, for example, his telling persons who want to make a search to go to the British Museum to examine specifications! and then, when he was shown what nonsense he had been writing, endeavoured to put it off by saying it was needed if an inventor wished to "see the patents at length!"—whatever this may mean. It is pretentious amateurs and dabblers of this description who are misleading inventors, increasing the number of useless and invalid Patents, and causing Patent property to be lightly esteemed and ridiculed. The drawings filed by our correspondent can only be esteemed as rough "sketches," and not by any means as "drawings" in the mechanical sense of the term; and this would be quickly proved if ever they came into the Law Courts.—C. E.

**Patent.**—ONE OF YOUR CONSTANT READERS.—It is amusing to see the readiness with which persons entirely ignorant of a subject will set themselves up to guide and instruct others, and what useful and infallible authorities they consider themselves! Our correspondent informs us of one of these, who had "registered an idea" (!) at the cost of £1. Now, in the first place, an "idea" cannot be patented. The only thing that can be patented is a *new* manner, method, or mode of performing or producing *something;* and unless a manner, method, or mode is described, such Patent (if granted) would be invalid and useless. The object to be attained in trying to obtain a Patent is the creation of a property, and one which the law will support. Unless this is done, time and money will be wasted, and it is almost needless to add that this cannot be done by the ordinary inventor, though he may put in some papers himself, and get a so-called Patent granted in response. The first thing our correspondent should do is to ascertain if his invention is *novel*, has not been patented before, and that there are no provisional specifications of an earlier date in existence for the same subject. Now, the grant of a provisional protection assures the inventor that no *later* applicant can take precedence of him under the subject of the invention. This provisional protection lasts nine months from the date of application, and before the expiry of this term the complete specification, claims, and drawings must be filed, or the Patent is *lost*. If, however, it is found that what has to be done cannot be completed within that term, an extension of time of one, two, or three months may be applied for, for one of the three periods named, with the stamps for fees of two, four, or six pounds impressed upon the application; but *no further* extension of time will be granted. The cost of a patent will entirely depend upon the amount of work to be done in the search, drawings, specifications, etc.—in fact, unless this is known beforehand, no one can name a price which shall be fair to both parties. The Government fee of £1 on the application no more represents the cost of what has to be done than the penny stamp on a letter settles the value of its contents, or the stamp on a legal document covers the cost of preparing it. If a provisional protection is obtained for an invention under a certain subject, and there are one or more prior provisional protections in existence for the same subject, there is always the risk that, on showing the protected invention, it may be appropriated and embodied in one or other of them, in which case the inventor will be nowhere. A little consideration should satisfy any man of common sense that a person totally ignorant of a given subject is not, and cannot be, qualified to instruct others, or properly to perform what is required therein. If our correspondent has got a thing that is useful and new, let him place himself in the hands of one who knows what has to be done, and how to do it, and is thereby qualified to secure for him what he desires.—C. E.

**Contract.**—J. P. (*Manchester*).—I can hardly understand from your note the precise nature of your requirements. For instance: do you want to know how to take dimensions off drawings or on the ground? Or do you want a book of prices? The act of contracting really is merely the stating of a certain sum, for which you are prepared to do a specified amount of work. Write for the "Contractors' Compendium and Complete Catalogue," by John Edward Sears, published by the Compendium

Publishing Company, 16, New Bridge Street, E.C. It states that it is published for 5s., but I know for a fact that it is given free to the trade. You will, I think, find it very useful; for not only does it give a dictionary of manufacturers' specialties, with their illustrations and price, but it also gives a "price book," divided into four sections. Section I., schedule of all trades; Section II., schedule for a dwelling-house; Section III., schedule for a church; and Section IV., builders' measured bill.—E. D.

**Clock Case.**—G. W. (*Birmingham*).—The works, without cases, can be supplied by any dealer in clocks. There is no difficulty in getting them.—D. D.

**Removing Ink Stains.**—H. S. A. (*Wolverhampton*).—I do not know of the particular fluid to which you refer as being sold to remove ink stains; but you can easily make one yourself by dissolving some oxalic acid in water. In using this material be careful, as it is a deadly poison.—D. D.

**Whitworth Scholarships.**—ANGLO-CYMRO.—There are thirty scholarships, each tenable for one year, some of the value of £100, and the rest of £50 each. There are twelve scholarships, tenable for three years, of the value of £125 a year each, four being awarded each year. The limit of age is twenty-six years. The competition is in theoretical subjects; but the candidate is required to have been engaged in handicraft in the workshop of a mechanical engineer for at least three years. The idea is to give as nearly as possible an equal chance to the highly qualified student and to the skilled workman. But for complete particulars I must refer you to the Secretary of the Science and Art Department, South Kensington, S.W., who, on receipt of 3d. in stamps, will send you a full prospectus of the Whitworth Scholarships.—J.

**Poker Work.**—POKER.—To describe poker work in all its details would require a treatise; but the following hints may be of service:—Well-seasoned, hard, white woods are the best to work upon, as sycamore, box, holly, American white wood, etc. The design to be burnt may be drawn directly upon the wood, or it may be drawn upon tracing paper and transferred to the wood with old carbon paper, old paper being used in preference to new, which marks the wood. The wood must have a smooth surface, such as is imparted by rubbing down the planed surface with fine glass-paper. The design may be burnt out, or the background may be burnt, leaving the design in relief. For etching the lines a special piece of apparatus, costing about £1, is used. You can get it of W. Barnard, 119, Edgware Road, who will also give the necessary instructions about its mode of employment. It consists essentially of a platinum-pointed pencil kept at a high temperature by means of the ignition of benzine or of benzoline blown upon it by means of an air blast. The blast is supplied by means of bellows worked with the foot, or the common double globular pneumatic apparatus, operated by the hand. The air thus pumped passes through an indiarubber tube into a bottle containing the benzine, and forces a spray of the latter out through a second tube into the hollow platinum-pointed pencil. According to the intensity of the blast, the temperature of the pencil point will be greater or less, adapted to fainter or blacker lines. The bottle is never more than half filled with spirit, and when not in use must be tightly corked. The left hand produces the blast, while the right hand is engaged in tracing the design. Two points are required: one for lines and dots, another for backgrounds and deep shadows. The poker points must be kept in movement; if allowed to rest upon the wood, a hole will result. The poker is held very diagonally when working, and is moved indifferently in all directions. The outlining and the grounding lines must meet each other. The work when finished may be stained and polished, or varnished at discretion. French polish can be used, or white, hard spirit varnish, or mastic, or copal varnishes. There is scarcely a limit to the designs, or to the articles of domestic use that may be done by means of poker work, and in clever hands very artistic results are obtainable. But go to Barnard's, just now mentioned, and you may also write to Abbott Brothers, Southall, for prices.—J.

**Model Engine.**—F. D. (*Devonport*).—I cannot do better than ask your attention to the series now running through WORK, entitled, "How to Make a Quarter Horse-Power Engine." By reducing the dimensions there given, you can get a cylinder of a very pretty type, and there is ample information given as to the fitting up, which is equally applicable to smaller as to larger cyliuders.—J.

**Tempering Tools.**—A CONSTANT READER.—Tools for working granite are hardened and tempered at one operation—that is, they are not let down like metal-cutting tools. There are various plans made use of, the endeavour being to impart exceessive hardness combined with some degree of toughness. In every case the tools are heated to a dark cherry red, and quenched at once and for good in a medicated liquid, in which salt, alum, and nitrogenous substances are dissolved. Thus for one: Take half a teacupful of salt, ½ oz. of saltpetre, and a teaspoonful of alum, and dissolve in rain or soft water. Another: Take six quarts of salt water, 1 oz. of corrosive sublimate, 1 oz. of sal-ammoniac, and three handfuls of salt, and dissolve. Another: Take two gallons of rain water, 1 oz. of corrosive sublimate, 1 oz. of sal-ammoniac, 1 oz. of saltpetre, 1½ pints of rock salt, and dissolve. Another: Take three gallons of water, 3 oz. each of ammonia, white vitriol, sal-ammoniac, spirits of nitre, and alum, and 6 oz. of salt, with two handfuls of horse-hoof parings.—J.

**Glass Case.**—F. G. (*Liverpool*).—Presuming you want a plain case for your model, you cannot do better than make up a framework of wood into which the glass can be fitted either with putty or with wooden strips of beading. As an alternative you may run the glass into grooves ploughed in the wooden framing as suggested in the accompanying illustration, which represents a portion in section.—D. D.

Section of Framing of Case.

**Invalid Chair.**—J. H. (*Glasgow*).—It will be necessary for you to supply more information as to the kind of invalid chair required before details for its construction can be given. There are so many kinds of chairs or seats for the afflicted that many might be described without meeting your wants. You might say, for example, whether it is wanted merely for sitting in, reclining in at variable angles, or in a fixed position; whether it is to be used for carrying an invalid up and down stairs, and if sanitary conveniences are an essential feature, with any other particulars which occur to you. It may be remarked that unless you are an expert, which presumably you are not from your asking directions, you would find it impossible to make a satisfactory article, unless of the simplest character. It would also probably cost you more to make than to buy. To judge from your letter, I am inclined to think you want an Ilkley couch. Is this so?—D. D.

**Arrangement of Cuttings.**—NESCIENCE.—I know of no "cheap and handy method of arranging or filing or binding . . . cuttings and scraps on various scientific subjects of all sizes and shapes," but one, and that is to select a size of sheet such as may be most convenient to you—say folio in your case—and paste down the longer articles on single pages, and the shorter scraps in kindred groups on pages set apart for the reception of cuttings on particular subjects. Number your sheets; prepare as full an index as possible; and when you have filled sufficient to make a volume, have the volume bound. In doing things of this kind you must depend, as lady novelists do, on inner consciousness of what is necessary, and from this evolve a method of meeting your own special requirements.

**Propeller for Steamers.**—E. F. B. (*Liverpool*).—You do not, by your own admission, understand the construction of a "modern high-speed steamer," and yet you "have an idea of a new (quicker and cheaper than the old) method of propelling steamers." I have heard a great deal about new propellers of late years, but no good results have come from any of them. Under the circumstances, be content to leave the matter to experts, who are trying all they know to devise propellers that will drive a ship through the water faster than any that are now in use.

**American Watch Movements.**—J. SHAW.—All American movements have a pin projecting from the edge of the plate, and this pin fits in a small hole in the rim of the case; pass the pin in this hole, holding the movement face upwards, then press the movement well down into the case, turn the case over, and screw the dog-screws half a turn, to grip the case tight. Swiss movements are fixed in the case the same way; but they have usually three pins, one of which is filed half away, and this one goes in a notch; the other two go under the edge; press down the movement, turn the case and movement over, and give the dog-screws a turn round to hold it in.—A. B. C.

**Straining and Mounting Water-colour Tracings.**—A BINDER.—It is difficult to handle these by the damp process, unless the colour is mixed (in use) with gum or a weak isinglass size to fix it. If very carefully treated the tracing may be maintained by steam from a kettle, of course holding the back to the steam spray, then just paste the *edges only* for ¼ in., and lay down. The other and the easiest way is to provide a strainer, similar to those used for oil paintings, and nail down your calico, then wedge out your strainer. These strainers can be purchased for a few pence of any dealer in artists' materials.—F. B.

**Wardian Case.**—W.P. (*No Address*).—A design, with practical instructions for making up the same, is in the hands of the Editor, and will appear as soon as the pressure of other subjects will allow.—C. M. W.

**Waterproof Leather.**—PLUMBER, *alias* A READER.—The above question was answered in WORK, page 413, column 1, of "Shop."—W. G.

**Making Hand-sewn Boots.**—S. E. (*Battersea*).—There have not as yet been any articles in WORK on hand-sewn boot making; but there is a series in hand which will I hope, set you right. The actual thing of your being able to make riveted work will greatly enhance progress in the above, for you have commenced at right end, and the comfort of wearing band-sewn boots will well repay you for your study and trouble in the future. I hope you have followed up my articles on "Repairing," now appearing, the last of which will soon be published, and as it is on soling and welting hand-sewn boots, it will teach you a lot that you wish to know, as these were intended (although of practical use for the moment) to be a preliminary to the more important set, "Making." There is a book on boot and shoe making, and several touching the subject; but I would not advise you to buy them, for they are very dear, and touch, not one, but all subjects of boot and shoe manufacture. They are written almost expressly for technical students—in fact, they are only technically practical, and not what one might call practical, pure and simple. In fact, that is why I write practical matter, with hints on some of the most simple points, for I myself, years back, needed such instructions, and therefore know others must, in rising, do the same, and not the science of a trade that they know not yet the rudiments. The previous answers in "Shop" ought to have been of great use to you, as you are so far advanced. If you have not an index of Volumes I. and II., you should get them (1d. each). You would see at a glance every number that has anything in it connected with your requirements.—W. G.

**Liquid for Curling Hair.**—F. R. (*Sunderland*).—It does not come within the scope of WORK to furnish information of this kind. Moreover, no liquid will curl your hair. You must resort, as others do, to curling-irons, curling-pins, or curling-papers.—ED.

**Staircasing and Handrailing.**—J. W. C. (*Tavistock*).—Articles on these subjects are now being prepared by a competent hand, and the first will appear in the next volume of WORK.—ED.

**Architectural Draughtsman.**—J. W. C. (*Tavistock*).—It is not possible for me to tell you now where you may get a post of this kind. Why not advertise in WORK, and so catch the eye of some of the many employers who read WORK?

**Fittings for Rocking-horse.**—RAWTENSTALL.—For eyes, RAWTENSTALL might apply to Messrs. Donziger & Isaacs, Beadmakers, Frederick Street, Birmingham; or, better, to Messrs. E. Schramm and Co., 33, Pershore Street, in the same town; but as these wholesale houses would scarcely care to supply a single pair, we would rather advise RAWTENSTALL to go to the nearest taxidermist. Hair for mane and tail can doubtless be bought from Mr. W. Brabe, Horsehair Manufacturer, Moseley Street, Birmingham. For the priming material with which to coat the body, RAWTENSTALL had better apply to the nearest carver and gilder, who will supply him; but should this be impracticable, he might prime with a mixture of gold size and yellow ochre, pumicing each coat down, when dry, till a sufficiently level surface is obtained.—S. W.

**Wheel of Life.**—J. F. (*Tipton*).—The exact size of wheel in the zoetrope is immaterial—perhaps one having a diameter of 1 yard would be found efficient; 4 in. square might be given as dimensions for the pictures. The slots must be so large as to enable the eye to take in one picture at a time as the wheel revolves—say, 1 in. long by ½ in. wide. Smaller slots require the eye to be brought closer, larger ones make it necessary for the eye to retire. Clark's zoetropes were, we believe, smaller than the above dimensions—the diameter of wheel being 18 in. or 24 in. Clark's, Garrick Street, London, W.C., was formerly the best place to get pictures for the zoetrope; but we are not sure that the business is still carried on; perhaps J. F. had better try E. Schramm & Co., 33, Pershore Street, Birmingham.—S. W.

**Glass Lamps and Paper Lanterns for Decorations.**—LISFARRON.—We should advise you to go to Messrs. E. Schramm & Co., 33, Pershore Street, Birmingham.—S. W.

**Working Models.**—W. D. (*Wigston Magna*).—Probably Messrs. E. Schramm & Co., 33, Pershore Street, Birmingham, would be able to supply the sheets of illustrations which you require for cutting up to make these things. These would doubtless come from Germany, and the above German firm import all matters connected with toys.—S. W.

**Dolls for Ventriloquists.**—VENTRO.—Try Messrs. E. Schramm & Co., 33, Pershore Street, Birmingham; if unable themselves to supply what you want, they will doubtless be able to point out some house that can do so.—S. W.

**American Organ.**—H. W. (*Southampton*).—I regret to say that the contemplated papers on the American Organ cannot possibly appear in the present volume of WORK.

**Folding Sheets for Work.**—H. W. (*Southampton*).—There are no plates or illustrations published with the monthly parts of WORK that are not included with the weekly numbers.

**Book-keeping.**—NESCIENCE.—We know of no work on book-keeping having special reference to manufacturers' accounts beyond the one you mention, namely, Garck and Fell's "Factory Accounts."

**Advertising.**—G. K. (*Ramsgate*).—Your idea has been anticipated and carried out at various seaside resorts during the summer.

**Glass Case for Minerals.**—ROB ROY.—A cabinet for specimens of natural history will appear shortly.

**Ticket-writers' Ink.**—BRIEF.—Replies to correspondents on "Ticket-writers' Ink" appeared in Nos. 24, 38, 46, and 74 of WORK. This information might have been gathered from the indexes to Vols. I. and II., which can be obtained for 1d. each through any bookseller or newsagent.

**Staircasing and Handrailing.**—N. B. (*Eltham*).—Articles on these subjects will appear separately in Vol. IV. of WORK.

**Engraving on Metal.**—N. B. (*Eltham*).—You will obtain the information you require with regard to engraving, the tools that are used, and how to sharpen them, from the papers on this subject, by Mr. Norman Maclean, in Nos. 33, 38, 40, 43, 45, and 48 of WORK.

**Carpenters' Bench.**—J. V. H. (*No Address*).—Replies are not, and ought not to be, forwarded by post to correspondents. It appears, however, that the contributors did so. Stamps sent in letters do not reach the Editor's office, and are not forwarded by contributors. All letters sent from editorial offices are duly prepaid by the Company. When correspondents send a stamped and addressed envelope, it is generally returned to them with a notification that replies cannot be sent by post.

**"Work" Exhibition.**—E. M. B. (*Withington*).—There will be no renewal of the "Work" Exhibition this year.

**French Polishing.**—G. T. (*Bow*).—Articles on this subject have recently appeared in Nos. 105, 108, 115, 117, 119, 122, 123, 126, and 130 of WORK.

**Strips of Beaded Mahogany.**—S. N. (*Southsea*).—Apply for these of Messrs. Henry Zilles & Co., 24 and 26, Wilson Street, Finsbury, E.C., who will no doubt be able to supply something that will meet your want.

**Corner Bookcase.**—NOVICE.—A bookcase to stand on a corner cupboard would be practically useless to you and everybody else. You will find a good "Corner Bookshelf Fitting" in Vol. I., page 561; otherwise, No. 36 of WORK; but not even the central compartment of this would stand on a corner cupboard unless the cupboard were abnormally large.

**Co-operative Inventive Association.**—Inventors may like to know that an Association, Limited, under this name, exists at Newcastle-on-Tyne.

**Safety Bicycle.**—G. I. (*Lower Broughton*).—Articles on this subject have recently appeared in Nos. 107, 111, 115, 119, 124, 127, and 132 of WORK.

**Expanding Envelope.**—J. P. W. (*Bristol*).—You must submit your envelope to a practical maker. I cannot undertake, under any circumstances, to advise inventors with regard to their inventions.—ED.

**Bedroom Suite.**—W. J. (*Portsea*).—No, I cannot undertake to give you "A design and details for a bedroom suite with a duchess dressing-table and drawers, and washstand with a marble top and towel-horse, with two drawers in dressing-table and one each side of looking-glass, and turned legs for both washstand and dressing-table." Have you any idea how many pages of WORK it would take to give you designs, etc., that would be practically useful to you?—ED.

**Dulcimer.**—P. J. (*No Address*).—You say you "wish to make a good dulcimer." Well, carefully follow the instructions given in the series of articles in Vol. I., and I see no reason why you should not succeed as well as others have done. Ample instructions are given in No. 41, p. 646, for stringing, and the diagram on p. 645 of the same number shows the correct way of tuning. For the rest, I think I had better take your questions *seriatim*. (1) It is found that four or five strings to each note give the best effect, less than this giving a thinner and weaker tone. (2) The degree of softness is regulated by the performer. If a very soft tone is desired, the beaters must be covered with several layers of Berlin wool or other material, and the player himself must exercise his judgment in using them. (3) Any ordinary tune can be played on the instrument, but music of a quick and lively character is the most suitable. (4) The introduction of "more semitones" would only have the effect of confusing the scale and rendering it more difficult to play; as it stands, it is a very easy instrument to learn, and not much knowledge of music is required. (5) It can be tuned to the harmonium, and the two played together make a very pretty and effective combination. (6) Hardly requires an answer, but as there are only twenty bridges on the instrument, it must be obvious that only twenty pieces of wire will be required for them, and that, consequently, forty is an error.—R. F.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Fretwork.**—E. B. (*Dorsetshire*) writes:—"I should be glad if some kind reader could tell me of an address where I could dispose of fretwork brackets, cabinets, etc."

**Model Steam Launch.**—A. M. C. (*Holywood*) writes:—"Will any reader of WORK kindly tell me how to make a model of a steam launch, and where the best place would be to get engines for same?"

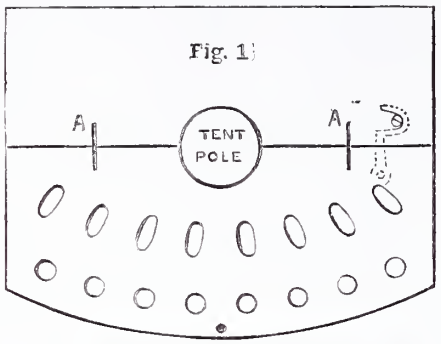
**Ebony for Walking-sticks.**—J. P. (*Hollinwood*) writes:—"Can any correspondent kindly inform me where to buy black ebony for walking-sticks in Manchester?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Carvers' Tools.**—PROFESSIONAL writes, in reply to J. D. (*Tiverton*) (see page 631, No. 91), asking for the addresses of makers of the above:—"For straight tools, Addis, Arctic Works, Sheffield; bent gouges, T. Beddall, Malvern Hill Road; Nechells, Birmingham."

**Carbon Plates.**—W. C. H. (*Godalming*) writes, in answer to J. H. (*Wolverhampton*) (see page 254 of current volume):—"You can obtain carbon plates, 2¼ in. by 1¼ in., for box battery, as described by Mr. Bonney, at 2s. 6d. per dozen, or 3d. each; also tapped and drilled zincs for same, 2¼ in. by 1 in., at 2s. 6d. per dozen, from Mr. H. Fentum Phillips, Electrician, Stoke, Guildford. He makes amateurs' work a speciality, and is moderate in price."

**Rifle Rack.**—P. W. (*Devonport*) writes, in reply to A. S. (*London, S.E.*) (see page 331, No. 125):—"I enclose a rough sketch of a rifle rack which I made to take eight carbines. I find it very useful in camp, and think it is something like A. S. asks for. It is very simple, light, and portable. To make it, get two pieces of mahogany board 16 in. long, 7 in. wide by ⅞ in., cut a hole for the tent pole in the centre of the joint, as shown in sketch, and around the front bore eight holes (as shown) the size of the muzzle of the rifle, and get eight plugs turned, as at B, to fit in the holes and down into the muzzle, which will keep the rifle in place. I have a piece of fringe around the front, as shown at Fig. 2, which hides any irregularity in the muzzles not being exactly level, as the ground may not be



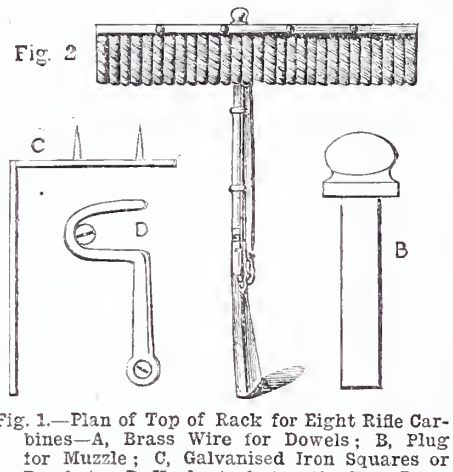




Fig. 1.—Plan of Top of Rack for Eight Rifle Carbines—A, Brass Wire for Dowels; B, Plug for Muzzle; C, Galvanised Iron Squares or Brackets; D, Hooks to fasten the Two Parts together underneath. Fig. 2.—Elevation, showing Carbine standing in Place, and Fringe round Top of Rack.

even. By simply lifting the plug you can immediately free the rifle you require without moving the other seven. The other eight holes at the back of the plugs are to take the swords, which I pass down through the top of the rack into the scabbards underneath. By so doing I do not require the holes so large, and the top is not weakened by having large holes cut in it. Two squares are screwed under the top, close to the tent-pole holes, and are lashed to the pole. The back half serves for a shelf for brush and comb, etc. etc. The two hooks hold the two parts together, and are screwed under the rack. In fixing, it should be 1 in. higher than the length of rifle, as the pole will settle, especially in soft or sandy soil. One or two sconces for candles can be fixed, if desired."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. M. G. (*Glasgow*); E. J. (*Belfast*); GAS-LIGHTER; E. R. D. (*Sherborne*); NEWLAND; W. F. B. (*Rochester*); G. P. (*Tunstall*); R. S (*Darwen*); RAILWAY; J. B. (*Sowood*); A. M. W (*Dublin*); A. R. (*Birmingham*); J. H. (*Smethwick*); A. W. (*Leicester*); W. W. (*Sussex*); T. T. (*Darlington*); H. R. K. (*Bedford Park*); A CONSTANT READER; J. T. G. (*Norwich*); SLIDE RULE; C. Y. H. (*Smethwick*); T. H. T. (*Blyth*); J. W. W. (*Renishaw*); OLIVER ASKING MORE; J. G. (*Norwich*); J. E. B. (*Chesterton*); DERF; C. W. S. (*Northallerton*); C. B. A. (*Streatham*); H. J. L. J. M. (*London*); E. E. R. (*London, N.*); FAITHFUL READER; S. & D. (*Harlesden*); T. H. T. (*Blyth*); PROBYN; A. H. (*Nottingham*); W. J.; S. L. (*London*); J. E. G. (*Carmarthen*); TELEGRAPH; TED; C. S. (*Leigh*); S. & B. (*Bristol*); BARIUM; TEMB STEERT; W. C. (*Hurst*); TRIPLE EXPANSION; T. G. S. (*Richmond Hill*); G. N. H. (*Marlborough*); A. J. A. (*Notting Hill*); J. D. (*Glasgow*); F. W. L. (*Southborough*); E. M. W. (*Cheltenham*); CAWD HUD; E. P. (*East Finchley*); H. G. H. (*Saxmundham*); G. R. (*Camberwell*); E. E. (*Walsall*).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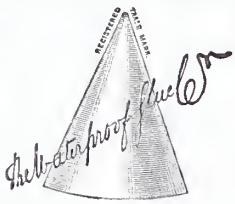


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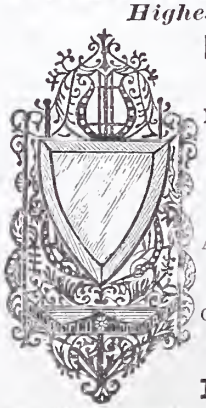

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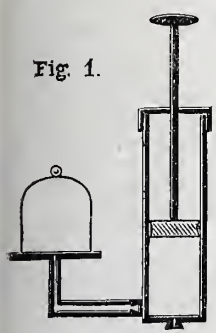

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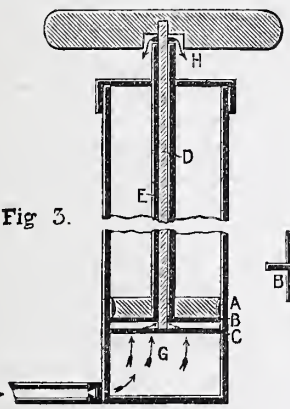


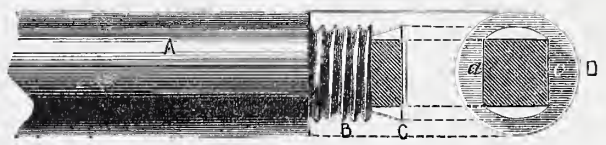


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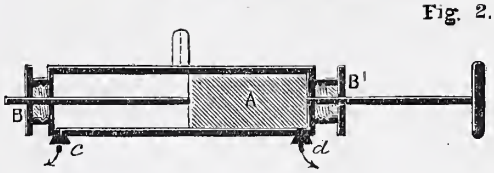



Fig. 5.

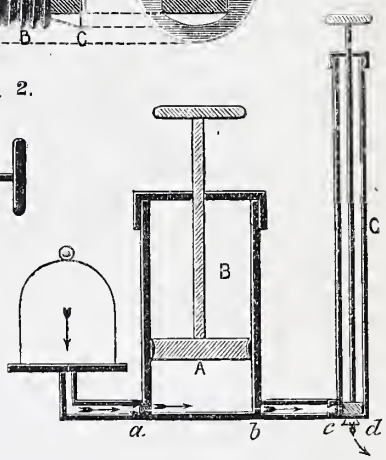



Fig. 6.

Fig. 4.

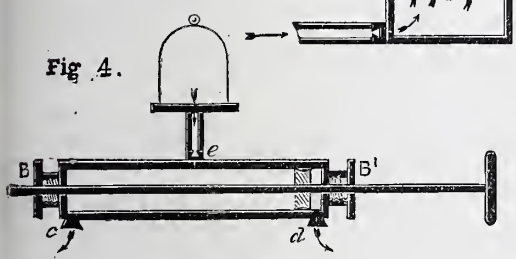


Fig. 7.

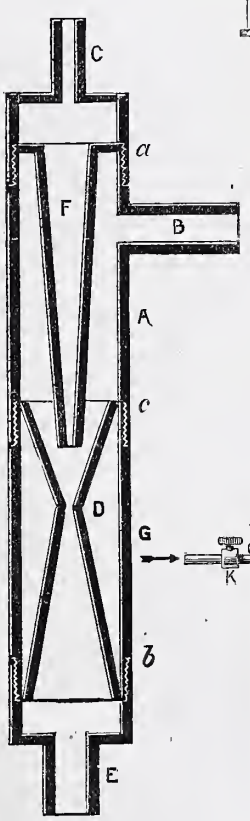



Fig. 12.

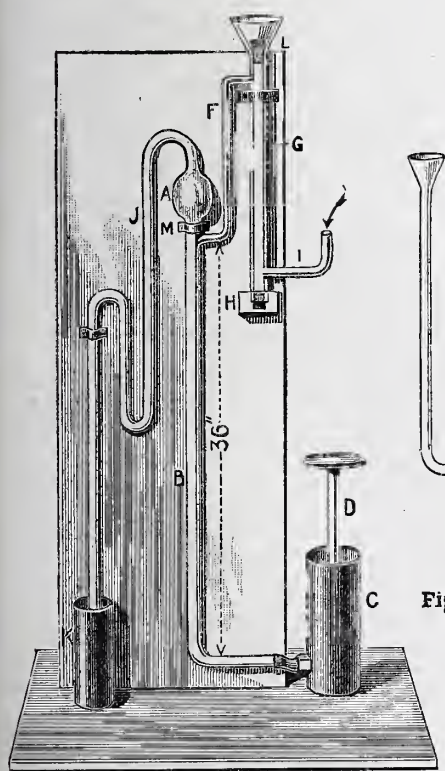



Fig. 10.

Fig. 9.

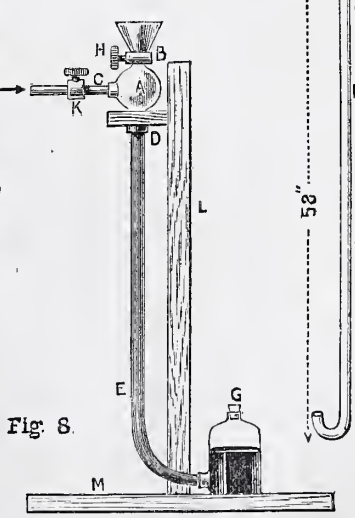



Fig. 8.

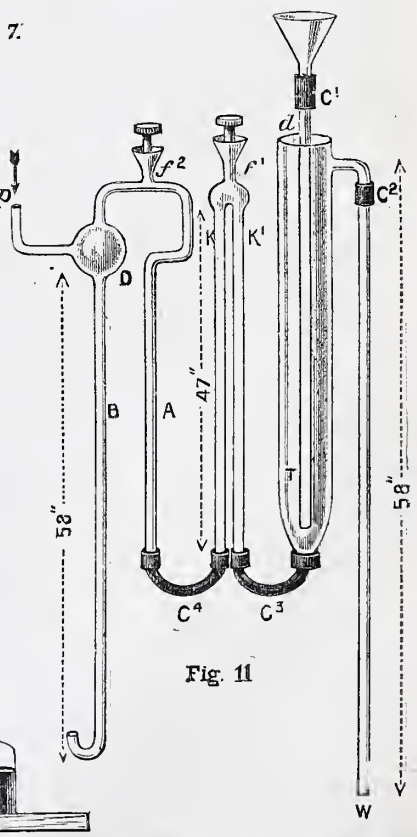



Fig. 11.

Fig. 1.—Common Air Pump. Fig. 2.—Valve (full size). Fig. 3.—Mechanical Valve in Barrel. Fig. 4.—Double-action Air Pump. Fig. 5.—Double-action Solid Piston. Fig. 6.—Double Exhaust Pump. Fig. 7.—Springle's Mercury Pump. Fig. 8.—Geissler's Mercury Pump. Fig. 9.—Springle's Pump. Fig. 10.—Sutton's Mercury Pump. Fig. 11.—Springle's Pump. Fig. 12.—Modification in Brass of Mawson and Swan's Operator.

# AIR PUMPS AND THEIR CONSTRUCTION.

BY O. B.

INTRODUCTION—VACUUMS UNKNOWN—KINDS OF AIR PUMP—PISTON AND BARREL PUMPS—JOINTS—VALVES—PISTONS—IMPROVED PISTON—DOUBLE STROKE—SOLID PISTON—IMPROVED DOUBLE PISTON—MERCURY PUMP—SPRINGLE'S PUMP—PERFECT PATTERN—GEISSLER'S PUMP—SUTTON'S PUMP—WATER ASPIRATORS—MAWSON AND SWAN'S MODIFICATION IN BRASS.

*Introduction.*—The advances which have been made in late years in electric lighting and other departments of physical experiment and investigation have rendered air pumps of the highest efficiency an absolute necessity. It is the purpose of the writer to offer such observations as will help the amateur to succeed in his various operations.

*Vacuums Unknown.*—It may be taken for granted that to produce an absolute vacuum is an impossibility as far as our efforts are concerned, for if even all air and vapour of water could be extracted from a containing vessel, it is highly probable that vapours would be thrown off from the material of which the vessel was made.

Still, though an absolute vacuum may be impossible, yet air, etc., may be reduced to such tenuity as to prevent the passage of electricity; for it is a misconception to suppose that a perfect vacuum is needed in an electrical vacuum tube; a certain quantity of attenuated matter is necessary to render the energy visible.

*Kinds of Air Pump.*—Air pumps may be broadly divided into two classes: First, those in which a cylinder and piston are used; and secondly, those in which the falling of a fluid is made to entangle portions of air.

*Piston and Barrel Pumps.*—Of these there are various kinds: such as the single-action barrel (Fig. 1). This, if carefully made, is fairly efficient.

*Joints.*—The three points to pay especial attention to are: first, joints. To make good joints with solder may seem very simple, but where air pumps are concerned it is really not so. I have known days spent by professional workmen—and they, too, makers of scientific instruments—in the endeavour to find a leak, and, after all, were baffled. The plan the writer has adopted is to place the parts under water and force air into them. A leak is shown by a bubble. Another point to attend to is to boil the work in water in which soda has been dissolved. If any kind of soldering fluid is employed, and a portion is left in any crack or crevice, it will be sure to corrode, and eventually make a leak probable.

*Valves.*—Secondly, valves. The holes should not be larger than will admit a dress pin; indeed, it may be said the smaller they are the better. On the edge there must be no burr or sharpness that can, by possibility, cut the silk. A general idea of a valve is given in Fig. 2. The tube, A, is turned down, and a screw thread is chased on it at B. A disc, C, $\frac{1}{4}$ in. thick, is carefully soldered on the end; this is under-cut as shown. In the centre a fine hole is drilled. The end of the disc must be made perfectly true, without the suspicion of hollowness; too much attention cannot be paid to this, as if the silk does not lie perfectly close to the disc it cannot be air-tight. Two sides of the disc must now be cut away, as shown at D. The edges must be carefully smoothed and a strip of oiled silk, *a c*, must be drawn over the end and carefully tied, as shown. Due attention must be paid to the quality of the silk; in fact, no portion of the work must be performed carelessly, for in vacuum apparatus most certainly the strength of the instrument is only equal to its weakest point.

The action will be easily seen when a vacuum is made in the barrel; the air in the receiver expands and passes under the silk. As soon as the piston returns and the pressure is greater than in the receiver, the silk is forced on the disc, and the return of air is prevented.

*Pistons.*—Thirdly, the piston. This, as made and applied in the ordinary pump, is very inefficient, as when the air in the vessel is reduced to a given rarity and flows into the barrel, it cannot be compressed sufficiently to overcome the pressure of the outside atmosphere, and so cannot force open the outer valve.

*Improved Piston.*—But there is another method which may be adopted, and the wonder is that it is not always used, as the valve is mechanical, and independent of the pressure of the atmosphere.

Fig. 3 is a sectional diagram. The under side of the piston, A, is faced with a disc of rubber, B. The rod attached to this is a hollow tube, E; C is a disc of brass in which are drilled four or five holes, as at G. To this disc is securely fastened the rod, D, small enough to work in the tube carrying the piston. This rod is fastened to the cross-handle, and is $\frac{1}{8}$ in. longer than the tube in which it works.

We will suppose the piston is at its lowest point. In pressing it down the disc has been forced away from the piston, and the air in the barrel has escaped through the pin-holes and by the hollow piston-rod. As soon as the handle is drawn up, the disc beds on the rubber sole of the piston and connection with the outer atmosphere is cut off. In the vacuum thus formed the air rushes in from the vessel, and the action is repeated. This is a very great improvement over the ordinary method, in which there is always a residuum of vapour which cannot be compressed sufficiently to overcome the pressure of the external atmosphere.

*Double Stroke.*—The barrel and piston may be modified in various ways: such as a double stroke, in which the valve leading from the receiver is placed midway between the extreme ends of the barrel (Fig. 4), by which means exhaustion is produced at each stroke. At B, B′, are stuffing-boxes, through which the piston works. At *e*, *c*, *d*, are silk valves.

*Solid Piston.*—Fig. 5 is a modification of this plan, only here is a piston one-half the length of the barrel. By this means the valve, *e*, is dispensed with. In all other respects it is similar to Fig. 4, though perhaps it is needless to say that its action is not so rapid. There is also a further well-known method, viz., the pump with two vertical barrels and pistons worked by rack and pinion action.

*Improved Double Piston.*—Fig. 6 is an instrument I have designed, being a modification of one designed some years since by a Mr. Turton, which, as far as I am aware, has never been taken up in a commercial way, or received the attention it has deserved. We have seen already that the one great drawback in the ordinary pump is that the residual portion of air becomes so rarefied ultimately that it cannot be compressed sufficiently to overcome the pressure of the outer atmosphere. When this condition is obtained no further exhaustion can take place

By the arrangement here shown this difficulty is minimised to a large extent. The barrel, B, is in communication with the receiver, and the small barrel, C, communicates with B. At *a* and *c* are valves which open into the respective barrels, and at *d* one for the expulsion of the air. The action is as follows: Let the piston of C be raised to its full height. The piston of B is now to be used until the receiver is so far exhausted that the rarefied air can no longer open the outer valve, *d*. The piston, *c*, is now forced down; but as the barrel is so much smaller than B, the residual air can be correspondingly compressed, and a portion forced out. When raised, there will be a comparative vacuum left, into which some of the residual air can be pumped until the atmosphere in C becomes so dense that the air from the large barrel can no longer force open the valve, *c*. The piston in C is now forced down, and compresses the atmosphere so much that it is equal to overcoming the resistance at valve *d*, and is again raised, forming a vacuum. This process goes on, working the alternate barrels until the atmosphere becomes so rarefied that no further exhaustion can take place, which will be much more complete than by the ordinary method. In the construction of a pump on this plan, the one point to be remembered is that the smaller the area of C is as compared with B, the better, whilst an obvious advantage will be gained by making C as long as possible. The longer it is the more air it contains; the smaller in the bore it is the smaller will be the amount of residual air left in it when the piston is forced down.

A convenient, and at the same time a workable, size would be large barrel, 2 in. diameter by 6 in. high; the smaller, $\frac{1}{2}$ in. by 12 in. high.

By this means, when B has exhausted the receiver to a point where the residual air could no longer overcome the outer valve, it can be further compressed sixteen times, as the area of C is only $\frac{1}{16}$ that of B, and thus the rarefaction can be further carried on.

*Mercury Pump.*—Besides the various modifications of the barrel and piston described, there is another class of apparatus in which the piston is a stream, either of mercury or water. As the piston is always moving in one direction, the difficulty arising from the incompressible residuum found in the barrel of the best model we have described is done away with. There is no valve to open, and the vacuum can be carried on until an electric spark will not pass.

Of mercury pumps there are various types, though they all start from the same central idea.

*Springle's Pump—Simple Pattern.*—The one most generally known is the Springle. Figs. 7, 9, and 11 are various modifications. Fig. 7 is the most simple. It consists of a glass tube of small bore, and 40 in. long. One end opens into a funnel; about 2 in. from this, a tube is placed at right angles. This is also bent at right angles, so that its outer end is parallel with the main tube. To the short tube is attached the vessel to be exhausted. Mercury is poured into the funnel, which must be kept full. As it flows it forces the air before it, causing a partial vacuum. The air in the vessel expands, and entering the tube, a portion of it is forced onwards. This process is carried onwards, resulting in a very perfect vacuum. Fig. 9 is another form. The vessel to be exhausted is attached to the stem A.

*Perfect Pattern.*—In Fig. 11 we have the same instrument expanded to its perfect

form, which yields the most perfect results attainable.

The tube, T, should be about 50 in. long, $\frac{3}{4}$ in. bore; A is about the same length, and $\frac{4}{5}$ in. bore. Tubes K, $K^1$, are 47 in. long and $\frac{4}{5}$ in. bore. At the bend they are expanded somewhat: with a funnel fused as shown. D is a globe, such as can be procured at most chemical and laboratory stores, having three openings. A tube of fine bore, $\frac{1}{15}$ in., is bent as shown, into which is fused the funnel, $f^2$; $p$ is a short length of tubing bent to right angles, and fused into the globe; B is the same bore, and 58 in. long. In the two funnels, $f^1$ and $f^2$, glass stoppers are ground, or else corks which have been thoroughly soaked in paraffin-wax must be used. The tubes A and K are connected by strong indiarubber tubing. For this purpose bicycle cement should be used. Strong tape, with one side dressed with the cement, must be wound round the tubing: this will give the necessary resistance to the pressure of the mercury. $K^1$ and T must be joined in the same manner. The waste-pipe, W, must be joined by a short length of rubber; also the funnel, $C^1$, to the tube, $d$. The vessel to be exhausted is attached to the tube, $p$. Under B must be placed a vessel to receive the mercury as it flows. To use the apparatus, proceed thus: Strong spring clips are placed at $C^2$, $C^3$, and $C^4$. Pour mercury into the funnel C until T is nearly full. Remove the stopper, $f^1$, also the clip, $C^3$, and pour in mercury until $f^1$ is nearly full, when replace the stopper with the mercury flowing round it, thus sealing it. Further sealing may be effected by pouring water on the top of the mercury. Clip $C^4$ is now removed, when the mercury will rise in A, leaving a vacuum in the bulb at K K′, where will accumulate any air which may be contained in the mercury.

As more mercury is poured in the funnel, C, the funnel, $f^2$, will fill, driving all air before it, when it must be sealed as the other. The mercury will now fall through the bulb, D, into the tube, B, in the form of drops. So much air having been removed from the bulb, the air in the vessel expands, and again fills the bulb. The next fall of mercury forces another portion out. For a while the portion of air between each succeeding drop will form a cushion; but when the exhaustion is complete, the mercury will fall with a distinct click or knock, showing that there is no film of air between the separate drops, and that its work is complete; exhaustion can thus be carried on until the air in the vessel to be exhausted is only $\frac{1}{1000000000}$ of its original quantity.

*Geissler's.*—This (Fig. 8), for complexity, stands midway between the extremes already described, whilst for efficiency it is all that can be desired. D is a shelf for holding a bulb, A, with three openings. At B is a funnel with a ground glass tap. At C is a tube with a similar appliance. At D is attached a strong rubber tube in the manner already described. The lower end of the tube is joined to a jar containing mercury. To work the instrument, fasten the vessel to be exhausted to the tube, C, and close the tap, K. Open the tap, H, and raise the bottle, G, until the mercury fills the bulb as well as the funnel. Now close the tap and replace the bottle on the stand; the mercury will fall in the tube, leaving a vacuum in the bulb. Open the tap, K, when the air will rush in from the vessel and fill the bulb. Now close K and open H, and fill the bulb with mercury as at the first, and again exhaust it by lowering the bottle. Each time this is done a portion of air is removed, until at last, when, with both taps closed and the bottle raised, the bulb fills with mercury, we know the exhaustion is complete.

*Sutton's.*—Fig. 10 is an instrument which bears the name of Sutton, which is somewhat less complicated than Fig. 11, and at the same time all that can be desired in the way of efficiency. The illustration will almost explain itself. B is a glass tube which develops into a bulb. It should measure not less than 36 in. from the lower bend to the point where the tube, F, joins it. G is a tube of about $\frac{3}{4}$ in. bore, terminating with a funnel, L. Into this are fused the tubes, F and I. The tube, G, is filled with small lumps of pumice-stone or fibres of asbestos which have been dipped in sulphuric acid. This is for the purpose of absorbing any moisture. Each end of the tube is to be secured by a stopper, either of ground glass, or cork prepared as already described. The funnel is now filled with mercury; a glass vessel is placed so as to contain the lower end of the tube. This, too, contains mercury; by these means the tube is securely sealed. C is an iron vessel with its inside accurately bored and fitted with an iron piston. A strong tube of rubber connects the cylinder to the tube, B. At K a vessel is placed to receive the overflow mercury. To use the instrument, proceed as follows: attach the vessel to be exhausted to the tube, I. Force the piston down until the mercury rises in the bulb and fills the tube, J. Now raise the piston to its original position, when the mercury will fall out of the bulb, leaving the bulb vacuous, the mercury at the same time rising in the bent tube, J, until it balances itself to the atmospheric pressure. The mercury must be allowed to fall in the tube so as to be just below the point where F joins it. When this point is reached the air rushes in from the vessel to be exhausted, filling the bulb, at the same time causing the mercury to sink in the bent tube, J. It may be observed that the bending of this tube forms a trap, as, though air can be forced down, it cannot of its own accord rise up the tube and pass the mercury, seeing its gravity is so much less than the metal. When the inrush by the tube, I, has been made, the piston is again pressed down; the mercury rising above M at once seals the communication with the vessel to be exhausted, and, filling the bulb, expels the air by the tube, J. This is to be continued until the vessel is exhausted, which will be manifest when the mercury forced over ceases to be separated from the preceding portion by a cushion of air, and the column is continuous.

For the tube, B, a bore of $\frac{1}{8}$ in. will be sufficiently large, whilst for the tubes, J and F, the ordinary barometer tube should be used. By the use of these appliances gases can be so rarefied in vacuum tubes that the electric spark fails to pass, for want of a medium dense enough to conduct it.

*Water Aspirators.*—This article could hardly be considered complete if no reference was made to apparatus in which water is used in the place of mercury. The principle of construction is similar to those given. Whilst they are very useful in the laboratory for many purposes where a high vacuum is not required, yet for some purposes they are useless.

*Mawson and Swan's.*—Messrs. Mawson and Swan, well-known makers, have introduced, however, a pattern which is very effective. It is exceedingly simple in construction, and, consequently, inexpensive. As its price is only 4s., it would hardly pay anyone to attempt to make one, unless it were for the love of making, which is an instinct with all true amateurs.

*Modification in Brass.*—As sold by the firm mentioned, it is made in glass, though it might easily be made in brass; the extra cost and labour would be balanced by its greater strength and non-liability to be broken.

The diagram (Fig. 12) will give a correct idea of its construction. A is a tube of brass into which is soldered the tube, B, which is to be attached to the water-main. C is another tube to which the article to be exhausted is attached. At the juncture of these tubes, $a$, a perforated disc is soldered, to which is joined a fine bore taper tube, F, as shown. D is a tube composed of two cones joined at their apex and soldered to tube G. E is a tube to which is attached the waste-pipe, and is joined to G at $b$. G and A are joined at $c$. This will quickly produce a vacuum capable of sustaining a column of mercury of nearly the full barometric height. As sold by Messrs. Mawson and Swan, the instrument is much more simple than it appears in brass, and quite as efficient; but the hints I have given are for those who prefer to make their own instrument, but are unable to work in glass.

All the screwed joints in the above instruments must be made air-tight with white lead.

## STAGE PERSPECTIVE.

BY WILLIAM CORBOULD.

### Interiors: their Perspective, and how to Outline them.

We will take a square room first, drawn in parallel perspective, supposing the spectator to be standing in front and looking into the centre of the room. (See Fig. 7.) The vanishing or points of measurement in this case, on the imaginary horizontal line, B B, are $a$, $a$. The point of sight, $c$, would be the vanishing point where all lines must fall into. The line $d$ $d$ is the base or commencement of the floor; a line drawn from each corner at $b$, $b$, to the vanishing point, $c$, would give the base of each side of the room, $f$, $f$; by the same rule, lines drawn from the top corners, $e$, $e$, to the point, $c$, will give the top of the sides, or the ceiling lines. Draw lines from the corners, $b$, $b$, to the points of measurement, $h$, $h$. Where these lines cross, base lines, $f$, $f$, would come, the two upright lines forming the further sides of the room. The top and bottom lines, $g$, $g$, complete that side, or the back wall of the room. Point A is the spot where the spectator stands.

The reader of these rules will observe that the points of measurement, $a$, $a$, in all the drawings extend beyond the square lines of the rules laid down. This brings the scene well within the circle of 60°. It will be seen also that you get greater breadth and boldness, as the top and bottom lines will not drop or rise too suddenly. When the points, $a$, $a$, are brought in closer to your work, you would see the difference. It would dwarf your work. On the other hand, the further you keep the points of measurement, the opposite is gained—*viz.*, breadth and boldness. Supposing you were painting a scene which took up all the space of the room or stage you were painting on, and you could not get your measurement point on the horizontal line beyond the square of your scene: place a dot a little above and one a little below the horizontal line. (See $h$, $h$, Fig. 7.) You will

see that all lines passing through those dots would fall into the points, *a*, *a*. It will be seen at once that the further apart the dots, *h*, *h*, are the broader and higher would be the room.

Fig. 8 shows an interior drawn in oblique or angular perspective. It will be seen by this rule that the base or floor lines are drawn—one from the right corner, *b*, to the vanishing point, *a*, on the left of the horizontal line; the other from the left corner, *b*, to the vanishing point, *c*, which is the point of sight. You will see this point of sight is shifted from the centre a little to the right. By doing this, you raise the height of the wall in the corner of the room, giving greater breadth and height to the walls of the room. By the same rule, if you shift the dot, *c*, to the left, you will get greater length, which you may want to do at times. Lines drawn from each corner, *e*, *e*, to the same points, *a* and *c*, will give the ceiling lines. When a cornice is shown, those lines would start inside, according to the width of the cornice, as at *d*, *d*. All lines on the right side of the room would fall into the left-hand point, *a*, while all lines on the left side of the room would fall into vanishing point, *c*. Bear in mind, these lines are such as dado, mantelpiece, doors, windows, pictures hanging on the walls, etc. A little practice and judgment will soon make it easy.

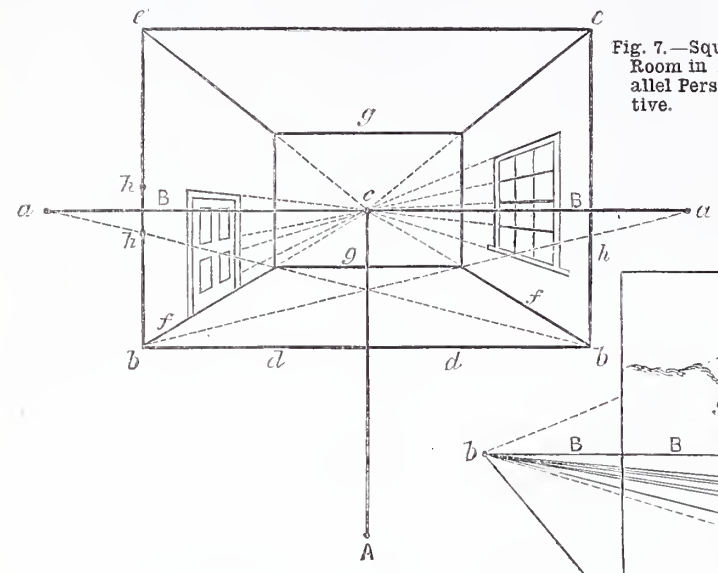



Fig. 7.—Square Room in Parallel Perspective.

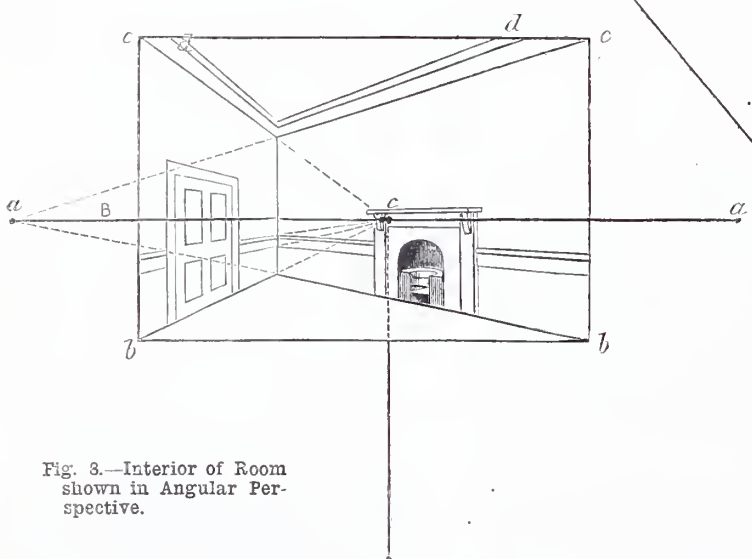



Fig. 8.—Interior of Room shown in Angular Perspective.

Fig. 9 is also in oblique or angular perspective, and shows the way to draw a bridge or aqueduct. Just draw your horizontal line, B B; then the point of station, A, fixing this a little to the left of the centre. It will be seen that the line drawn from A to *a* on the horizontal line is longer than the line drawn from point, A, to measuring point, *b*. I have mentioned this again to show the difference between parallel and angular perspective, as these lines may all be imagined. When the artist has mastered the rule, having decided upon where your bridge shall start from, you erect your first upright line, *c c*; divide this line in half, as at *e*; draw a line from *e* to measuring point, *a*. You will find the use of this line further on. Now draw your geometrical scale, *d d*, from the bottom of your first perpendicular line. You lay out the breadths of the several arches and spaces between them on this line. Say the arches are 10 ft. and the piers 3 ft. Dot out the distances on the geometrical line. If lines are drawn from these several dots to vanishing point *b*, it will give the perspective breadth and depth of the arches and piers, as where these lines cross the ground-line, *b b*, will be the spot to erect the perpendicular lines, *o*, *o*, *o*, *o*, *o*. Should the bridge or aqueduct have more than two arches, you probably would not have room to lay out more than two on your geometrical line; therefore, you must adopt another simple plan. This is where the line from dot *e* to point *a* comes in useful. It will be seen that the lines marked *h* when drawn the first one from *c* to *c*, cut line *e* exactly where the second perpendicular line rises from the ground-line, *b*; given the perspective width of the first arch, as laid out on the geometrical scale, the next line from *o* to *b* gives the second arch; the two lines in front of the two first, which we have just drawn, gives the width of the piers. You will now see that after the first two arches are drawn how easy it is to get the rest, by continuing the diagonal lines through each pair of arches where it intersects the centre line, *e*, with each and every perpendicular line, drawn from where the previous diagonal line comes in contact with the ground-line, *b b*; a line drawn from dot *g* to measuring point, *a*, would give the apex of each arch. I might show other lines, such as those indicating the parapet and ornamental parts of the bridge, but this is not requisite, because if the pupil will study the rules of perspective which I have laid down as simplified as possible, he will soon overcome any difficulty he may have to contend with at first, and he must always remember and bear in mind that perspective is the grammar of art.

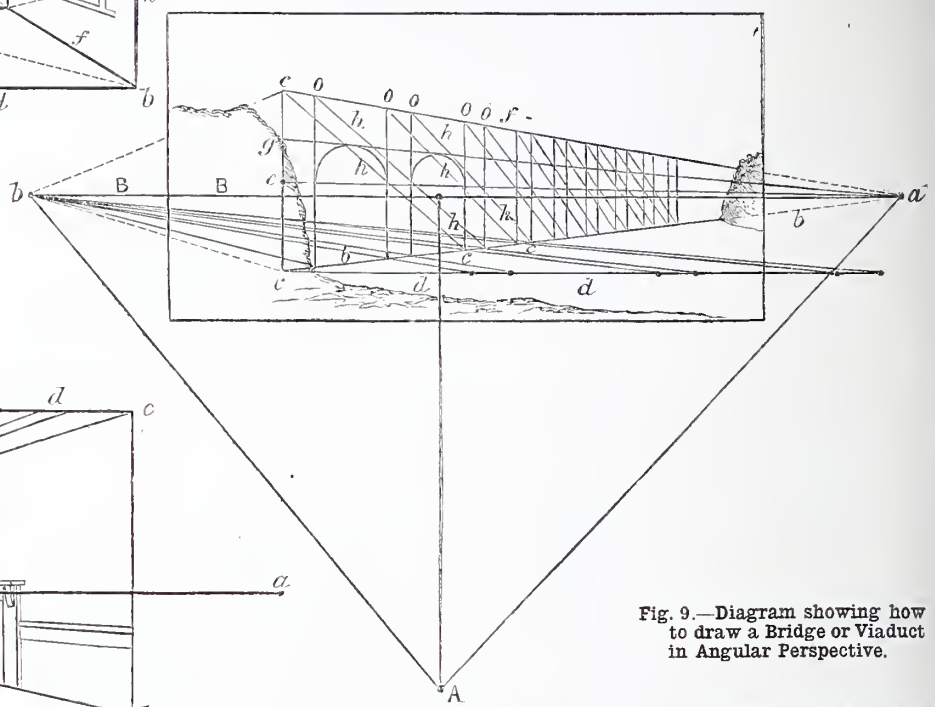



Fig. 9.—Diagram showing how to draw a Bridge or Viaduct in Angular Perspective.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### The Main Shaft Bearings and Connecting-rod.

Fitting the Brasses without Filing—Turning up the Pins on Upper Brasses—Filing up the Bearings and Fitting the Caps—Turning the Outside of Brasses—Chucking the Bearings and Boring them out—Turning the Connecting-rod—Carrier for Turning Square Bars—Fitting Small End Brasses—Or Hard Steel Bushes—The Large End Brasses—Bringing the Hole true with that of the Small End—Re-centring the Rod—Filing up Forked End.

Let us now take up the angular crank shaft bearings shown in Figs. 8 to 11 (page 328), as well as in Figs. 4 and 5 (page 260). It is not very easy to fit the brasses into an ordinary bearing, but these bearings are arranged so as to require as little filing as possible. The brasses are not square or octagonal outside as usual, but round; and therefore they can be turned and their seats can be bored. Lest, however, they should turn in their seats, the

upper brass of each pair has a pin cast on it, which fits into a hole in the cap, and both prevents all danger of turning and conducts the lubricant down to the journal, without allowing any of it to escape, as it may in the usual form of construction, between the cap and brass. We have two castings of iron for each of the two bearings and two of brass, or rather gun-metal—a harder kind of brass. Begin with the two upper brasses, which we must chuck for turning the round pins. Rub each of the four brasses upon a file so as to bring up their two edges flat and smooth, and make them semi-circular; take the two upper ones and centre the round pins with the centre punch and drill; put a bit of wood in the lathe and face up the end, which should be about two inches in diameter; lay the half bearing on this and bring up the back centre point to enter the centre hole in the pin, advancing the point till the little casting is firmly held. The pin to be turned is so small that this pressure may be sufficient to hold it against the action of the tool (see Fig. 47); but if not, two nails, *a*, *a*, can be driven into the end wood, so as to ensure that the brass shall turn with the wood. Having turned the pins on both the upper brasses, tin the edges of the two pairs of brasses, and put them together edge to edge, in pairs; heat till the solder melts and they are united. They can now be smoothed out inside with a file till the inside of each pair is fairly smooth, and then they are ready to be chucked by the hole whilst they are turned to 1 in. diameter outside the body (Fig. 11) and on the inner sides of the flanges; but this cannot be done just yet. Lay aside the brasses and take up the two bearings and their caps. File up the soles of the bearings so that they will stand upright and square with the plate; file the sides of the bearings, bringing them to $\frac{3}{4}$ in. in thickness (Fig. 8). Now fit the caps in: the opening where they go measures 1 in. It must be as much as that, or the bearing brasses could not be put in, but it would not hurt if it were a little more, provided only that the caps fit well, without shake. Fit the $\frac{1}{4}$ in. screws that hold down the caps, provide nuts, and bolt it down; file up the sides of the caps level with the sides of the bearings. The reason for filing the sides of the bearings true first, is, that then the sides of the opening for the caps can be got square with the flat sides of the bearings. Now file the under-sides of the caps, both under the ears, or lugs, and under the edges of the projection, so that they will stand up square on these surfaces. There is now an oblong projection under the caps measuring 1 in. by $\frac{3}{4}$ in., and we can chuck them by this so as to bore the $\frac{7}{16}$ in. hole exactly in the centre of this projection. Chuck a piece of hard wood, turn it about $2\frac{1}{2}$ in. in diameter, and face it up; make a recess $\frac{1}{2}$ in. deep, and enlarge it gradually till you can press the projection of the cap into it with the fingers: this will centre it truly. Now pass a couple of wood screws through the screw-holes in the ears to secure them to the wood chuck; starting it with a graver, bore a $\frac{7}{16}$ in. hole, into which the pins on the upper brasses can fit easily. Treat the other cap in the same way. We may now go back to the brasses,

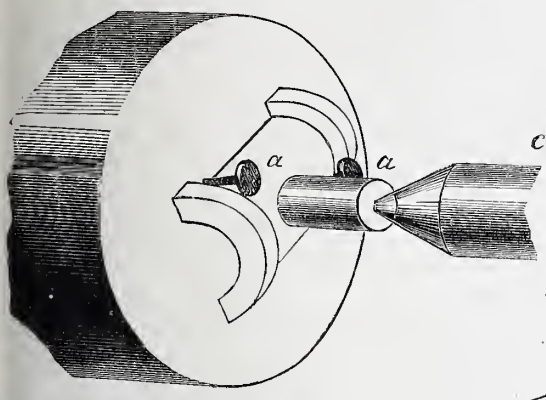



Fig. 47.—Mode of chucking the Upper Brasses.

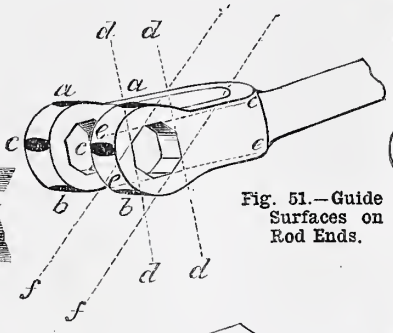



Fig. 51.—Guide Surfaces on Rod Ends.

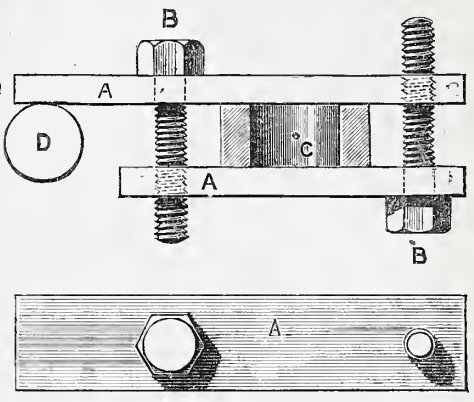



Fig. 49.—Carrier for turning Square Bars.

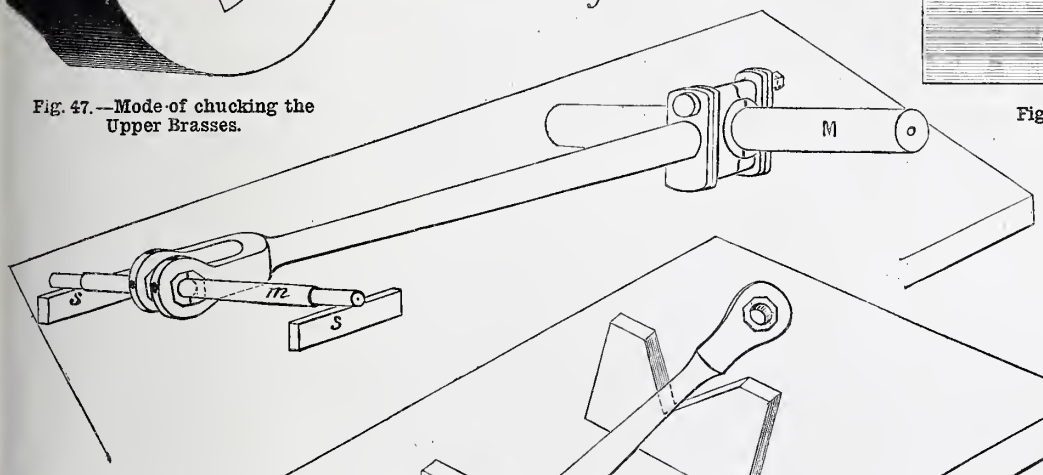



Fig. 53.—Mode of adjusting Brasses for Parallelism.

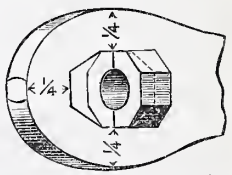



Fig. 52.—Trying the Brasses into Rod End.

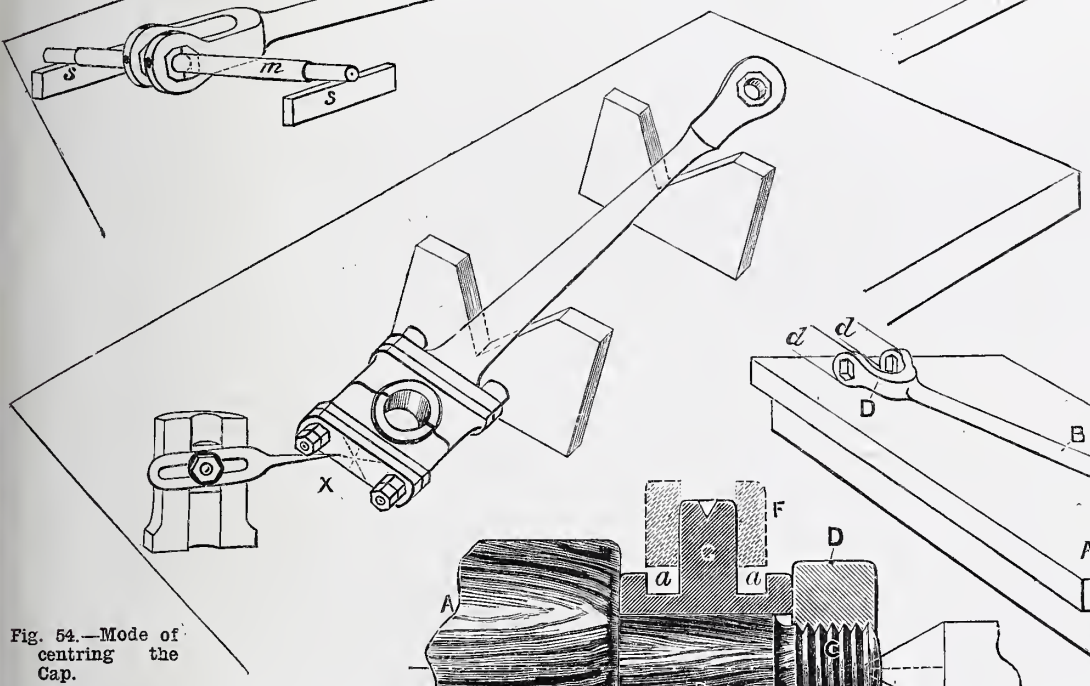



Fig. 54.—Mode of centring the Cap.

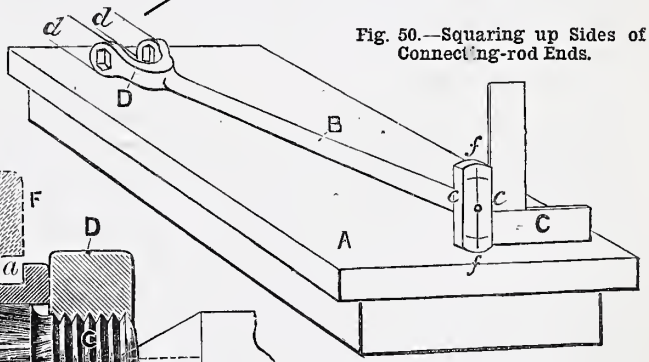



Fig. 50.—Squaring up Sides of Connecting-rod Ends.

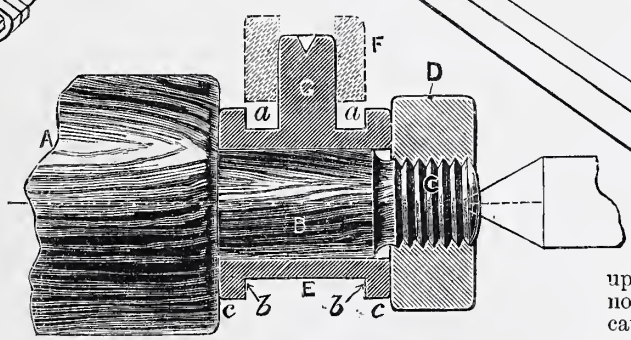



Fig. 48.—Mode of chucking the Brasses.

which we left soldered together in pairs, the pins being turned and the holes being filed out fairly round. Unfortunately, we cannot drive them on to a mandrel to turn them because that would burst them apart; we must therefore adopt another method of holding them. Make a chuck of hard wood (Fig. 48), A; turn down a pin, or short mandrel, B, on which the brasses, E, can fit; cut a screw, C, on the end, and fit a nut, D, so that the brasses may be pinched between the nut and the shoulder of A, and held without any tendency to burst asunder the soldered joint. A rather easier way would be to cut off the pin, B, where the screw begins, and, instead of a nut, have a bit of flat wood to receive the back centre point and transmit to the bearings the pressure of the back centre screw; this does away with the necessity for cutting screw, C, and its nut, but it is not so good a plan, because the point of the back centre will gradually indent the bit of wood, and diminish the pressure on the bearing, which may then turn round on the pin and require to be trued up again. The plan shown at Fig. 48 will not relax its hold, and, if the cutting is carefully and cautiously done without catching against pin G, the necks, *a*, *a*, can be turned to exactly one inch in diameter, the outsides of the flanges, *c*, *c*, to 1¼ in. in diameter, and the inside edges of the flanges, *b*, *b*, can be turned true. In doing these last, the cap, F, would be tried on to the turned pin, G (see Fig. 48), and the flanges turned away till the cap will just go down between them when put over the pin. It is much easier to *turn* the inside of these flanges true than to *file* them. The caps and the tops of the pins of the brasses should be marked so that the caps may not be exchanged nor turned half round, since, if the hole in the caps were not absolutely central, they will not fit both ways. Now, though we have turned the bands, *a*, *a*, true on each side of the brasses, there is a band $\frac{7}{16}$ in. wide in the middle which cannot be turned on account of the pin; it will, however, be very easy to cut this down level with the two side bands with a little sharp chisel and files, and so make the rest of the outer surface almost as true as if it had all been turned.

We must now return to the bearings. Fit on their caps, screwing them firmly down; then take the face-plate and angle-plate we used for boring the crosshead. If the angle-plate has not been moved, it will be in exactly the right position for boring the bearings, since their centres should be 1¾ in. high, the same as before; if the angle-plate has been taken off, it can easily be replaced by means of the same little template (Fig. 40, page 420). Bolt the bearings upon the angle-plate one at a time, so that their sides shall be exactly parallel with the face of the plate, standing up perpendicularly from the top of the angle-plate. To test your work, bring up a tool and let it touch the circular facing, on bearing and cap, as it goes round, when it should touch equally, or nearly so, all round. Now bore out the seat for the brasses to 1 in.; take off the cap and try the brasses in. The flanges have been fitted to the sides of the cap, and the cap has been filed to the same thickness as the bearing, therefore the flanges of the brasses should fit the bearing equally well; they should require a little gentle rapping to drive them down into their seat: it would be very bad indeed to have them loose. Having got one pair of brasses down solidly on to their seat, put on the cap and nuts, screw them down, and bore out the brasses to ¾ in.; face up the front of the brasses, and round the corner at the mouth of the hole. In Fig. 5 these corners will be seen dotted; looking at the crank shaft, where it passes through the bearings, it is seen reduced from ⅞ in. to ¾ in. in diameter; but shafts of this kind are never cut into by a square corner, but always by a little quarter circle, which leaves them much stronger. Now, therefore, we must round the corner of the hole in the brasses to a little quarter circle of $\frac{1}{16}$ in. radius. This done, and the other bearing put on the angle-plate and treated in the same way, we must re-chuck them in a reversed position so as to face up the other side of the brasses; turn them half round on the angle-plate, and adjust till the hole in the brasses runs true, and the face of the bearing is parallel with the face-plate; then face the brasses and round the corner with a $\frac{1}{16}$ in. quarter circle as before. Now warm the brasses till they come in two, mark them carefully and their bearings, drill the oil hole in the pin, and tap it for the lubricator, when the bearings may be laid aside for the present.

Here it should be remarked that success in fitting a bearing of this sort depends very much on *the order* in which the several operations are performed. Order, or sequence, is always of importance, and should be carefully considered before a piece of work is begun.

The connecting-rod may be undertaken next; it appears in Figs. 4 and 5, uniting the crosshead and the crank, and also in Figs. 12 to 15 (page 328), where its ends are shown in detail; it has been left till now partly because it is perhaps the most difficult part of our work. The difficulty lies in the necessity for having the holes through the brasses at the two ends exactly parallel. Begin by centring the connecting-rod and putting it into the lathe; the forked end will admit the lathe centre between the forks, and the carrier can be of the kind used to hold upon a square. A sketch of this sort of carrier, which any amateur can make for himself, is given at Fig. 49. It is simply formed of two pieces of flat iron, A, A, A, held together by two screws, B, B; C is the connecting-rod end, seen in section, and D is the pin of the driver chuck. Having then chucked the rod, turn the body, leaving it tapered from $\frac{9}{16}$ in. at the large end to ⅝ in. at the small, and nicely polished with emery-paper. Turn up the oblong flange at the large end facing the end square, and scratching upon the end surface two short arcs of a circle 1¼ in. in diameter, on which to mark the centres of the bolt-holes. The only parts now remaining of the large end of the rod not got up bright are the sides of the end flange, and these must be filed up with reference to the small end of the rod. Lay the rod down on the surface-plate so that it rests on the fork at one end, and on the end of the flange at the other (see Fig. 50). A is the face-plate, B the rod, and C the square. The edges, *c*, *c*, of the end of the rod must be filed up square with the small end, but this can only be done if the depth of both the eyes, *d*, *d*, are equal. Having tried the surfaces, *c*, *c*, with the square, we file little flats under each eye for the rod to rest on—which little flats will be useful as guides hereafter—and in filing them we may take a trifle more off one eye than the other, so as to bring *c* and *c* upright, if it be not so already. Now file up *c*, *c*, making the flange a little over ⅝ in. wide, so as to allow a little for after correction, but bringing both surfaces square and parallel; then turn the rod over and file two other little surfaces on the other sides of the eyes, so as again to bring *c*, *c*, vertical; this will make the distances, *d*, *d*, at D, equal. Draw a line with the scriber point down the centre of the flange at *f f*, to determine the centres of the bolt-holes, and centre-punch the intersection of this line with the arcs marked with the lathe tool. Looking now at Fig. 51, we have two little flats on each eye, *a*, *a*, *b*, *b*, square with the flange at the other end of the rod; we need, however, two other guide surfaces (*c*, *c*) before we can attack the octagonal hole for the brasses, and these surfaces are obtained by standing the rod up vertically upon the plate and filing the surfaces, *c*, *c*, till the rod stands straight up as tested by the square. When this is done the three surfaces can be used as guides for filing out the octagonal holes; distance *a* to *b* being 1⅛ in., then the thickness of metal from *a*, *b*, and *c* to the adjacent side of the octagon will be ¼ in. In order to mark the lines *d d*, *d d*, at right angles to the length of the rod, put a bit of wood under the end, at D, Fig. 50, so as to bring the rod horizontal and level with the plate; then these lines can be marked with a scriber by squaring up from the plate. Lines *e e*, *e e*, too, can be drawn at the same time with the scribing block. In filing out these holes the little square file will pass through both eyes at once, so that it must run straight, and the lines *d d*, *e e*, will be marked on the outside of both eyes; then, by taking ⅛ in. in the callipers, and making that the thickness of the metal inside each of the little guide surfaces, we can hardly fail to get out the holes correctly. Lines *f*, *f*, can be drawn with the scriber by means of an ordinary set-square (for drawing) of 45°, resting on the face-plate, whilst the rod is packed up level by means of the bit of wood. Now take the four little castings provided for the brasses of this end, and, rubbing their edges upon a file, tin and join them in pairs with solder. Now take each little couple and rub on a file, so as to get up one side true and level from which to work; then begin with two opposite sides of the octagon—say those which fit against *e e*, *e e*—make these square with the first face, parallel with each other, and leave them just so far apart that you can almost push the brass into the hole sideways. Fig. 52 will make this plain. The brasses being only $\frac{5}{16}$ in. thick, and the top and bottom sides of the octagon a little more, it is possible to try the two first sides of the brasses in that way; but as the octagon is not a true one, but somewhat elongated, the other six sides being shorter than $\frac{5}{16}$ in., we cannot try the other sides of the brasses in, and must trust to careful measurement until they will begin to drive in a little way, when the shape of the hole in the rod will get marked on them, and they can be filed accordingly, keeping every side square with the first face and making sure that they fit tightly so as to require a little gentle driving to get them in. Having fitted the two pairs of brasses into the forked end of the connecting-rod, we may proceed to bore the hole, or rather enlarge it, to the size for the crosshead pin by means of the ⅜ in. fluted reamer. Begin by passing through the holes a small round file, using it very carefully so as not to get the hole askew; enlarge it gradually, stopping continually to measure with callipers from the hole to the three test surfaces. As soon as the ⅜ in. reamer will enter, use it to round the hole and measure again, then correct with the file if needful. Of course, it is very important that both sides of the fork should bear equally on the crosshead pin. To ensure this, test still further by

turning a little iron mandrel, about 4 in. long, to the same taper as the reamer, so that it will fit into the holes where the pin goes (see Fig. 53); then turn a bit at each end to, say, $\frac{1}{4}$ in.; now pass this mandrel into the two holes and stand the connecting-rod up vertically on the face-plate. Now you can measure from the plate up to the small diameter ($\frac{1}{4}$ in.) at each end of the little mandrel to prove whether the mandrel is perfectly parallel with the plate and therefore square with the length of the rod. If not, ease the hole inside with the file, and round it again with the reamer. The reamer must finally be worked into exactly the right distance so as to make the hole about the same size as that in the crosshead; the pin should, however, fit more easily in the brasses than in the crosshead, in which latter it should be driven pretty tight, and further secured with the set-screw. The brasses then being driven into their places in each side of the fork, and the hole for the pin being finished, we must cut the two little slots for the cottars or wedges which tighten the brasses. Looking at the section of the crosshead in Fig. 5, the cottars are seen cutting into the brasses; this is to keep them in place, and it would prevent the fork end of the connecting-rod from slipping sideways. This, however, is already prevented in our case by the crosshead fitting between the fork, still it may serve to keep the brasses in place when the rod is taken off. These little holes must be cut by drilling from both sides and finished with small files and much patience. The cottars should be of steel, and may be hardened and spring tempered.

Here I may say that it would be easier, and perhaps as efficient, to insert hard steel bushes or ferrules in the fork ends, and to harden the crosshead pin instead of fitting the brasses and cottars. True, there is no means of taking up wear in that case, but the movement of this joint is very small, and, if both bushes and pin are hard, the wear will be almost inappreciable; moreover, it is always possible to make a new pin and to insert new hard bushes. To fit the fork end this way, we should have to file out the octagonal holes, round, in connection with a $\frac{3}{4}$ in. fluted reamer, using the same precautions to ensure the hole being square with the rod which have been described when the hole in the brasses was being adjusted. The crosshead pin would be made of cast steel, and hardened; the steel bushes would be bored slightly small, turned on a mandrel, hardened, driven tightly into place, and then ground out by working an iron or brass rod with emery and oil through both bushes while in position in the rod end, the iron or brass rod being turned to exactly the same taper as the crosshead pin.

We must now complete the large end of the connecting-rod as seen in Figs. 13, 14, and 15 (page 328). Unite the two brasses with solder as before described, and file up the end surfaces parallel with each other; mark the positions for the bolt-holes and bore them; make the little oblong cap of steel and bore similar holes in it. By means of these bolt-holes, the brasses, with the cap, can be secured to the angle-plate on the face-plate of the lathe whilst the hole in the brasses is bored out, faced, and the corners, seen at Fig. 13, rounded. The next operation will be to bore the holes for the bolts in the end of the rod; one of these holes may be bored first and the bolt fitted; but, before we bore the other, we must take certain precautions to ensure it being so placed that the hole through the brasses at both ends of the rod shall be parallel. The bolts to secure the large end brasses should be of mild steel, and the nuts should be hardened; the holes they fit in should be cleaned out with a $\frac{1}{4}$ in. taper reamer. The bolts are shown in the drawing with the heads inside and the nut outside, which looks best, but necessitates the reamer being put in from the rod side, which is not very convenient; however, the reamer may be put in from the cap end, and the bolts may also go in that way if preferred; the body of the bolts should be turned to fit well into the holes. To ensure the holes at both ends of the rod being parallel, and not, as carpenters would say, "in winding," fit two turned rods into the holes, using them as winding strips, the cap and brasses of large end being secured by the one bolt first fitted. We have already fitted a small mandrel to the small end of the rod (see *m*, Fig. 53); the small end of the rod may be supported on this by means of the two small strips, *s*, *s*, which are of equal width; the other end of the rod rests on the face-plate. Now, when the larger mandrel, M, is fitted into the brasses at the large end, it will be easy to see whether M is parallel with the plate; if not, the brasses can be slightly twisted on the one bolt till it is so. When they have been correctly adjusted the bolt may be firmly secured and the $\frac{1}{4}$ in. drill put through the cap and brasses to bore the remaining hole in the rod, then after cleaning it out with the reamer the second bolt may be fitted. We now require a centre at the top of the cap by which we can turn the whole rod. This can be found by resting the rod on two similar V's, or angles, standing on a level surface, on which the rod can be turned round. This will be easily understood by looking at Fig. 54, where the complete rod is seen lying on two V-pieces; lines are scribed across the top of the cap at ×, the rod being turned partly round between each line, taking care not to move it endways in the V's. These V-pieces may as well be of wood for this purpose, nailed together and cut out both at once; but a pair of cast-iron ones, carefully made, are very useful things for centring rods for the lathe, etc. Having found the centre, as nearly as may be, and made a dot with the centre-punch, the rod may be put in the lathe and brought true with the square centre, then the rounded edges of the head of the rod, brasses, and cap may be turned up and finished, when it only remains to drill a hole for the lubricant, starting from the centre hole just found, through cap and brass; enlarge this hole and tap with $\frac{1}{4}$ in. thread in the cap, and it is ready for the lubricator; then the sides of the flanges can be filed up, and the large end of the rod is finished. The fork end must now be filed up; the four flat surfaces through which the hole for the crosshead pin passes must be accurately at right angles to this hole or the joint cannot work. We can attain this by using the crosshead pin as a guide. Observe in Figs. 5 and 8 how the head of the pin abuts against one of the sides of the fork; file that side flat first and test it as you do so by inserting the pin with a little red marking under the shoulder; do not be satisfied till the red marking shows equally all round the hole, then you may be sure the first surface is square with the hole, and the other three surfaces can be filed parallel with it by means of callipers. Though, however, the first surface may be square with the hole, before we proceed to file the second or left-hand side surface to it, we must lay the rod on the V's with the finished side up, and, with the scriber, measure from the plate up to that surface; then, after turning the rod round, measure up to the second surface to try how much will have to come off to bring the rod central; also, whether, when both these two first surfaces are parallel, square with the hole, and equally distant from the centre line of the rod, the fork will measure $1\frac{5}{8}$ in. from side to side, according to Fig. 8. When all these conditions have been complied with and the two outer surfaces have been finished, the two inner ones, which embrace the crosshead guide, may be filed parallel with them, using the callipers to bring them to exactly $\frac{5}{16}$ in. thick. Now it will only remain to file up the top and bottom of the fork and round the end, take out the three pairs of brasses and separate them where soldered, and the connecting-rod is done at last.

The writer is much afraid he may have wearied his readers by going into such detail, yet though he is well aware that too much has been said to please some, yet others may still wish for even more particulars. All directions as to the use of files and other tools will be spared the readers of these papers, and only those points insisted upon which seem likely to prove stumbling-blocks to those who are already fairly proficient in handling the tools themselves. Though much time and space have been given to the connecting-rod, the directions given are such as should throw light upon fitting in general, and may be useful even to those who never attempt to make such a thing as a $\frac{1}{4}$ horse-power steam engine. Having, however, got thus far in our work together, we have overcome the most important obstacles, and both work and description may perhaps proceed somewhat more quickly from this point.

## TWO FOLDING BOXES:

### WITH LEGS ADAPTED TO USE AS COMBINED TRAVELLING CASE AND TABLE.

BY J. SCOTT.

"THERE is nothing new under the sun." These words are constantly ringing in the ears of the designer, and no doubt there is a great deal of truth contained in them. But I think I may venture to say that, in the boxes shown in my illustration, I have succeeded in producing something that is new, novel, and useful.

Personally I prefer box No. 2; but, as No. 1 may probably be mostly admired, I have considered it best to give them both.

Who has not, at some time of removal, found the inconvenience of packing up the small odds and ends—things that seem nothing when lying scattered about on tables, shelves, and in cupboards? Boxes may be provided for the time being, but they eventually become as great a nuisance as they were previously an assistance. These boxes, then, supply a want in this direction, and they will also be found handy as travelling cases.

I have also given illustrations of some suitable legs, so that when these boxes are folded they can be made to serve as table-tops.

Very little skill is needed for making these articles. The putting on of the hinges will perhaps be the most trying part, seeing that one box has eight pairs, and the other six pairs. But it must be remembered that,

if it were not for these hinges, we should not be able to stow our box away into so small a compass.

The size I have represented Figs. 1 and 2 as is 2 ft. square by 1 ft. deep. Of course, they can be made larger or smaller, and of a different proportion; but I shall only proceed to describe the size I have given.

For Fig. 1, then, we require six boards, each 1 ft. wide by 2 ft. long, and one board 2 ft. square. All these boards should be of the same thickness, either ½ in. or ¾ in., according to the strength required.

The large and side boards require canting on the edges all round, so that when any two of them are placed edge to edge they will stand at right angles to each other. The other two boards should each have three of their edges canted, leaving one long edge on each free to receive the fastenings.

Through the four boards, which will form the sides of the box, holes should be bored, large enough to admit of the free movement of a thin rope. These holes would be best if they are bored on the angle, following the line of the rope, instead of being bored straight through.

When all the boards are ready, place them in their proper position, and mark off where the hinges are to go. The two top pieces should be hinged on to the two sides to open *outwards;* these sides, in their turn, should be hinged to the bottom of the box, to shut *inwards.* The two remaining sides will require hingeing on to the bottom, to open *outwards.* The fastening on of the lock, and the placing of the rope, require no commenting upon.

Fig. 2 now occupies attention. The size of each separate board varies slightly from those of Fig. 1, although it is exactly the same size when expanded.

We need two boards, each 2 ft. long by 1 ft. 11 in. wide; two more, each 1 ft. 11 in. long and 11½ in. wide; and four, each 2 ft. long by 6 in. wide. The only parts that require canting on these pieces are the two edges on the *width* of the bottom board, and the bottom edges on the inside of the two ends. The top edges of these ends will each need a lock.

The hingeing of these boards will be a more "ticklish" job than in fastening those of Fig. 1 together. It will be found best, I think, to hinge two of the narrowest pieces together first. These form one side, which will need to be hinged to the bottom and top boards, so that it will fold inward. Then hinge each of the other two narrow pieces in a corresponding position on the opposite side to the bottom and top. The two ends will then require to be hinged to the bottom board, to open outward. It will be found an easy matter then to fix the two remaining hinges.

It will be necessary to have handles fitted to some part of this box. These should be sunk in the same manner as that adopted in an ordinary travelling trunk, so that they will not prevent the boards from folding flat together. The rope will be found sufficient for box No. 1.

Box No. 2 may be made exactly 2 ft. square each way, by making the four side pieces, which fold in together, 12 in. wide each, instead of 6 in.; and by making the end pieces 2 ft. by 1 ft. 11½ in., instead of 2 ft. by 11½ in.; and by fastening one to fold over on to the top, and the other to fold under the bottom. This will necessitate the top and bottom boards respectively to be canted on one of their edges only.

Now we come to the legs, by using which the box can be made to serve as a table. In Fig. 3 we have four legs, each 27 in. long, 1½ in. square at the top, and gradually tapering down to 1 in. square at the bottom. Four pieces of ¾ in. stuff, 1½ in. wide and 15½ in. long. Also four pieces of ½ in. stuff, 1½ in. wide at the centre end, and 1¼ in. at the outer end, which are fastened to the legs.

The square centre blocks should be 1½ in. square and ¾ in. thick. The turned piece which is joined between these two squares may be of any length, but I should advise 13 in. long and 1 in. thick. The longest wooden strips are for the top, and should overlap the legs by about 1½ in. It will then be found that the weight of the folded box will be sufficient to keep the legs from collapsing.

Perhaps it will be said that there is too much hingeing on these legs. But, of course, in giving publicity to the design I do not compel the reader to make an article accordingly; and, so that it may not be said that it is a matter of "Hobson's choice," I have also given the design, Fig. 4, which requires nine hinges instead of sixteen.

The longest pieces of wood shown in Fig. 4 are 30 in. long, by 1½ in. wide at the top and 1 in. at the bottom. The three pieces on to which the table-top rests are 10 in. long and 1½ in. wide. The other three pieces are 1½ in. wide at the top end and 1¼ in. wide at the bottom end. Both the ends of these last three pieces should be canted, so as to allow them to fit nicely to the other parts when used as a table support.

The triangular block in the middle of each leg will have to be very firmly put on, as a great weight will rest on them.

The triangular centre-piece will be 2½ in. wide on each side. As the legs, when folded, come underneath this block, it will be found necessary to cant them on their inside edges. The thickness of all the wood used in Fig. 4 should be ¾ in.

Perhaps it will be best to fasten all the hinges on to the thickness of the wood.

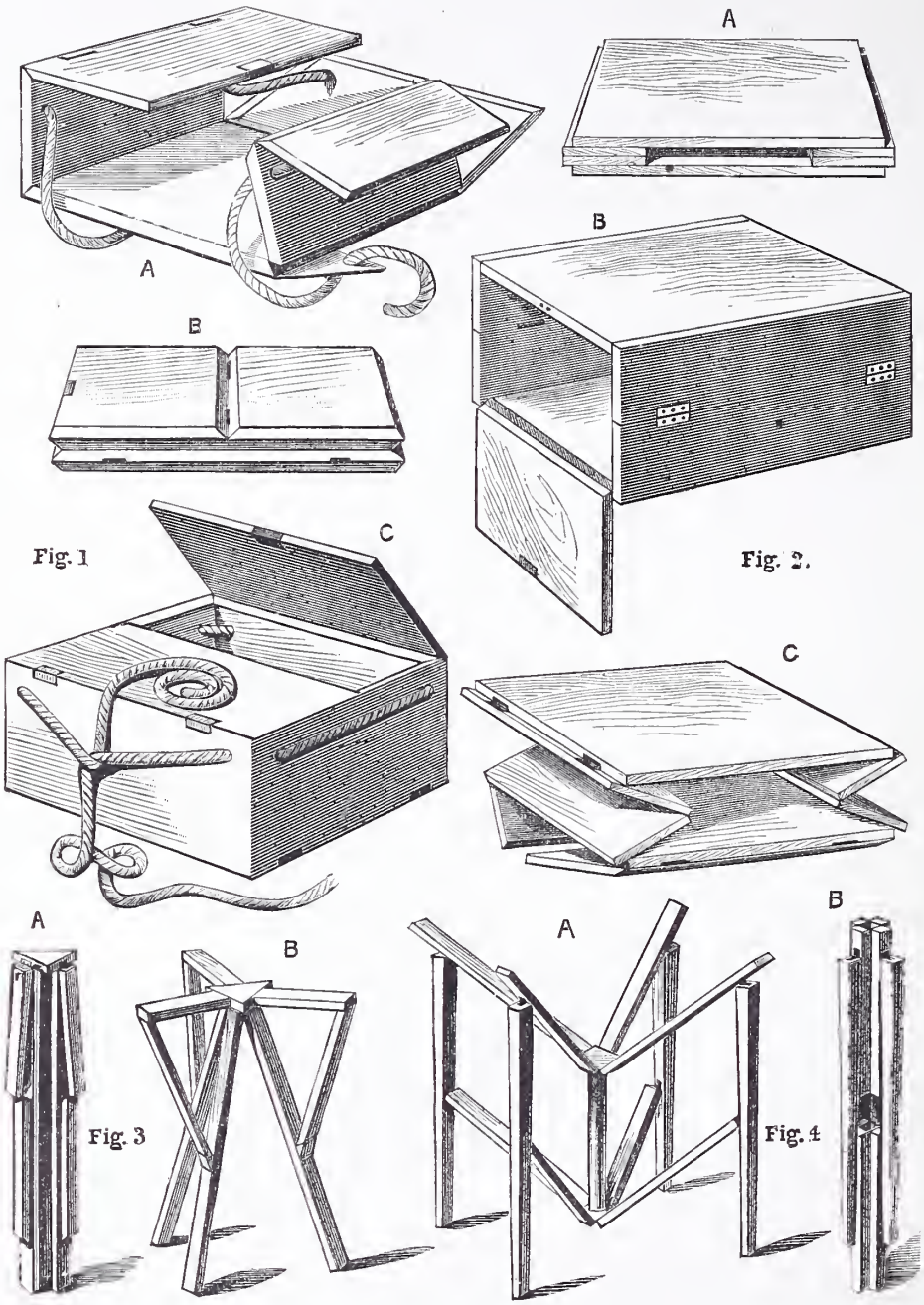



Fig. 1. Fig. 2. Fig. 3. Fig. 4.

**Fig. 1.—Method of folding Box (A), Box folded (B), and Box ready for Use (C). Fig. 2.—Box folded (A), Box ready for Use (B), and Method of folding Box (C). Fig. 3.—Legs forming Stand for Box, folded (A) and unfolded (B). Fig. 4.—Ditto, expanding (A) and folded (B).**

None of them will show them. The same with fixing the hinges on the box. If a little judgment is used none of them need be exposed to the eye.

I have represented them as fastened on to the surfaces of the wood, so that thereby I might indicate the position of them, and show in which way the wood is to fold.

I think there is nothing so boring as to read certain statistics, such, for instance, as the number of miles Mr. So-and-so's bank-notes would reach if placed end to end; or the height Mrs. So-and-so's sovereigns would attain if placed one above another, but at the risk of being termed a bore, I will give just one or two statistics of these boxes.

Two hundred and two 4 ft. square and 2 ft. deep boxes, standing one above the other, would reach as high as the top of St. Paul's—which I have always been given to understand is 404 ft. high—but when folded they would only occupy a space of 4 ft. square by 33 ft. 8 in. high.

Again, ninety of them, 2 ft. by 1 ft., filled with articles, would fill a pantechnicon van 10 ft. long by 6 ft. high and 6 ft. wide; but when compressed together the pile would be but 1 ft. high. I give these figures to show to what use these boxes may be put with advantage.

## A PATENT RUBBER FELLOE WHEEL.

BY JOHN C. KING.

About two years ago an article in the *Saddlers' Gazette*, on the use of rubber in carriages, received the tribute of appreciation by transfer to foreign journals. Here is something coachmakers have long sought for—a hard-tired, perfectly round-rimmed wheel, suspended in rubber, free from contact with the ground.

A shrewd man of experience remarked that "the merit of using rubber in carriages was at present not very great: plastering it on the sole of an iron-shod wheel, or wedging a piece of it between spring and axle—the one to wear out quickly as well as augment draft on good roads; the other, to produce a loose bearing where a tight one was wanted."

He rode on a vehicle with the rubber protected by a tire, as illustrated, and further remarked—"Here is successful genius—applying rubber in so small a quantity as to be economical and in such a manner as to be indestructible, while effecting its purpose of saving riders from traffic noises (and the street dwellers also), and relieving the shoulders of the horse from the effects of wheel concussion with road obstacles, and, above all, saving the rider's spine, heart, and brain from jars incidental to hard-tired vehicles."

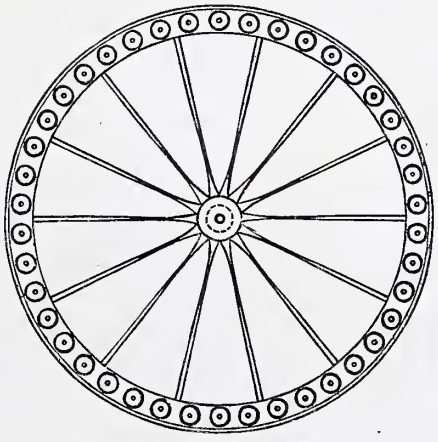
It will be obvious that the rubber ring felloe wheel is a spring wheel within a rigid circular hoop, the rings at bottom forming flattened ovals in shape, and at top vertical elongated ovals, as the rings there suspend the wheel and the superincumbent load. The action of obstructions the wheel surmounts is to compress the rings, which, when the obstruction is surmounted, causes the tire rim to bound forward by the released compression of the rings. A hundred miles' drive on very muddy roads showed that the ever-alternating shapes of the rings kept them from holding mud, so that splashing is less than with ordinary tires.

These wheels seem destined to develop new aspects of coach-making, as they and the superstructure may be so much lighter in wood- and iron-work, and the springs may be lighter for heavier loads.

Already a new cab company, with hansoms two-hundredweight lighter, with room for three riders on the seat, is being formed. This will be an immense advance in economy for cab-owners in the wear of their horses and harness, and allow cabmen to do quicker work with less fatigue to their horses or themselves; for it must not be supposed that cab-driving is free from fatigue to the men, even in the best weather for such work.

The only difference in this wheel to ordinary wheels in its make is the double tires, with the rubber rings riveted between them.

The spoke-tire is of T-shaped iron, the stem of the T being notched into the spokes and riveted there. To this spoke-tire is clipped the rubber rings of suitable strength for a 4 cwt. dog-cart, which will eventually be ½ cwt. less. A twelve-spoke wheel has thirty-six rings. The outer or wearing tire is of C iron, the rubber being clipped to the outer side of the C. The hollow is filled with a hard, light, durable composition.



**Patent Rubber Felloe Wheel.**

These tires are 1 in. wide on the sole, and about ⅞ in. deep in the channel. When the wheel revolves rapidly the rings are not visible.

They may be placed sideways or end on. The above is an illustration of the wheel.

## A RUSTIC FLOWER-HOLDER FOR TABLE DECORATION.

BY OMADAUN.

Its Form—A Gipsy Tripod—Natural Sticks to be used—A Cocoanut Shell for Flower-holder.

So very rustic is it, indeed, that it is almost with an apology that I present it to my fellow-readers; yet in its extreme simplicity there is somewhat of a charm, which I need hardly say is greatly enhanced if taste is displayed in the arrangement of the flowers; and having recently made one for my own dining-table, which has called forth great admiration, I am tempted to hope that a description of it may prove acceptable to others.

I can hardly claim for it any novelty of form, which, it will be seen, is simply that of a gipsy tripod, and the novelty—if it can be so called—lies rather in the simplicity of the materials used in its construction.

The tripod is formed with six rustic sticks, put together in the form shown in Fig. 1, and being tied with a sort of dried grass, known to all gardeners, I believe, as "bass." There is no attempt made at what I may call "finish," but the sticks must be firmly

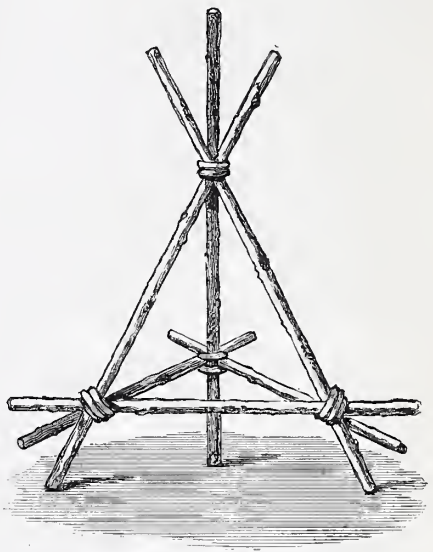


**Fig. 1.—Construction of Tripod.**

tied together at the joints, and the ends of the bass can be left either hanging loose or tied in a bow. The holder for the flowers is a cocoanut shell, which has been sawn in two, so as to leave one part a sort of cup or egg shape; three holes are drilled at equal distances round the edge (this can be done with a bradawl), and it is suspended from the tripod with three more pieces of the bass, which completes the arrangement. Of course, any small receptacle can be used in place of the cocoanut shell, but that,

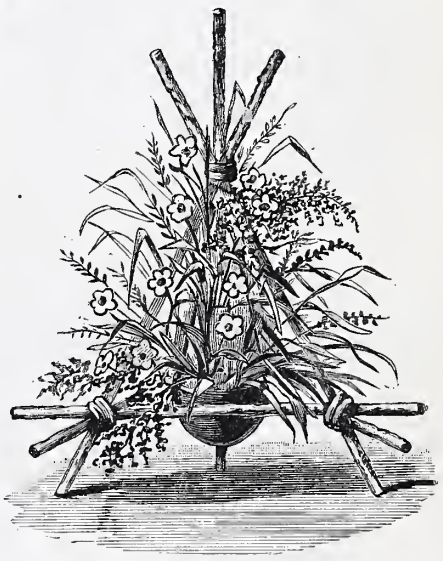


**Fig. 2.—Flower-holder Complete, with Cocoanut Vase in Position.**

perhaps, carries out its rustic appearance the best, and is very easily obtained.

In Fig. 2 I have attempted to show the tripod when decorated. The effect can be hardly more than "suggested" in a black and white drawing, but I can assure my readers that it is well worth the little time and labour necessary for its construction, which is of so simple a nature that no one need despair of making a satisfactory "job" in putting one together.

## A SIMPLE AND EFFECTIVE DRAUGHT EXCLUDER FOR DOORS.

BY H. HINGE.

INTRODUCTION, MAKING AND FIXING, ETC.

ALL house doors are so fitted as to admit being opened without rubbing on the floor, and it often happens that a little more has to be planed off to allow them to pass freely over a carpet or linoleum. Such being the case, we may expect the door, when closed, to have a space under, through which the air comes freely. In the summer months this is all right, and helps to ventilate the rooms; but in winter-time it is another thing altogether. Most of us have experienced the fact when in a nicely heated room, and, upon the door being closed to make the room more comfortable, we have still been chilled about the feet and

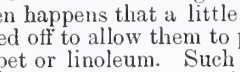


Fig. 1.—Transverse Section of Oak Strip.

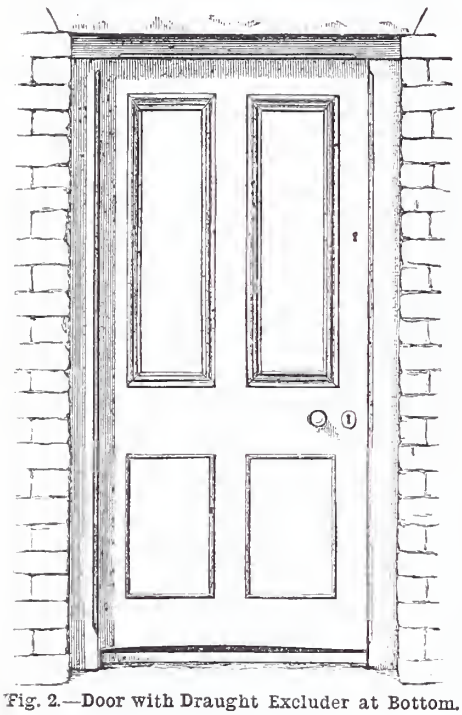


Fig. 2.—Door with Draught Excluder at Bottom.

legs. The cause of this is the draught coming through the space between the door and floor. A simple experiment will at once make this apparent to all. If a match or taper is lighted and held at the bottom of the door, the force of air will, in many cases, extinguish the light. This can easily be obviated by making draught excluders, and fixing them to our doors. The whole operation is so simple and the requirements so small that almost anyone who possesses a taste for mechanics can make and fix them.

*Making and Fixing.*—Procure a piece of oak, $\frac{1}{2}$ in. or $\frac{5}{8}$ in. thick, $2\frac{1}{2}$ in. broad, the length to be determined by the width of the door-casing (or frame). This must be rounded up till the end appears like Fig. 1, feathering it off on the edges to nothing, and rising gradually to the whole thickness. This should fit in tight (in the length) between the door-casing (or posts), the door closed, and the strip of oak gently tapped up into its place under the door till its edge just fills up the space between the door and floor. The door should now be opened, and a piece of felt or cloth, about $1\frac{1}{2}$ in. wide, tacked along the bottom edge of the door, allowing it to hang below the door about $\frac{1}{4}$ in. Now close the door, and, if it is in its right position, it will pinch up tight against the oak, and be perfectly air-tight. The strip of oak should be stained or painted to match the floor, and screwed down with three fine screws. It can then easily be taken up in warm weather. If it is a stone floor or step, holes must be drilled in it with a small iron chisel, and plugs of wood put in to receive the screws. Fig. 2 shows a draught excluder in position.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

74.—ELECTRICAL NOVELTIES, ELECTRIC JEWELLERY, ETC.

MESSRS. CATHCART, PETO, & RADFORD, electrical engineers, send for inspection eight useful illustrated sheets of novelties in electrical instruments and appliances. This firm has been well known for several years as the makers of pocket batteries and accumulators, made of ebonite, and fitted with lithanode plates. These batteries have been much used for supplying current to small electric lamps on the stage and elsewhere in situations where portable electric lights are desired. In the repair of powder magazines, gas retorts, and steam boilers, these portable electric lamps are a boon. Body belts, to contain curved ebonite cells, are worn by the workmen, who can then freely move about with the electric light in their hats. These belts are sold at the low price of 7s. 6d. each. The firm also supply portable table electric lights and bull's-eye electric lights, from 15s. to six guineas complete. They also make a speciality of electric jewellery, made up in the form of pretty scarf pins and hair ornaments in silver and tortoiseshell set with brilliants, at prices varying from 9s. to 25s.

75.—SHEETS OF FURNITURE DESIGNS.

Messrs. Henry Zilles & Co. have just published some thirty or forty sheets of furniture designs for the use of art workers in wood. For information respecting prices, etc., and a list of subjects included in the sheets already published, our readers must be referred to the publishers, whose address will be found in the advertising pages of WORK. The drawings are boldly done, and treated in a broad and vigorous manner, but the designs themselves, however well calculated they may be to suit continental tastes, are too elaborate in ornamentation to meet the requirements and desire of English makers and buyers of furniture. The designs comprise a large variety of articles of furniture, from the grandfather's clock to the massive sideboard and drawing-room buffet.

76.—NONPAREIL ENAMEL LETTERS.

Mr. James E. Brindley has submitted to me specimens of his Nonpareil enamel letters, figures, trade marks, etc., for fixing to windows, showcases, glass door fanlights, and for fascias, signs, door-plates, and general advertising purposes. The letters and ornamental adjuncts—in the form of rules, corner-pieces, borderings, etc.—appear to be very much like opaque glass, cemented on to plates of clear glass. The method—although it does not apparently possess the merit of being perfectly original—of thus making, at a short notice, very attractive advertising tablets is simple enough. The following exhibits the nature and formation of the cement and the method of fastening the letters on the glass. The cement itself is made of white lead, with a small proportion of plaster of Paris and a few drops of gold size, mixed well together. It is applied to the back of the letter or ornament to be fixed on the glass with a knife, and the letter, etc., must then be pressed firmly in its place. The glass should be perfectly dry and clean before any attempt is made to put on the letters. All superfluous cement that appears round the edge of the letter after pressure must be removed with a piece of wood cut to a point, and the whole must finally be cleaned with dry plaster of Paris rubbed on with a brush. Mr. Brindley claims to make elegant and correctly shaped letters in a great variety of size and form at a low price; but for prices and particulars readers of WORK must apply to the maker, who will readily furnish these on receipt of a stamped envelope. Mr. Brindley is also making a speciality of window name-plates, and speaks of photos of this and another class of article that he manufactures, believing that there are numbers of people who would like what he terms a chaste and attractive display of their name and business from the windows of the ordinary dwelling-house. The other class of article to which reference is made is manufactured for cabinets, carriages, perambulators, cycles, etc. He also supplies alphabets for pigeon-holes, and labels for music drawers—such as "Piano," "Sacred," "Dance," etc.—which have been mentioned before now in WORK as necessary for the proper completion of musical and literary cabinet work.

77.—CLASSES FOR WOOD CARVING.

I am requested to call attention in "Our Guide to Good Things"—and in doing this I have considerable pleasure—to the fact that "The Worshipful Company of Carpenters, in conjunction with the Council of King's College, have established at that college wood-carving classes. The day classes are held on Monday, Wednesday, and Friday afternoons from two till five, and the evening classes on Mondays and Wednesdays from seven till nine. Arrangements have been made by which ladies are permitted to attend, and prizes are offered by the Company. Particulars may be obtained from the Carpenters' Company, London Wall, or of the Secretary at King's College." In thus seeking to give an impetus to the acquirement of wood carving, one of the most attractive of all the various branches of wood-working, the Carpenters' Company are doing their best to carry out a work that especially belongs to them, and in associating themselves with King's College in the task, they are moving in the right direction, for there must be many among the senior and junior pupils there who will be led to take advantage of the classes, and so engage in an occupation which will be a relief to their more serious studies, and perhaps lead up to a further acquaintance with wood-working, which cannot fail to be of utility to them in after life. THE EDITOR.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

A SUBSTITUTE FOR PLATINUM.—Amongst the things really "wanted" by the manufacturing world is a substitute for platinum, which at present is found to be the only metal which will furnish wire suitable for connecting the carbons of electric lamps to the current wires. Unlike all other known metals, it contracts or expands under the influence of heat in exactly the same ratio as glass, and can, therefore, be embedded in the bulb necks without danger. It is quite possible that some of the Japanese metal alloys, which are trade secrets in the far East, may possess similar properties; and the matter is, at least, worth inquiry.

## SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**The Copus-Booth "Ideal" Patent Castor.**—I must ask the attention of readers of Work for a few moments to the illustrations of the mode of fixing these castors on round tables and single chairs as shown in my notice of this decidedly "good thing" in page 410 of the current volume, in which some of the blocks—the small blocks, I should say—illustrative of the castors, and the way in which they should be applied, have become misplaced. I presume it is owing to a misapprehension on the part of the printer to a certain extent, but mostly to the fact that the cuts were not whole and entire as one would naturally suppose them to be, but were made up by placing the small blocks inside the space defined by the circle in Fig. 2 and the trapezium showing single chair in Fig. 3. The difference between the right and the wrong

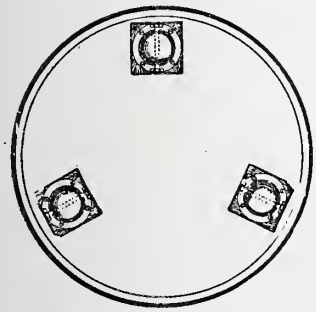


**Fig. 2.—Mode of fixing Castors on Round Table.**

method in putting on "Ideal" Patent Castors will be noted on comparing the illustrations in p. 410, which are wrong, with those given here, which are right. With regard to fixing castors on a round table, it is essential that the axes of the castor should, as I said, "point to a vertical line dropped from the

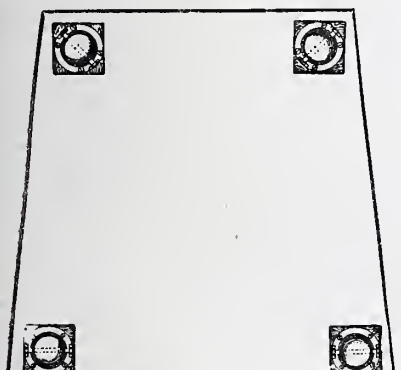


**Fig. 3.—Mode of fixing Castors on Single Chairs.**

centre of the table." In Fig. 3 "the axes of the front castors are parallel to the edge of the front of the chair, and the axes of those behind are at an angle of 45°, or thereabouts, with it." For the proper way under all circumstances, and for various kinds of furniture, recourse must be had to Mr. Copus's prospectus and price list.—Ed.

**Lamp Explosions.**—H. G. N. (*Islington*) writes:—"I observe in notes as to wants in Inventors' columns in Work that hitherto there has been no safety paraffin lamp invented. I am inclined to think that if lamps were made in the same way as the paraffin stoves—that is, with an extra stopper with a small hole in it for the gas generated by heat to escape—there would be no explosions, for I have never heard of a stove exploding. I have pointed this out to several lamp makers, but no one has adopted it yet, and I have too many irons in the fire to patent the idea myself."

**Cricket Bat.**—W. S. (*Northampton*) writes:—"Will you please put this in Work? as I think it very important that a misleading answer to any person or subject should, if possible, be put right. The answer about which I am writing appeared in p. 75 of the present volume, under the heading of 'Cricket Bat.'—No Name. J. W. H. says: 'Celebrated makers use pieces of whalebone halfway up the handle, and one-third down the bat.' Let me say that whalebone is not finished off halfway up the handle, but goes right through the same. Again, he says: 'Some make handles of lancewood and some of willow.' Has he lost faith in cane, or is it too much trouble to make it up into handles? He may introduce any article he likes into handles; but there is nothing yet to stand the wear and tear as cane. It holds into the splice better, and is so much lighter and stronger, and has more spring in it than anything, and resists, if made right, the jarring more than anything yet introduced. When makers line up handles with willow or ash, or any other wood, it is simply to reduce cost of material. Now with respect to the splice. Has J. W. H. ever made a spliced handle bat? I say no; and unless he knows what he is talking about, I think it would have been best to have left it alone; and if he has got an idea of his own, he can tell it to the nation, but do tell the questioner right. Now, the splice of a bat is not made as J. W. H. says, as a V-joint, but simply as a wedge, cut and fitted properly. I will defy him or anyone else to make a job of a handle splice made in the manner he has shown. He may make a clear joint back and front, and he may allow the glue to fill up the rest of the joints in the V. It is no good, again, as it has more tendency in it to split the blade than the plain wedge. Again, he says: 'The inquirer does not like pins or dowels;' but he strongly recommends them. *Let him!* It clearly proves he has no faith in his recommended splice. The inquirer is right; do not pin on any account. It is useless; and if made right, does not require anything but good joints and glue. If the querist cares to ask me how to make a cricket bat, if he will send me a stamped address, I will with pleasure tell him, as plainly as it is possible to do so, and tell him right."—[Any instructions you may wish to give must be given through the medium of "Shop," and not by private correspondence.—Ed.]

**Testing Accuracy of Framework.**—J. S. (*London, N.*) writes:—"I must protest against J. C. K. in his comments, page 427, terming as an 'erroneous plan' the method of testing the accuracy of framework which I and another contributor gave in different numbers. I should not have sent the hint had I not passed by the one previously given. I thought, however, that it might be useful to those who do not possess squares, compasses, etc., and not particularly for wood-workers. J. C. K. is, of course, right in his other remarks—at least, I cannot answer for the Egyptians, as I never knew them: intelligent, it seems, although no Work existed. J. C. K. supposes one side of his 'square' to be 5 in., and the remainder individually $4\frac{7}{8}$ in. long. Now, the amateur or professional workman who would cut four rails, each of which should be $4\frac{7}{8}$ in., and yet cut one much longer, is yet to be found. I will not believe such a flagrant error possible. But where four rails are *exactly* equal, or where a frame contains one pair of one length and another pair somewhat shorter, it is, by a long way, no impossibility that those rails *may* be mitred up apparently correct, and yet be out of the square. Naturally, I supposed it would be fully understood that outside measurements would be taken in addition to diagonal ones; which outside measurements, although proving the correct length and width of a job, would *not* prove its right angularity. It seems that if I do not stick to originality and designing, I shall get into hot water; but, happily, I have crawled out this time."

### II.—Questions Answered by Editor and Staff.

**Softening and Mounting Tiger Skin.**—Tiger.—Without being able to see what the present state of the skin may be, it is hard to give exact directions as to your method of procedure. If it has only been roughly taken off and cured, I should say damp it by rolling in damp cloths; stretch it tightly, hair downwards, carefully remove any lumps of fat, flesh, etc., with a knife, and then rub it down with pumice-stone and powdered chalk. The chalk takes out the dirt, grease, etc. A skin may be softened by rubbing only. The softness so much admired in certain skins brought from South Africa is said to be produced solely by long and patient rubbing between the hands of native women. But such substances as yolk of egg, oil, etc., worked into the pores, assist in giving pliancy. The kid skins of which gloves are made is softened with yolk of egg, and then rubbed backwards and forwards over the edge of a blunt semi-circular knife. As regards mounting, no lady who is clever with scissors and needle need find much difficulty. A thin crimson cloth, cut in scollops with the scissors, is generally used to surround the skin. For lining, a less showy material suffices.—M. M.

**Electrotyping.**—G. D. (*Lewisham*).—Assuming that the work to be copied is small, you will find the single cell process the most suitable for your purpose. Into a glass or earthenware vessel of about a gallon capacity place a white, close-grained porous cell, of about 3 in. diameter, and just a trifle taller than the outer stoneware jar. Next place an amalgamated zinc rod or cylinder, with a binding screw attached, in the inner porous cell, and then charge the latter with water, slightly acidulated with sulphuric acid. The zinc must not be allowed to touch the sides of the porous cell, but should be suspended in the solution by means of a couple of pieces of copper wire passed through holes drilled crosswise at the top of the zinc. For the outer cell make a saturated solution of sulphate of copper, by dissolving the pure crystals in warm water until it refuses to dissolve any more, and as soon as it has become cool pour the solution into the outer cell and add ½ oz. of sulphuric acid to each quart of liquid. A piece of perforated copper, cut to a suitable form, should now be suspended at the upper part of the outer cell, on which to support fresh crystals of sulphate of copper to compensate for the copper deposited on the mould, and thus keep the solution at a uniform strength. If preferred, a muslin bag filled with the crystals may be suspended in the solution for the same purpose. The plaster mould is now attached to the end of a piece of stout copper wire by twisting the latter securely round it, after which the entire surface to be copied is carefully and thoroughly covered with the best plumbago (blacklead). Thus prepared, the free end of the conducting wire is bent at right angles in the form of an L, and the short end is inserted in the hole in the binding screw of the zinc, with the other end of the wire to which the mould is attached dipping into the copper solution with its face *towards* the porous cell. A bright red deposit of copper will soon appear on the end of the conducting wire, from which it gradually spreads over the entire surface of the mould. If the copper deposited on the mould appears to be dark, the latter should be moved further away from the porous cell, as it is a sure indication of the current being too strong. When the current is weak it gives a pale or crystalline deposit, which should be corrected by bringing the mould nearer to the porous cell, or by the addition of a few drops more sulphuric acid in the inner cell. Whenever it becomes needful to alter the position of the wire attached to the mould, it is important to always screw up the nut of the binding screw tight again. In an ordinary way an electrotype sufficiently stout for all general purposes can be obtained in about twenty-four hours; but the action can be continued much longer if desired. Care should be taken not to remove the mould too soon, otherwise the electrotype may be accidentally damaged. If both sides of the mould have to be deposited upon, it will be requisite to occasionally turn the mould in order to secure a uniform deposit, as the copper always forms the thickest at those parts of the mould which are nearest to the porous cell. The mould can generally be separated from the electrotype by plunging them in hot water for a few minutes, after which the metal is trimmed up, polished, or lacquered, according to taste. Should any difficulty occur, write again as fully as possible. By looking up the Indexes you will find that several answers have already appeared in "Shop." You might, with advantage, read the articles which appeared in *Amateur Work*, Nos. 72, 73, 74, and 76, published at 6d. each by Messrs. Ward, Lock, and Co., Salisbury Square, E.C. Coin enamelling is too difficult a branch of work for an amateur to attempt with any hope of success, as the coins require to be undercut, then floated with the enamel, and afterwards fired and polished, the colour and beauty of the designs being mainly dependent upon the manner in which the engraving is executed. There are very few really good enamellers in the trade.—C. A. P.

**Geometry: Honours.**—J. W. C. (*Tavistock*).—Good books to use in reading for honours are: "Euclid," Hall & Knight; "Conic Sections," Smith. Write to Cassell & Co. for their catalogue of school works.

**Lamp.**—J. T. (*Biggleswade*).—I am not aware of a lamp being in the market for boiling water which burns benzoline. There is one which is used by plumbers, which forms a blowpipe lamp, using benzoline; but an ordinary methylated spirit lamp would be much more suitable, and three tablespoonfuls would certainly suffice to boil a pint of water in three minutes.—C. M. W.

**Aquarium.** — G. A. G. — As your aquarium measures 18 in. by 9 in., and is, I presume, of a proportionate depth, it is too small to admit of an effective self-acting fountain being inserted in it. You should have provided for the fountain before making the aquarium. You can, however, get over the difficulty by making a stand for the aquarium upon the lines of a fountain fully described in No. 69 of Work, and connecting the jet-pipe, screw-plug, and the main pipe to the inside of your aquarium at similar points to those which they occupy in the diagram, covering them with rock-work. The only difference in practice will be that your aquarium will form the top basin instead of the open one shown in the diagram. Make the tanks to any dimensions you like.—C. M. W.

**Fountain.**—Fountain.—Your sketch of fountain has not reached me. You say that you made a fountain, but failed to make it play more than three-quarters of an hour. I should consider that a very fair time. Should you desire to make it play longer, you have only to make the vessels larger. With reference to furnishing you with a design for a combination fountain and fern-case, I shall be happy to do so upon learning some particulars as to size, material, and the position it is intended to occupy; also whether a plain or an elaborate design is wanted.—C. M. W.

**Saw Blade.**—CYMRO could get a piece of band saw from the following agents and makers, which would suit his purpose by punching a hole in each end: C. D. Monninger, 10 and 11, Ray Street, London, E.C.; Messrs. Eadon, President Works, Sheffield; Messrs. Aublet, 35, Curtain Road, London, E.C.; or from almost any saw-maker. The price of saw, ⅜ in. wide, would be 2½d. per foot; ½ in., 3d. per foot. You do not state the kind of handles you want to fasten. I should say to fasten with a good rivet would be the proper way to fasten them firmly.—A. R.

**"Work" Exhibition.**—R. O. (*Elgin*).—No "Work" Exhibition will be held for 1891-92.

**Standing Hammock.**—F. H. B. (*Forest Gate*).—What do you mean by a "standing hammock?" Hammocks are always slung, and must be so from their construction. There is an article entitled "How to Net a Garden Hammock" in Vol. II., p. 425, otherwise No. 79. It is impossible to answer any question in the number that appears in the week following its reception.

**Flower Stand.**—F. H. B. (*Forest Gate*).—Buy the Indexes to Vols. I. and II. of WORK, and you will then, by searching them, be aware of all that has been done in this direction, and be able to indicate to the publishers what articles you require. The Indexes may be obtained through any bookseller or newsagent, and the cost no more than 1d. each.

**Carpenter's Shop.**—F. H. B. (*Forest Gate*).—Your application is devoid of any particulars that would enable anyone to answer it. How could anyone tell you "how to fit up a carpenter's place, where to put the tools and shelves, etc.," when all the information you vouchsafe with regard to the place is: "The shop is oblong shape—I mean the place I work in." Send a plan, with dimensions, etc., and showing where the door and windows are. Writers can no more give practical directions that would be of any real value to you than the Israelites could make bricks in Egypt without straw.

**Cost of Patents.**—YOUNG CHIPS.—Under the provisions of the New Patent Act of 1883, the Government fees or stamps on applying for the grant of a Patent for an invention is a stamp impressed—of £1—on the application form, in reply to which, if accepted, the provisional protection is granted, which lasts nine months, at or before the end of which term a complete specification, drawings, etc., must be filed, and this specification has to bear *three* impressed stamps of £1 each; and when the documents are accepted, the Patent issues. These stamps, however, have nothing to do with the cost of preparing the documents, drawings, etc., required by the law prior to the grant of the Patent, which will vary according to the amount of work required to be done, and the skill, ability, and experience employed in the performance. This kind of work cannot be successfully carried out by ignorant and inexperienced inventors, unaided by proper skill and knowledge of Patent matters, and it is owing to the persistent attempts of such people in preparing and putting in their own documents that the Patent Office records are being filled with invalid and useless Patents, hundreds having been patented long before, and others most hopeless and useless crudities; which is causing Patents to be regarded with suspicion and contempt, and doing an injury to Patent property which it will take years to put right. If a thing is worth doing at all, it is surely worth doing well.—C. E.

**Patenting.**—S. F. D. (*Lewisham*).—There is nothing to prevent an inventor preparing and putting in his own documents and making application himself personally for the grant of a Patent, if he pleases to do so. Before, however, he attempts to do this, he should ask himself if he understands what a Patent is, what it is required to comprise, and what he knows about Patent Law and the judicial requirements for a sound and valid Patent. If he arrive at the conclusion that he does not know, and has had no experience in such matters—as in ninety-nine cases out of a hundred it will be found is the case—it seems to us that he should decide that it would be a very foolish proceeding on his part to attempt to meddle with matters of which he possesses no knowledge or experience, and that, therefore, he should at once place himself in the hands of a respectable, skilled, and experienced person, capable of carrying out his wishes in a proper manner, or he will quickly find he is adding another useless and invalid Patent to the already existing mass of such as are on record. Unless one knows exactly what work has to be done in preparing the documents, drawings, etc., for his invention, and ascertaining the novelty of it, it is impossible to name an exact price for the cost, the work and requirements varying so much in each case.—C. E.

**Leaking Cocks.**—W. S. (*Ilford*).—Our correspondent does not tell us what kind of packed cocks he has to do with—whether shell-packed, plug-packed, or screw-down washer; but, according to his statement, they have begun to leak very soon. If I knew what kind, or whose Patent, they are, I might be able to give him the required information.—C. E.

**Ploughs.**—H. U. (*Ballycanew*).—These can be bought in several places, but Mr. McKinnon, Carrick Street, Glasgow, has long been known for producing excellent articles at a reasonable price. I would advise you to write to him. George Royle, Lovell's Court, Paternoster Row, London, also supplies them.—G. C.

**Telephone.**—T. R. M. (*Liverpool*).—The information you ask for is too much for "Shop" columns. It has already been given piecemeal through various numbers. Look up the Indexes, which you should have by you. Judging from the number of letters I have had from you, you are a constant subscriber, or, at least, should be. We never answer by post; so you must wait if you want information through "Shop," as others are content to do.—W. D.

**Selling a Patent.**—W. J. (*Heaton, Newcastle-on-Tyne*).—An invention for which provisional protection only has been obtained is *not* a Patent, and cannot be sold as such, there being no property to sell until the Patent is sealed. A man may sell his invention under these circumstances, covenanting to complete and assign the Patent when granted, if he can get parties to agree to such an arrangement. We have often carried out business of this kind; but, as a rule, it is not generally done, nor is it advisable to make such arrangements. It may, in some cases, be both advisable and advantageous to both parties to do so, but this will depend on circumstances. By law, a Patent is only granted to the true and first inventor; therefore, in strict law, any person whose name is added to that of the inventor, but who has not invented anything in the matter, will at once invalidate the Patent! What is the object to be gained by doing what our correspondent seems to wish, judging from the nature of his query? The proper thing to be done in the case is for the real inventor to apply in his own name for the grant of a Patent for his invention, and when obtained, he can then sell and assign his rights as he seems to desire, or make any other suitable or desired arrangement, there being then a property to be dealt with.—C. E.

**Bookbinding.**—AMATEUR.—I am pleased that you have been able to bind books from the instructions given in WORK. I am astonished that you want to know what a press-pin is, particularly so, seeing that you say you have a press, etc. A press-pin is simply an iron rod about the length of an ordinary kitchen poker, for putting into the holes at the ends of the screws, and is used as a lever for tightening up the press. A description of the process of making one is superfluous. If you have not one, you could use the poker with advantage. Pressing boards are smooth wooden boards for putting between books while in the press. Backing boards are long, narrow strips of hard wood with the top edge bevelled, and are put along the back of the book during the operation of backing. These things are fully explained in the articles on this subject. Rolls, fillets, and pallets are finishers' tools made of brass, with a pattern cut upon the face of them, and are used for the ornamental work. Read the articles over again, and you will get full particulars of all these. Your lathe and carpenters' tools will be of little use in the manufacture of these articles.—G. C.

**Oil Paper.**—C. B. P. (*Rockferry*).—You want to know how to make oiled "royal," "black carbonic," and "manifold" for duplicate order books, so that you will be able to manufacture them. In the first place, you will require elaborate machinery; and secondly, you would require to have a paper mill in full swing, as the first two papers are made from waste outsides and sheets with some flaw which would prevent them being sold as perfect ones. The tissue is prepared during manufacture; so you would have to set up a paper-maker's plant for this alone. I cannot give instructions for setting up a paper-maker's plant—at least, in this column. I know something about this class of machinery, and if you are really going in for it, I could advise; but if I was doing it here it would be somewhat of a free advertisement, which I would rather avoid.—G. C.

**Electric Bell Magnet.**—T. B. (*Liverpool*).—The number of layers of wire to be laid on the bobbins of an electric bell magnet are determined by the battery power to be used in ringing the bell. If a low-tension current of full volume is to be used, a few layers—say two or three—of coarse wire will be required. If a high-tension current of thin volume is to be employed, the bobbins must be wound with several layers of fine wire. In No. 12, Vol. I., of WORK, on p. 180, you will find a full table of the proportionate parts of electric bell magnets. For a 3 in. bell, the bobbins should be 2 in. in length by ¾ in. in diameter, and filled with No. 24 silk-covered copper wire. For a 4 in. bell, the bobbins should be 2½ in. by 1¼ in., and filled with No. 22 wire. For a 6 in. bell, the bobbins should be 3½ in. by 1⅝ in., and filled with either No. 22, 18, or 16 wire, just as may be required to balance the battery power. A greater number of turns or layers will ensure a stronger magnetic pull and a stronger stroke, if the tension of the current is high enough to overcome the extra resistance of the additional turns. A bobbin will take more layers of a fine than of a coarse wire, and the resistance will also be higher.—G. E. B.

**Leyden Jar.**—T. F. (*London, W.*).—Get a wide-mouthed glass jar holding from one to two pints, or a confectionery glass jar. Also get some good tinfoil and some thin varnish. Rinse the jar with some thin varnish, then coat it with tinfoil to within about 1 in. of the top. Coat the outside in a similar manner. Get a disc of hard wood (such as mahogany) to fit the mouth of the jar, and have it smoothly polished and varnished. In the centre of this disc fix a brass rod 4 in. in length, with a hook turned on the inside end, and a round brass knob on the outside end. Hang a piece of brass chain to the hook inside, and let the chain be long enough to just touch the bottom of the jar. The brass rod may go to the bottom of the jar and terminate in a disc of wood coated with tinfoil, instead of having a length of brass chain, if so desired. The upper part of the rod above the cover may be curved, but must terminate in a metal ball. To charge the jar from a Rhumkorff coil, place the jar on a thick piece of glass, on which has been placed a sheet of tinfoil. Connect the tinfoil with one terminal of the secoudary wire, and connect the knob of the jar to the discharger. Work the coil in the usual manner, passing sparks between the points of the discharger; but do not allow these to touch each other.—G. E. B.

**Electric Engine.**—J. M. (*Liverpool*).—Electric engines made in imitation of steam engines rarely work in a satisfactory manner. If you wish to work your model lift with a small engine made in imitation of a steam engine, but driven by electricity, do so in the following manner: Make or get a model steam engine. Also make or get a small electro-motor, and conceal it under or at the back of your model lift. From the motor convey a fine gut band to the driving-shaft of the engine, and work the engine with this. A model electro-motor suitable to this purpose was described in No. 109, p. 71, Vol. III., of WORK. The motor may be made to work the driving gear of your lift direct, if you do not wish to show the engine. The battery of three or four pint bichromate cells may be at some distance from the motor, the current being conveyed by No. 18 wire. The speed will be high, but you can pull this down by suitably reducing pulleys or wheels. The motor will pull the lift up, but it will fall by its own weight when the current is switched off, so should be provided with a brake to ease the descent.—G. E. B.

**Dry Battery.**—W. C. H. (*Godalming*).—The makers of dry batteries either patent them, and thus protect themselves against imitation, or keep the process and proportions a dead secret. On p. 97, Vol. II., of WORK, in reply to G. A. B. (*Ascot*), I have given instructions on making a dry battery; and in several other parts of Vols. I. and II. you will find information respecting the Gassner dry battery. This is all I can tell you about them. I cannot give you the "exact quantities of materials" used in dry batteries.—G. E. B.

**Materials for Coils.**—EXPECTANT.—Ebonite, platinum, and other material used in the construction of coils, can be obtained from any dealer in electrical instruments. Among those known to me are Messrs. King, Mendham & Co., Narrow Wine Street, Bristol; Mr. Bottone, Wallington, Surrey; Mr. G. Bowron, 93, Praed Street, London, W.; Messrs. Bonney & Co., 19, Avenue Road, Lewisham; and Messrs. F. C. Allsop & Co., 165, Queen Victoria Street, London, E.C. Sheet ebonite for coil ends and discs costs about 5s. a pound; platinum varies very much in price from week to week. By writing to one of the dealers mentioned above, you can always get a current quotation. If you want any odds and ends for coils, I should advise you to pay a visit to the electrical museum and second-hand emporium of Mr. A. Caplatzi, 3, Chenies Street, Tottenham Court Road. He has a great variety of coils and oddments of coils for sale or exchange.—G. E. B.

**Silver-plating Tricycle.**—B. B. (*Bradford*).—The simple silvering pastes you inquire about are useless for silver-plating the bright parts of a tricycle. Nitrate of silver will not deposit its metal by contact with bright steel, nor by simply immersing the steel in a nitrate of silver solution. All pastes containing silver are useless for plating steel. They can only be used in whitening bright and freshly cleaned surfaces of copper and of brass. To silver-plate bright steel, it must be first coated with copper or with brass in an alkaline coppering or brassing solution, and then silvered in a solution of double cyanide of silver and potassium. As these processes will involve the use of costly appliances and solutions, I should advise you to send your tricycle to a professional plater, or to the maker of the machine, and get it plated. The plant needed to properly plate tricycles will cost about £150 at the lowest estimate.—G. E. B.

**Battery for Electric Light.**—H. G. (*London, N.W.*).—The Bunsen is, without doubt, the best battery for electric-lighting purposes. It is not generally liked, because it gives off nasty poisonous fumes of nitrous oxide whilst at work; hence it has to be placed in an outhouse, and the wires brought to the lamps. It gives a strong and almost constant current for a period of from six to eight hours, if properly set up and used. At the end of each run of from six to eight hours it must be taken to pieces and cleaned, and its parts must always be put away clean. Get Nos. 1, 2, and 3 of WORK (obtainable from Messrs. Cassell & Co.), and read the articles therein published about the Bunsen battery. They will tell you all about this battery, and how to amalgamate the zincs. Your four cells must be connected in series—that is, in tandem: zinc of one cell to carbon of next cell, and so on, a wire from a zinc at one end, and another wire from the carbon at the other end of the battery forming the line wires to the lamp. The four cells, thus connected, will furnish enough current to light up a 6 volt 5 candle-power lamp. The battery might light two such lamps if the lamps were placed side by side.

If the lamp or lamps do not light when connected to the battery, the voltage of the lamp is too high, and more cells are required to overcome its resistance.—G. E. B.

**Small Horizontal Engine.**—C. F. (*Eastbourne*).—You ask advice as to making a small horizontal engine, and that is exactly what I am trying to give in WORK; I suppose, therefore, you have only just begun to take it in. Get Nos. 106, 110, 121, 125, and 131; the articles are also continued in the present number. You will see in No. 121 the size of the fly-wheel. The castings for this engine will shortly be advertised. You can buy second-hand engines by advertisement in the *Exchange and Mart*, or the *English Mechanic*, or at Caplatzi's, Chenies Street, Tottenham Court Road, London. The boiler may be 2 ft. 6 in. high and 1 ft. 3 in. diameter, and have a cross tube in the furnace. This will be a one-horse boiler.—F. A. M.

**Copal Varnish.**—F. T. (*Liverpool*).—To make copal varnish appears to be the height of many an amateur painter's ambition, judging by the queries for ingredients received. We have repeatedly stated that the novice has not the faintest chance of making it successfully. F. T. wants to know the *probable* cost of making a gallon. Here are a few items: the value of several domestic pots and pans, of the loss of his peace of mind, his wife's respect and patience, a quantity of good oil, turpentine, copal gum, etc., and perhaps the cost of putting out a fire right up the kitchen flue! Varnish is made according to the purpose it is intended to be used for. Prices range from 6s. to 36s. per gallon, and there is now so much competition amongst large manufacturers, that even were it a simple thing to undertake, copal varnish could not be made on the kitchen stove nearly so cheaply as it can be bought.—F. P.

**Litho Transfer Paper.**—W. G. (*Blackburn*).—Transfer paper is so commonly used now, and is so easily obtainable from any dealer in lithographic materials, that it is seldom, if ever, necessary for anyone to make it for themselves. By the way that you word your question, I do not quite understand whether you want a receipt for making the paper itself, or whether you wish to know the mode of proceeding to work in transferring from stone to stone, or from plate to stone, as the same paper may be used in either case; but I will give a couple of the most general receipts for making the transfer paper. Should the paper be required to be transferred to a warm stone, mix a size strong enough to be quite firm when cold, by boiling either parchment cuttings, glue, gelatine, or isinglass, etc. A good coating or medium to be used with this is either plaster of Paris, flake white, or chalk, etc., flake white being, perhaps, the best; this should be mixed smooth with water. Then warm the size, and pour the mixture into it, after which strain through a sieve or piece of muslin, but only experience will show how much white it is necessary to put to any certain quantity of size. A large flat camel's-hair brush should be used to put the coating on the paper, and any kind of paper may be used, such as ordinary drawing-paper, or very thin paper if the drawing to be transferred is very fine. Should the paper be required to be transferred to a cold stone, it is better to use starch in place of the size, and mix it with glue. The more adhesive the paper is required to be, the more common should be the kind of glue used. There are excellent papers for transferring good chalk work; but as these are more expensive, they are not so generally used as the following. The ordinary Scotch re-transfer paper is so well known that the receipt hardly bears repeating; but as every day brings fresh workers to the field of lithography, someone may be benefited if I herewith give it. It is simply made by mixing plaster of Paris and flour in equal proportions, by first mixing the plaster of Paris (which should be of the best) with water until it becomes a smooth liquid; this is obtained by continually adding a little water, and constantly stirring it, until it loses its natural propensity of settling into a hard substance. Then mix the flour with a little water, and boil it to a paste of ordinary consistency, after which add the paste to the plaster, well mix, and strain through a coarse muslin or fine sieve. Colour it by adding a little gamboge or vermilion, etc., which, when applied to the paper, enables the artist to easily distinguish the right side from the wrong. This applies equally well to the above receipts, and any kind of transfers can be taken from this paper, either from stone to stone or from plate to stone. Should you wish to know how to proceed in *transferring* from plate to stone, I shall be pleased, with the Editor's permission, to answer this, or any other question relating to artistic lithography, in "Shop."—A. J. A.

**Reverse Transferring for Lithography.**—T. A. J.—There are several methods of reverse transferring—to change the black letters of type, etc., to white ones on a black ground—one of which is to protect the drawing on the stone, or, in this case, the lettering, with resin, and etch it until the letters are raised from the level of the stone to a degree perceptible to the eye. Then wash the stone, first with turpentine to remove the ink, then with clean water, after which paint the stone solid all over with litho ink. When dry, it may be rolled up in the ordinary way in printing ink. The letters being now raised, it is necessary to level them to the stone with snake-stone; and the stone can be easily gummed, rolled up, and printed, the letters standing out white on a black ground. Should any accident occur to the groundwork in using the snake-stone, it can be easily filled in and remedied with litho ink. To make the letters level requires a very nice, neat, and patient piece of work. Another method is to take an impression of the subject in a strong ink, and dust powdered gum-arabic over it, so that it becomes slightly sticky if held before a fire or allowed to remain in any damp place. This now being placed over a damp stone, the gummy surface—and, consequently, the design or lettering—will be transferred to the stone. This should now be allowed to dry, and then the stone covered all over with litho or any greasy ink, and if the stone is washed in the ordinary way the lettering will stand out white on the stone, as the gum will protect the stone from the ink wherever the design comes. These are only two out of several methods for reverse transferring without the artist's assistance, several others being equally good; but I have only given the above so as not to confuse you in starting. It would be a good plan for you to try both and see which you prefer, but in either case you must be particularly careful to see that the edges of the letters are clean and neat. Should you, however, find any difficulty in working, write again, and let me know where your trouble lies.—A. J. A.

**Zinc Plates for Lithography.**—LITHO.—Zinc plates may be purchased ready grained for the lithographer's use at any of the dealers in lithographic materials. But, presuming you have only bought the plain zinc, and wish to prepare it yourself, as your question seems to imply, you would proceed in the following manner: After the zinc has been well rolled at the dealer's, it must be cut into sizes suitable to the subject in hand, and care will have to be taken to see that it is level and of equal thickness all over. Should the plate be required to be constantly in use—that is, as soon as one subject is finished the plate is required to be re-grained ready for another—it is advisable to choose one thicker than if the one subject is to be drawn and kept on the plate, to allow for the wear in preparation. The zinc never being quite free from oxide, dust, etc., when first bought, it is necessary that all such foreign substances should be scraped off with a sharp scraper, which should be used at an acute angle with the zinc, so as not to dig holes into it. The next process is to treat it like a litho stone by smoothing it with pumice-stone (*vide* p. 19, No. 106, Vol. III., of WORK). But where zinc differs from stone is, that *every kind* of work must be drawn on a grained surface, no matter how fine it may be. It is, therefore, necessary that the zinc should be grained; this gives it that dull, rough appearance that you mention and point out in your sample (No. 1). The zinc must be grained in exactly the same manner as stone, only using a zinc muller instead of a stone one. After the plate is finished and well rinsed with warm water, it should be dried quickly, to prevent the water corroding the zinc. The finest grain may be given to the plate for pen work, and, naturally, a coarser one will be required for chalk work. These are the general principles for preparing zinc plates for lithographic purposes; to enter more into detail would be to take up too much of the valuable space of "Shop." In specimen 2, the colour and surface are obtained by coating the zinc with a solution composed by grinding lithographic stone down to a fine powder, making it into a pulp with water, and then laying it on the zinc, which gives it a surface like stone, and which, it is needless to say, can be, therefore, either polished or grained, and may be used in the same manner as a litho stone. A firm in Leipzig hold the patent for this kind of plate with a litho stone coating. It would, therefore, be advisable to apply to them or their agents if you wish to obtain them.—A. J. A.

**Graining.**—J. T. R. B.—Vol. II. of WORK contains a complete and illustrated series of papers on the art of graining. Send for an Index, and then you will find particulars of each lesson. They form a thorough foundation for any learner, and are written for the instruction of those having no other means of getting lessons. Classes are held in graining at the Finsbury Technical College. The finest work on graining, with beautiful coloured reproductions of grained panels, is published by the proprietors of the *Journal of Decorative Art*, 15, St. Ann Street, Manchester.—LONDON DECORATOR.

**Enamel.**—CHARLES.—Why attempt to make enamel when so many reliable brands are on the market? A useful bright red can be made by dissolving sealing-wax in methylated spirit, but this is only fit for fancy goods not exposed to the weather. No ordinary mixture of pigment and varnish can be made to answer so well as Aspinall's, for instance. Let me advise you to get the back parts of WORK, and complete your volume. You will find it a great bargain.—F. P.

**Painting.**—E. H.—There is no work published dealing solely with the pricing and measurement of painters' and decorators' work; but any established builders' price-book contains a set of charges such as architects require. When you consider that wages vary as much as 25 per cent. between different parts of the country, and that the condition and required finish have more to do with the price of painting than the quantity alone, you will gather why such a book could not be compiled. *Mensuration* should be studied for learning *how* to take quantities.—LONDON DECORATOR.

**Lime Wash.**—G. M. G.—The cause of your liming turning yellow is probably due to the stained condition of the surface it is put upon, and which stains will strike through every coating. Try scraping off all the old coating with a wash of plaster of Paris and water, and then re-lime. Use chalk-lime; get it fresh from the kiln, and slack it when you intend to use it. A little blue or black colour helps to kill the yellow tint of the lime, but it will not affect the staining trouble.—F. P.

**Plumbago.**—H. P. (*Ash-next-Sandwich*).—Are you not aware that plumbago is the chemical name for blacklead—*oxide of carbon?* I fail to understand the purpose you require it for, and what you mean by small quantities. However, for 1 lb. I should say, go to the oilman; for 1 cwt., write to Farmiloe and Sons, Rochester Row, London, who will quote you for any such commodities according to your requirements.—F. P.

**Waterproof Covers.**—SCOT.—WORK, No. 73, page 340, contains a reply on "Waterproofing Canvas," which appears to be the receipt you want. If you have not that issue, send 1½d. to the publishers, and they will forward same at once.—F. P.

**Oak Graining.**—J. S. (*Birmingham*).—The only patterns for practice work that I can personally recommend to the student are those published with the Manchester work on graining. These are some of the best English chromo-lithography work that has been produced; and as the original panels were executed for the book by past-masters in the art, nothing finer can be desired. Write to 15, St. Ann Street, Manchester, and mention WORK. Inquire also, from the same source, as to panels of real woods for learners.—LONDON DECORATOR.

**Paint and Distemper.**—M. N. (*Rockhampton*) wants to know what will prevent the salts of cements coming through paint and distemper. You should not have painted the wall just after it had been made good, as it had no time to dry, and, as you may naturally expect, when you rub a wet article over a wet article the latter gets diluted with the former, as it has done in your case. The wall should have been left to dry for about a week at least, and then well sized before being painted. You ask me, in your letter, if I can give you a remedy for Portland cement. If you will repeat your question more clearly, and tell me what is wrong with your Portland cement, I will only be too pleased to try and answer your query.—W. B.

**Exposure for Enlargements.**—G. F. G. (*Oldham*).—Having made the enlarging camera, I take it for granted from your letter that you are familiar with the process of developing, and simply desire a few hints about the exposure necessary. This varies very much, according to the density of the negative, the time of day, the intensity of the light, and several other factors; and experience alone can guide you in the matter. I give you a few notes from a book in which I register particulars of all my exposures. They may serve to give you an idea as to how to proceed. January 6: thin negative, stop f 10, foggy day; exposure, 35 minutes; Eastman paper. February 10: ordinary negative, stop f 10, dull day; Eastman paper, 15 minutes. July 12: ordinary negative, stop f 20, bright day; 6 minutes. October 4: dense negative, stop f 20, sunny day; Ilford rapid paper, 2½ minutes. You will thus see that the necessary time varies considerably. A good plan is to proceed as follows: Take an ordinary negative, put it in the camera, cut a strip off your paper ½ in. wide, and place it in the dark slide; pull out the shutter one-fourth, expose five minutes, pull out another fourth, expose another five minutes, then again a fourth more for another five minutes. The strip will thus be exposed five, ten, fifteen, and twenty minutes in different parts; develop, and see which exposure is nearest perfect, then time your enlargement accordingly. Avoid letting the sun shine on your negative when enlarging. I generally choose a dull day, as I find the results, with long exposures, to be much more satisfactory. In the matter of papers tastes differ, but I think you will be quite satisfied with either Eastman's or Ilford rapid. I prefer the former, although a trifle dearer.—G. LE B.

**Plush for Frames.**—PLUSH FRAME.—An article on plush-covered frames is in the hands of the Editor, and if it has not appeared ere you see this, it will do so shortly.—D. D.

**Cabinet Maker.**—COUNTRY LAD.—I can quite appreciate your difficulty in acquiring practical experience in making good furniture. It is a most difficult matter to find a so-called cabinet-maker's shop in which the things are made for general sale. Wherever you go you will find that all the shops in which the furniture is sold to the public get the bulk of their goods from London, where it is made and supplied by wholesale dealers. The actual makers there seldom make more than one class of article, and though there are some shops in which really good things are made, they are comparatively few. If you could get into one of them, you might, by keeping your eyes open and working hard, learn a good deal; but undoubtedly your best plan would be to avoid the trade shops, and get into some retail house where things are actually made. Although, as I have said, most of the things are bought from outside makers, there are many retail cabinet makers who keep a few men for general work, and it is in such a shop that you will gain most experience. As such shops are found all over Great Britain, or, at any rate, in all the larger towns, such as London, Birmingham, Liverpool, and Manchester, you will see it is quite impossible to give you a list of firms who might be willing to engage you, even were I able, off-hand, to be able to sit down and write one. All you can do is to watch

your opportunity and make inquiries from your fellow-workmen; but I do not think you stand much chance of getting such employment as you want where you now are. I do not know if you have joined either of the cabinet-makers' trades unions. If you are able to, you might find it to your advantage to do so, though I fear, from what you say of yourself, that you would hardly be eligible. I am not at all surprised to hear that you have found the articles in WORK to which you allude of use to you. You will find more practical information in its pages than in any other periodical.—D. D.

**Plating Forks.**—W. G. (*Harrogate*).—For the price paid (30s. per dozen) the best quality could not be expected. Have they been carefully treated and cleaned with fine polishing powder, such as washed whiting? or have they been left in vinegar, etc.? Coarse polishing materials will soon fetch plating off, and so will vinegar and sauces. It will be best for you to take them to some respectable silversmith or jeweller in your town, and ask him to get you an estimate for re-plating with silver, which should cost from 15s. upwards the dozen to do properly. As the metal itself is yellow, it might be well to get an estimate to nickel-plate them first, and silver-plate them afterwards; or perhaps nickel-plating alone would do, when the cost would be 7s. 6d. upwards for the dozen. Nickel has not the colour of silver, as you can see by looking at the plated parts of eyelets. If you buy other plated goods and want the best, it should be that known as E.P.N.S., which can be translated, English plate nickel silver; but you will have to depend on your silversmith, anyhow, so choose a man of established reputation.—H. S. G.

**Black Varnish for Pins.**—J. W. (*Kensington*).—No special machinery is required for these, only a few cans with gauze bottoms, and a larger piece of gauze in a frame on which to spread the pins for draining and drying. The varnish used is what is generally called japan, and requires a stove heated at a temperature of from 250° to 300° Fah. These japans, of which asphaltum, gum amber, and boiled oil, form the chief ingredients, requiring from three to five hours' boiling, and a special knowledge and appliances to make satisfactory, are best bought ready made from the makers; in fact, large japanners seldom make their own. Should you, however, require the proper proportions and ingredients, and will write us again, we will gladly furnish them. As these japans are thinner when hot, it may be necessary to adopt some plan, such as a sand bath, to keep them hot when using; and as for the purpose you name a brush is useless, it will be seen that the better plan would be to put the pins in one of the gauze-bottom cans, place this over a water-tight one, and pour the japan through; drain well, and spread out on the gauze in the stove to dry. How much heat is really necessary, and how long an exposure is required, can only be acquired by actual experience. There are many makers of japans and varnishes in your neighbourhood to whom you might write, giving full particulars of your requirements: W. T. Bigsby, Trundley's Road, Deptford, London; R. P. Butteress & Co., Assembly Place, Mile End, E.; C. W. Schmidt, Carpenters' Road, Stratford, E.; Meredith and Co., 107 and 108, Lionel Street, Birmingham.—LIFEBOAT.

**Anti-vibrator.**—G. W. C.—The anti-vibrator described in WORK, page 407, Sept. 12th, No. 130, is not protected by any patent rights, and can be made and sold by anyone.—CYCLOPS.

**Anti-vibrator.**—CYCLIST will be able to get the castings for the anti-vibrator described in WORK, page 407, Sept. 12th, from H. Cliff, Old Foundry, Leeds Road, Bradford, by sending patterns of same; or he could, no doubt, get the anti-vibrator made complete by Mr. G. W. Carr, 83, Villiers Street, Dresden, Loughton, Staffs. The cost of malleable iron castings is something under 6d. per lb.—CYCLOPS.

**Monogram.**—E. R. (*Bermondsey*).—I am sorry to disappoint you, but monograms are costly to engrave, and the space they occupy cannot be spared. Those already given will furnish you with some idea of the method to be adopted in working out your own.

**Exhibitions.**—F. G. W. (*Kettering*).—There will be no "Work" Exhibition this year, and I am unable to tell you in what places local exhibitions are contemplated, as I am without information on the subject. Secretaries of local exhibitions should always send early notices to WORK, and then announcements of them could be made in these pages.

**Power to Drive Machine.**—IGNORANT.—If a machine takes 7 to 8 h.-p. when driven direct, when a line shaft is interposed between the two, there will be a very slight increase of power required, owing to the friction at the journals of this line shaft. The distance apart of the pulleys on the line shaft has nothing to do with it, except that, if they are far apart, there will have to be more bearings on the line shaft, and therefore more friction; also, if there was only *one* pulley on the shaft which both received and transmitted the power to the engine—the engine being on one side and the machine on the other—the belts would pull against each other and so relieve the journals of most of the friction. The friction will be very small if only the shaftings and journals are properly in line and firmly fixed.—F. A. M.

**Positives on Dry Plates.**—AMATEUR P.—Practically, it is not impossible to take such pictures on ordinary dry plates. The method used is the collodion wet plate process, either on glass or ferrotype plates, and the development by means of an acid solution of iron sulphate. Of course, positives may be made on Ilford plates as transparencies; but emulsion processes are unsuitable for the display of images by reflected light, which is a matter of necessity in the work alluded to.

**Bookbinding.**—H. W. (*Helston*).—Articles on bookbinding appeared in Nos. 6, 9, 57, 61, 65, 69, 72, 75, 80, and 85; and queries relative to the articles are answered in "Shop" in Nos. 14, 16, 17, 18, 32, 38, 45, 46, and 50.

**Registration of Designs.**—S. A. C.—It is possible that some papers on this subject, which may be useful to you, will shortly appear in WORK.

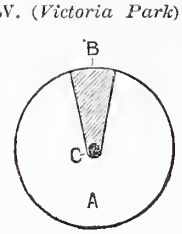
## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Fountain Driven by Engine.**—C. A. P. (*Ealing*) asks:—"Can any reader give me any information how I could make a small fountain worked by a hot-air engine? I should like the fountain to throw a continuous jet of water about 18 in. high; the whole to stand on a base about a foot square."

**Marionette.**—C. A. P. (*Ealing*) writes:—"I should be glad if you could tell me how I could make a marionette, about 15 in. to 18 in. high, to dance like those at the Aquarium, on a miniature stage."

**Linen Buttons.**—W. L. (*Huyton*) asks:—"Will anyone kindly give me the names and addresses of the *best* linen button manufacturers?"

**Grooving Cane.**—A. W. W. (*Victoria Park*) writes:—"Can any reader inform me where I can procure a tool, and what kind of tool it is I require, to cut a groove in cane after the manner shown in section in the accompanying diagram, in order to place in the centre of the cane a piece of straight-drawn wire? The tool I require is one that will cut out the strip of cane to enable me to lay in the wire, and also replace that which I cut out."



Section of Cane—A, Cane; B, Piece to be cut out; C, Wire.

**Drilling Grindstones.**—T. A. D. (*Royton*) writes:—"I wish to ask if any reader of WORK can tell me what kind of system they have in those quarries where they make small grindstones, about 1 ft. in diameter and from ½ in. thick upwards, of drilling the holes in the centre? and if they are drilled on a machine or by hand? and whether they use ordinary drills or diamond-pointed drills? At the shop I work in they make a machine which is fitted with these stones in it to grind small moulding irons for joiners, and they have a square hole in them about 1 in. square, and we have to drill them out to 1½ in. round size. When we have drilled one hole in, it makes the drill too small for the next one. It takes all the edge off the drill where the stone touches the drill. We drill them on an ordinary drilling machine—a vertical one. We have had the drills hardened as hard as we could get them without breaking them. The stones come from the neighbourhood of Rotherham, in Yorkshire, and are of a soft nature. I should also like to ask if they are done with a machine, what kind it is, how it is worked, and by what means—whether steam, water, or hand—and what kind of drills?"

**Plan of the Heavens.**—M. D. C. (*Liverpool*) asks:—"Can any reader make a suggestion to utilise the plan of the Heavens given with the first part of 'The Story of the Heavens?' My idea is to have a stand with the plan in a frame with a swivel, to turn it round if required, and to take it off when not required."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Bath, to Heat.**—J. H. (*Smethwick*) writes, in answer to ROUND O (see page 414, No. 130):—"If he could raise his bath high enough to get one of Truman's stoves in under it he could heat his water at any time or to any heat. He would have to raise it at each end 10½ in., the height of stove."

**Mail-cart Handles.**—C. M. (*King's Cross*) writes:—"In reply to query by ADIA (see page 414, No. 130) about mail-cart handles, he can get what he wants from Mr. H. Matthews, Baron Street, Pentonville, who keeps a stock of them already bent, or would bend them to pattern if a few pairs were wanted. Mr. H. Matthews can be recommended for bent timber of any kind."

## V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. B. P. (*London*); J. S. (*Longsight*); T. D. (*Liverpool*); H. E. (*South Norwood*); GRANT; W. F. (*Ascot*); CHATHAM; ENVELOPE; H. F. M. (*Ramsbury*); LITHO; H. H. (*Finsbury*); J. S. (*Hampstead*); F. H. (*Battersea*); T. J. S. (*Finsbury*); W. E. D. (*King's Lynn*); N. F. (*Gateshead*); W. C. (*Sharpness*); C. A. P. (*Finsbury Park*); J. O. (*Bradford*); SCARBORO'; ESOR; J. H. (*Bishophill*); E. A. P. (*Tollow*); F. F. (*Brixton*); F. R. (*Gosport*); W. F. (*Gateshead*); W. N. H. (*Bradford*); A. B. (*Rochdale*); STOURBRIDGE; L. S. L. (*Kirkcaldy*); WHITEFIELD; BARKIS; J. H. (*Smethwick*); W. R. (*Yeovil*); LEARNER; LUX IN TENEBRIS; P. R. (*Edinburgh*); F. B. (*Aldershot*); J. G. (*Edinburgh*); A. P. M. (*Notting Hill*); E. J. B. (*Dartmouth*); J. P. (*Belfast*); EUSTACE; R. (*Edinburgh*); J. W. (*Camberwell*); R. C. (*Glasgow*); MAINSAIL; W. H. (*London, S.W.*)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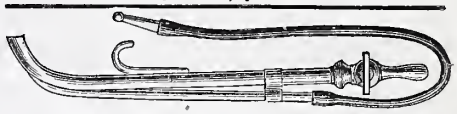

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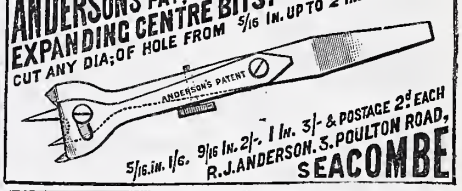


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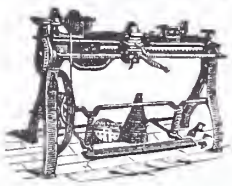

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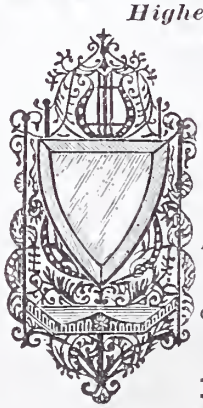

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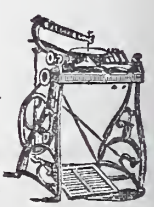

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# WORK

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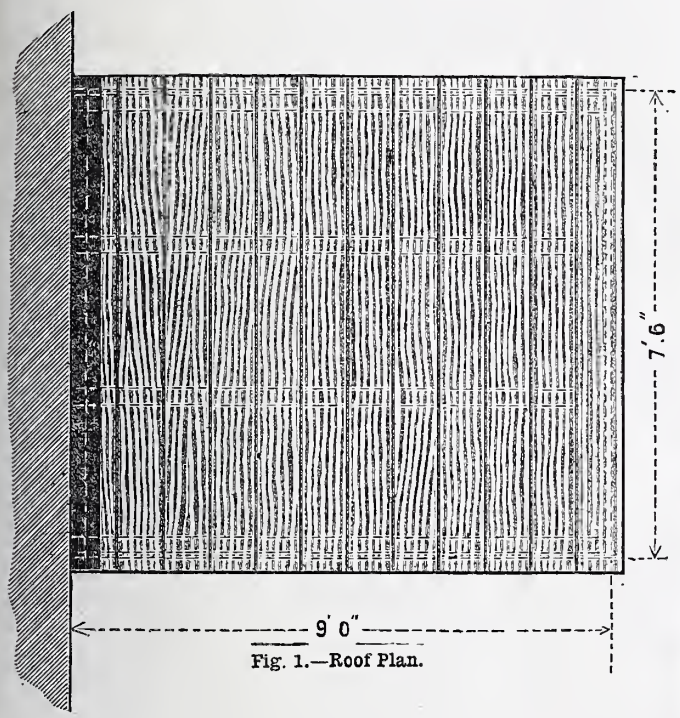



Fig. 1.—Roof Plan.

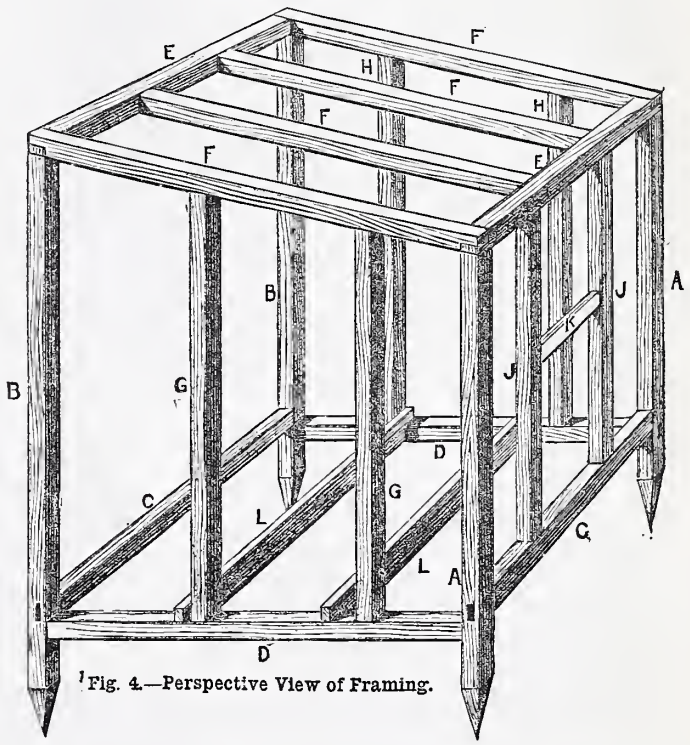



Fig. 4.—Perspective View of Framing.

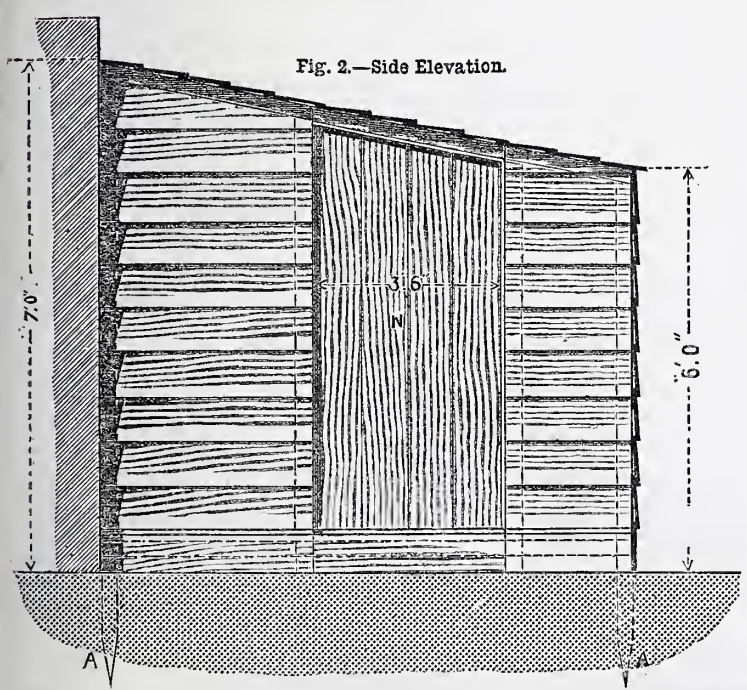



Fig. 2.—Side Elevation.

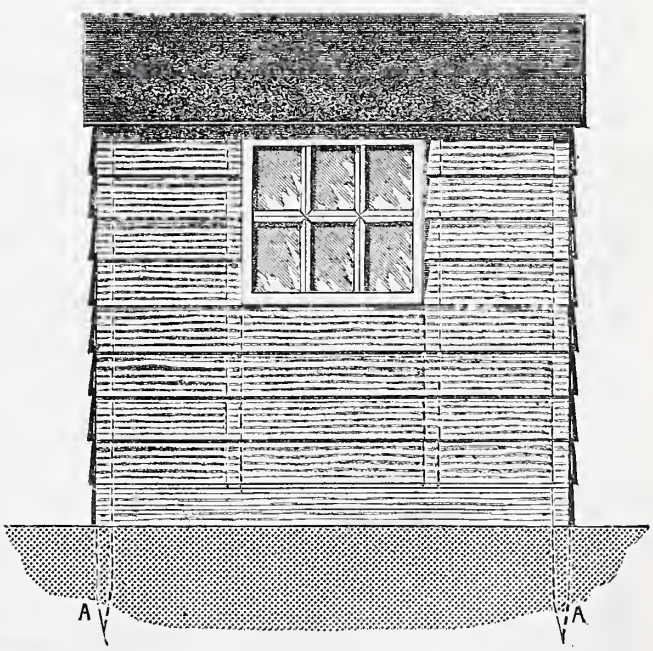



Fig. 3.—Front Elevation.

A CYCLE HOUSE.

## A CYCLE HOUSE.

BY J. H.

STORAGE OF CYCLES—GENERAL VIEWS OF HOUSE—MAIN FRAMINGS—BOARDING—PORTABILITY—COST—QUANTITIES REQUIRED.

*Storage of Cycles.*—Cycles, and especially tricycles and tandems, are awkward things to store away in the little houses occupied by working people in the towns. Some kind of shed is indispensable. The wash-house, or scullery, or kitchen is out of the question. It is a pity to use the green-house; a fowl-house is not nice; so a special place is almost indispensable. Such sheds are advertised at somewhat high prices, prices that are prohibitory to many young cyclists. I will show how a shed can be made for less than half the price of one of these, provided the cyclist is a bit handy with common tools. I propose to describe in detail a fairly large one of my own, made a couple of years ago. It contains a cripper tandem, a cripper tricycle, and two safeties—one full-size, the other a lad's machine. The house measures 9 ft. by 7 ft. 6 in., and cost less than £3 for materials, and being well tarred will stand for as many years as I and mine shall be likely to want it. A house of half the size would hold a tricycle and a safety, or three safeties, and the cost would be reduced in exact proportion to size.

*General Views of House.*—The general construction of the house is shown in Figs. 1, 2, 3, 4. Fig. 1 is a roof plan, Fig. 2 a side elevation, Fig. 3 a front elevation, and Fig. 4 a perspective of the main framework, given to assist amateurs to a clear understanding of the method of its construction. It is a lean-to shed, a wall occupying one side. In my case the roof slopes *towards* the wall, but as in most instances it would be more convenient to allow it to slope *away* from the wall, I show it thus in the sketches. The low wall against which my house leans happens to carry an oblong rain-water tank on the top, and the rain runs off the roof into the tank; hence the reason why I so built it.

*Main Framings.*—The main frames of the house are made of spruce quartering, having a cross section of 3 in. by 2¾ in. They are these (Figs. 1, 2, 3, 4):—

Four uprights (A, A, B, B), four horizontals (C, C, D, D), two roof horizontals (E, E), and four rafters (F, F). These are all mortised and tenoned strongly together, as I will show in detail in the next article. Upon the way in which the work is done, the stability of the house largely depends.

There are also two uprights (G, G) of the same cross-section, 3 in. by 2¾ in., that form the posts of the door. Also two uprights (H, H) to afford a central support to the boards on that side of the house, and two uprights (J, J) and a cross-bar (K), between which a window-sash is placed.

There are two joists (L, L), having a cross section of 6 in. by 1 in., fixed on and between the horizontals, D, D. These carry the flooring boards, of ¾ in. spruce. The house is therefore quite dry and clean.

*Boarding.*—The framework is covered over with spruce boards, ⅜ in. thick by 9 in. wide, overlapped about an inch at the joints, and nailed to the quartering and to each other. The roofing boards are covered with felt, well tarred. The door (N) is made of 1 in. spruce boards battened together.

*Portability.*—This house is built in such a way that it can be taken down and removed with the least waste of material possible. It is also economical, as the following account will show.

*Cost.*—The cheapest way to buy timber in moderate quantity is to purchase it in a deal or deals, and pay for sawing. Spruce deals measuring 11 in. by 3 in. cost fourpence per foot "run"—that is, fourpence for each foot in length. Sawing costs from 2s. to 2s. 6d. per 100 ft. superficial. Now the quartering is made by cutting a 3 in. deal into four strips—that is, three shallow cuts. ⅜ in. boards are made by cutting a 3 in. deal into six—that is, five *deep* cuts. In the first case a 12 ft. deal would cost at 2s. per 100 ft. about 2½d. for sawing. In the second a 12 ft. deal would cost 1s. 1d. for sawing.

Now for quantities required.

*Quantities required.*—Running through the dimensions given in the figures, we see that about 160 ft. of 3 in. by 2¾ in. quartering are required. Dividing this by four, it means that 40 ft. of 11 in. by 3 in. is wanted, and this will cost 160d. plus, say, 9d. for sawing—total, 14s. 1d.

Of ⅜ in. stuff we shall want about 220 superficial feet, equivalent to about 40 ft. of 11 in. by 3 in. at fourpence, costing 13s. 4d.; sawing this will cost, say, 4s. ⅜ in. flooring board, 7 in. wide and 1 in. thick, costs from ¾d. to 1d. per foot run, according to quality. About 150 ft. run will be wanted for floor and door—say, 150 times ¾d.—roughly, 9s. 6d.

An old sash can be bought for 1s., a pair of hinges and padlock for 1s. 6d., nine yards of felt for 4s., two gallons of tar for 1s., and six pounds of various nails for 1s., so that our account stands thus:—

| | s. | d. |
|---|---|---|
| Quartering | 14 | 1 |
| ⅜ in. stuff | 13 | 4 |
| Sawing do. | 4 | 0 |
| Flooring, etc. | 9 | 6 |
| Sash | 1 | 0 |
| Hinges | 1 | 6 |
| Felt | 4 | 0 |
| Tar | 1 | 0 |
| Nails | 1 | 0 |
| | 49 | 5 |

And every scrap of this timber will be new and clean, and sawn to thickness. The prices, too, are not the lowest possible. In some seaport towns lower prices can be figured.

In the next article I shall conclude by giving a detailed description of the methods of union adopted in these various parts, using the same reference letters as those employed in the present article.

## REPAIRS TO FLUTES, CLARIONETS, ETC., THAT MAY BE DONE BY AN AMATEUR.

BY B. A. BAXTER.

INTRODUCTION—PADS AND PADDING—SPRINGS—CLARIONET MOUTHPIECES—REEDS—SOME REMARKS ON THE CLARIONET AND ITS HARMONICS—CRACKS IN THE WOOD.

THE flute-player, or, indeed, any of those musicians who play upon the instruments grouped under the term of "wood wind," have need of mechanical ingenuity, in order to effect trifling repairs to their instruments, which are very delicate, and sometimes complicated pieces of mechanism.

It is not intended to give here any instruction to effect radical alterations in the instrument or its fittings; any directions I shall give will be of a conservative character, and I most strongly advise the most thorough and careful examination of any defect before the player attempts to cure it. When a would-be player first invests in a new instrument—new in the sense of his own inexperience, though it may be second-hand—he cannot always afford to buy the best instrument of its class, nor one that bears the warranty of the firm who sells it. By the way, the mere imprint of maker or seller's name is not a warranty of perfect condition. The beginner may have to be content with one of those instruments imported from France or Germany, which are sold by music warehousemen and dealers generally. These instruments are usually good; they bear no name and are sold as received, the dealer accepting no responsibility on the subject—good, I ought to say, according to the price; and if the young flautist can get a friend with experience to select his flute, he may be well content to have what is called a warehouse instrument.

But we will suppose it bought, and some progress made in learning. Some tones appear too loud, some harder to produce than the rest, some too faint to be in keeping with the rest, some too flat, some refusing to sound at all. Now, some of these are due to the player's inexperience, some are curable defects, though I shall not pretend that all are within the control of the amateur.

*Pads and Padding.*—The flute or clarionet will not sound aright unless the pads close perfectly the holes they are intended to cover. Pads may be bought at moderate prices, according to material and size, from 3d. to 1s. per dozen. First test each piece of the instrument separately by stopping one end and the finger holes, blowing into the other end: if a little water is placed on each pad it will soon be evident if any of them leak. Look if there is any chip or dirt lodging in the hole or on its edges. See if the springs act perfectly to keep the key closed, and if no fault is discovered there the defect is probably in the pad; some of them are made of a skin or membrane, like gold-beater's skin; this in a short time wears on the sharp edge of the wood. Select a new pad from your stock of the proper diameter and thickness, and, having removed the key, make it hot at the end where the pad is fixed; this may be done in a gas-flame, or a composite candle will give heat enough. Avoid holding the key *above* the flame: this will blacken it, so that it will be difficult to clean perfectly; hold the key close to but below the flame, in order to warm it. The old pad will be easily removed and the new one fitted with either shellac, good sealing-wax, or even bicycle cement, preference being given to the first of these, and either being used very sparingly, for we do not want cement or anything else to spoil the softness of the contact of the pad with the instrument. See that the pad fits well and replace the key at once, while warm; the pad will more readily adapt itself to the hole it has to cover.

*Springs.*—The springs of each key, though differing in size, should offer about the same resistance to the finger, though this must be quite secondary to the duty of the spring in keeping the key air-tight. In open keys, which the finger and not the spring closes, the spring can be as slight as may be desired. To weaken over-strong springs, I have found that a pin or a piece of wire placed between the spring and the key, and gently pressed towards the root of the spring, will lessen the curvature, and, therefore, its resistance. As this can be done without taking the key off, and the effect can be felt at once, it is a very good way to regulate the springs. It is not available for needle-springs, which,

however, do not so often require regulating. These I have at times regulated by merely pinching with pliers, so as to slightly reduce or increase the curvature as required. All this foregoing is applicable to any of the wood-wind family.

*The Clarionet.*—Now a few words about the clarionet, with which I am more familiar. A flute is a mere tube, in which a column of air is vibrated by the skilful way in which the player directs a stream of wind, neither wholly into nor outside the tube; the varying length of the air column is effected by the fingering.

In the clarionet, however, we have a reed vibrating outside an aperture smaller than itself, through which, therefore, it cannot pass: opening and closing this door-like arrangement with rapid, yet periodic, alternation, it produces a tone more or less musical. The tube, however, asserts its power to modify both the rapidity of the reed's movement and the quality of tone produced. Now, to do this it is important to have a good mouthpiece. The clarionet mouthpiece is a partly turned and partly carved wooden tube, in which the cylindrical hole in the end is gradually reduced to an aperture in the side of the mouthpiece, the reed resting on an almost flat surface, reduced from the original turned exterior.

A little consideration will show that this almost flat surface must be curved so as to allow the reed enough liberty of movement, that the shape of the curve must be such that the reed by its own flexibility, aided by the player's lips, will close the aperture. Hence the exact shape of the almost flat surface of the mouthpiece on which the reed rests depends on the stiffness of the reed and the strength of the player's lips. Here, then, is the reason of the difficulty in "laying" a mouthpiece, as it is called. Three varying factors contribute to the result, and must be brought into suitable relation to each other. Let no one think I wish to set all the young clarionet players to alter their mouthpieces; I do not. Had my reading some twenty years ago extended to repairs of this kind, I should have done much less re-laying, and better than I have sometimes succeeded in doing it.

Never try to re-lay a mouthpiece unless you have a good reed to try it with—a worn-out or badly cut-down reed will not do. Be sure to have the curvature of each side alike, or no certainty of tone can be expected, but an occasional piercing shriek may be foretold. After these warnings, you will expect to be told what to do and how to do it. If the clarionet will utter the lower sounds well, the opening between reed and mouthpiece is long enough; if it is hard to get some of the upper tones, the lay is too straight; if the very highest tones are impossible, it may be the fault of the reed, for I have proved that a reed cannot be made to vibrate more quickly by the tube to which it is affixed, though it can, and is, made to vibrate more slowly by the addition of the tube. I satisfied myself as to that by cutting the back out of a mouthpiece, so that there was really no tube; trying various reeds, I found various pitches, rising according to pressure of lip and wind, but in no case could I coax a reed to give a higher pitch on the complete clarionet than was possible on my mutilated mouthpiece. In order to prove whether a mouthpiece has its sides alike, the best plan is to obtain a piece of plate-glass, and holding it in contact with the flat part, test the opening with pieces of sheet-metal of even thickness, or pieces of note-paper, or even a postcard; if either lies obliquely, then the curvature is not alike on each side. In order to give some assistance as to the curvature of the mouthpiece, having measured a very satisfactory one, I find a white postcard will enter $\frac{3}{8}$ in., that the paper on which WORK is printed will enter $\frac{2}{8}$ in., and a buff postcard nearly $\frac{3}{4}$ in., while the reed and mouthpiece are in close contact an inch from the end of mouthpiece. But, as I have said, the reed and the lips of the player are factors in the result. A stiff reed requires less aperture; a flexible one more. By all means choose a reed as stiff as can be played with comfort; it is finer in tone and is more durable—moreover, it makes the high notes more certain.

*The Reed.*—Many players are not able to secure good reeds without trial; this is out of the question, but we may *look* at the reeds when we buy them. Hold a well-made reed up to the light, and the stouter part is seen to be opaque, while the thinner part is semi-transparent; that the change is gradual and equal on each side of the centre; see also the colour, which is an evidence of the ripeness of the cane—like the straw of corn, it is at first green, changing to a yellow, from lemon-yellow to orange or buff; avoid all greenish reeds or very pale lemon colour; also avoid dark yellow or buff-coloured cane. One is immature; the other is over ripe, and gives a splendid tone, but, alas! it is for a very little while, the cane soon losing the elasticity necessary to the best results. Try, therefore, to get reeds of a medium yellow tint; if the grain is well-marked, like a piece of wood, so much the better. A good reed will be found to retain its smoothness when wetted. If any get very rough when first put into use, throw them away, and avoid making your lips sore. A reed too stiff may be rubbed down carefully with a piece of "water of Ayr" stone moistened with water, which also, I ought to say, is useful to finish the lay of a mouthpiece, after the finest files have done their best to attain perfection.

*Harmonics.*—All the upper tones of wind instruments are due to harmonics: in the flute the octave is the first, and in the clarionet the twelfth is the first interval obtainable as the result of harmonics. The clarionet produces the odd series of harmonics; and, with the exception of *stopped* organ-pipes, I believe it is aloue in this respect.

*Cracks in the wood* are best prevented: care in the use of either of these instruments will often prevent a crack which carelessness would certainly produce; avoid any unnecessary moisture, and wipe out the instrument as soon as playing is over; do not expose it in a moist condition to the influence of heat, and treat it to a trace of oil occasionally, which may be of a drying character, in the iuside. Be sure not to let any drying oil go on the pads; let them remain clean, or if stiff from watery moisture, use a little vaseline, which may also be used to lubricate springs, but apply it very sparingly, or the instrument will collect dirt very quickly. If a crack should be noticed, it will probably begin on the outside: stop it at once. If the wood is greasy, perhaps marine glue is the best, or shellac varnish; but if not greasy, fish glue or best Scotch or Cologne glue would do well. If possible, get a turner to turn a shoulder and put on a ferrule; but by taking the precautions I have indicated, it is to be hoped nothing more will be required.

The above, I trust, will be found a very fair summary of the extent to which an amateur may reasonably proceed in repairing the two instruments mentioned.

## BOOT AND SHOE REPAIRING.

BY WILLIAM GREENFIELD.

### How to Re-welt and Re-sole Hand-sewn Work.

In this, my last article on "Boot and Shoe Repairing," I will deal with the two above subjects. They are certainly the two hardest that I have as yet put before you; but being the most important, or the two nearest approaching the making of a boot, it would be hard to say how important a part they will take in giving you a comprehensive knowledge of the more practical part of boot and shoe making.

You ought by this time to be pretty used to using the awl and thread, therefore, although the hardest, they ought to come far more easy than some of the minor repairs did, for in shoe repairing there is seldom a week passes without there are jobs of some kind to give a little practice and keep the hand in trim. But to proceed with the work in hand. It should be borne in mind that a last must always be put in and fitted well to the boot or shoe, or you will not be able to make them look well, and there is a *chance* of making them smaller. Pieces of stout leather can be put down on top of the lasts, or even pieces of bundle-of-wood stick will do, tapered at one end, and the thin end knocked in first; but then this must be done carefully, or the vamp may break just in front of the lacing. Fitting them up well in this form should make the bottom solid all over, and keep them in their proper shape.

A thin, long tack must be put in the back of the boot to keep the last in its place, as at A, Fig. 1; then put the sole and welt part in water, and when it is nicely wet take it out, wipe it, and cut the old sole off. This is done by putting a knife between the sole and welt at B, and continuing right along, round the toe, and down the other side to C. The old sole can then be cut away, cutting across from D to E if it is going to be a riveted or pegged graft, as shown in the first article (see WORK, Vol. III., page 113, otherwise No. 112), or from F to G if it is going to be a sewn graft.

In either case a small hole can be made in the old leather at H, and a piece of waxend put through, that it may be drawn down flat on to the top of the heel, securing it there by tying the thread round the nail at A. This keeps it in position while grafting, and also sewing in the welt. If you intend to welt it all round, carefully cut the old welt away from I to J, and take away, *pro tem.*, the bottom filling, K.

The next thing to be done is to fit the welt, which is a long strip of oil-dressed leather (price from a 1d. per pair). They must be buffed on the grain side, cut in two straight down the centre, tied in a knot, and put into water to get wet—thoroughly soaked, in fact, for they have to be used wet. But before they are ready for use they have to have an angular piece taken off the grain side, as shown at A B, Fig. 2. This will, when turned over (that is, grain side down), show an end as Fig. 2, A, and this is the position in which it is held while it is being sewn in.

You proceed with the sewing as shown in Fig. 3, starting by putting the thread in at A, then halving the thread, as shown before, and making a hole at B, and while the awl is in, place the welt against the upper at its point, and make a hole in it at I, as shown by the arrow in Fig. 2, A. You then put the bristle through first, that is in the left hand,

and then the one in the right, and pull them both out, changing the bristles by this means into the reverse hands, and set the stitch as before explained. This you continue, as in Fig. 3, until you reach the old welt on the other side.

To sew in the welt, use a sewing-awl and a thread about the same substance; this, with a fair amount of wax, as the two ends have to go through the same hole, makes it solid.

When the welt is sewn in, hammer the seam down all round, giving firm blows, so as not to break or bruise it. Then carefully skive off any surplus stuff above the seam that may in any way make it uneven or clumsy, but do not cut near enough to the seam stitches to weaken them.

For repairs it is only necessary to skive the waste part (that is, the ends) of the welt a little thinner after they are sewn in, though it can, and therefore should, be done first; but a novice is apt to make them too thin, and weaken it where it should be solid, having to stand against the splice or graft in the sole. A piece of tapered bone should now be rubbed round between the upper and the welt, to make the welt flat to receive the stitches which the sole will have to be stitched on with. The edge of the welt must now be rounded up to the shape required. Generally it does not need to have much taken off, only just a little here and there, to make it a good shape, for a pair of welts when split in two is nearly always the necessary width, but at places the stitching somewhat contracts it, and thus leaves prominent parts, which are best cut off, and, as shown by the dotted line in Fig. 3, is always a little too wide at the waist.

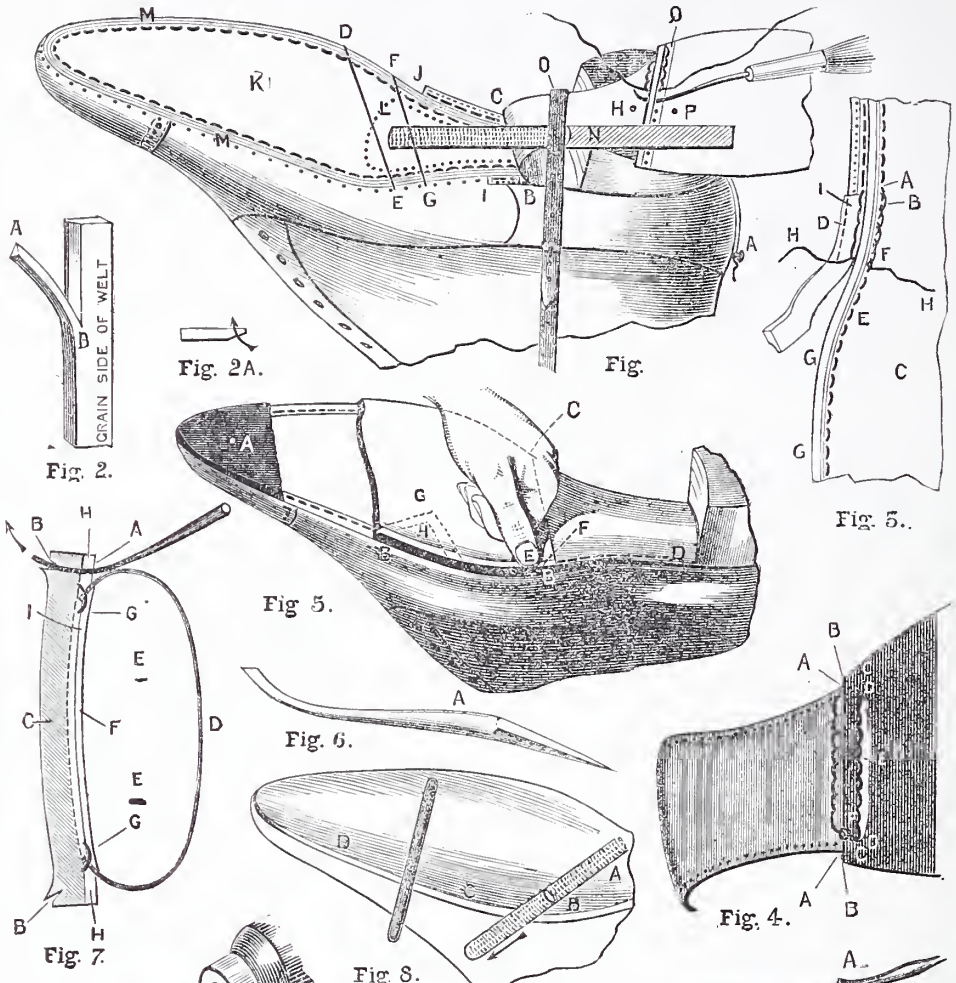



Fig. 1.—Boot showing Sole and Welt off and Waist turned back ready for Grafting, and Position to hold it while doing so. Fig. 2.—The Welt, with Piece nearly taken off to prepare for Sewing. Fig. 2 A.—Amount of Welt taken up in Sewing. Fig. 3.—Section of Boot, showing how to Sew Welt in. Fig. 4.—How to Sew Graft. Fig. 5.—Showing how to Fit, Stitch, Sew, etc. Fig. 6.—Blade of Stitching-awl. Fig. 7.—Transverse Section of Boot, showing Interior and Action of Awl in Stitching (A); B B, Channel; C, Sole; D, Upper Leathers; E E, Interior; F, Insole or Welt Stitch; H H, Welt; I, Bottom Filling. Fig. 8.—Showing how to rub down Channel. Fig. 9.—Fudge-wheel. Fig. 10.—Section of Boot, showing how to Stitch and Prick them up. Fig. 11.—Double Iron, showing Guards.

If the old bottom filling is good, paste it in again at K, Fig. 1; if not, replace it with new.

Felt is used for this purpose; a pennyworth will fill three or four pairs. In this case cut a piece a little larger than the old, and paste down the shank (generally a piece of skived leather, which reaches from under the heel to the dotted line, L, and just the width of the waist), then paste the new piece of felt in the bottom, hammer it in well all over, and let it dry while you do something else, and when dry skive off the edge all round at M M, making it level with the welt stitch and the centre, K. It is then ready to receive the sole. Prior to placing the sole down, the graft must be made—that is, if you intend to make a sewn graft.

To do this, it is all important to have the old leather cut straight across, and straight through from A to A, Fig. 4, and also the new sole from B to B; then draw a line from C to C about $\frac{3}{8}$ in. wide, and a second one, about $\frac{1}{8}$ in. from the first, reaching from D to D.

From D to D on the first line cut through into the leather about $\frac{1}{16}$ in., holding the knife quite upright; this can then be opened with any blunt instrument to show how far you have cut through. Then from this channel cut one side away to where the second line is (this is towards the toe), holding the knife this time quite slanting; this is to make a recess to receive the stitches, and make a flat seam to the graft, as shown at E.

From D to D make a series of holes (about five to the inch) with a sewing-awl, placing the point flat on the bottom of the recess and putting it through until its point is just seen in the edge of the leather, about $\frac{1}{16}$ in. from the grain edge.

All this should be done on the flesh side, with the leather fitted in the same way as shown in Vol. III. of Work, page 113, *et seq.*; with one exception—that is, this being sewn work the leather has to be used a little more wet.

The boot is now put on the knees, with the toe to the left and the back part on the right knee, in the position shown in Fig. 1, and, as also shown there, with the old waist tied back. The new sole can be put against the old leather, and an old rasp put along on top, as shown at N, and the strap or rope put round the toe of the boot you are wearing, and round the waist of the one you are repairing, as shown at O, and O passing over the rasp, which will, as it presses upon shank, L, the old waist, H, and the new sole, P, keep them all solid while the graft is being sewn.

The graft should be sewn with a good strong thread—say about fifteen strands of No. 9 Patent, or equal to it if a stouter hemp is used—and plenty of wax should be worked into it before it is twisted.

The sewing should be commenced at Q, and continued across to D F, Fig. 4, tying a small but firm knot at F, as each end must be particularly solid, and for this reason it is quite as well to make two short threads, and using one for each graft—it is better than starting and ending with a knot; and another thing is that novices wear out a thread much quicker than an experienced workman does, as it is handled more, and not pulled through without occasional snaps and jerks, and this seam must be solid even at the expense of neatness, which if riveted cannot so well be attained.

It will be seen that the grafting is done on the top of the heel; this is because it is the most convenient place according to the position of the old leather, and also to get a flat surface to work upon—viz., the old top-piece.

If it is found difficult to keep the sole firmly in position by means of the rasp only,

a long rivet can be put in at H, and another at P. They will only go through into the old lifts, as the heeling should be left till after the soling is done, and the two holes can soon be rubbed out in the finishing.

The graft sewn, the whole of the bottom, K and L, and also the new and old leather, H and P, should have a thin coat of paste. The sole can now be put into its place, pulled over from the toe, and a rivet put through, to keep it in position, as at A, Fig. 5, and one through the hole in the sole that was called P, on the other side of it, in Fig. 1.

This done, hammer it evenly all over, and then pare it up at the edge, close to the welt, the whole way round, as it is shown at B B, Fig. 5. This, as the sole is wet, can, with a little care, be easily done without cutting the upper part, and should be done so as to form one even edge all round, and be kept square or at right angles with the flat of the welt. A line can now be drawn with the compasses all round, about $\frac{1}{16}$ in. from the edge, and upon this line the channel is to be cut to receive the stitch.

To cut the channel the boot has to be held between the knees, with the toe towards you, and a sharp-pointed knife must be held between the thumb and finger, letting the second finger rest upon the top edge of the sole. The knife will then be somewhat in the position of a pen while writing, but it must be held firm, and its exact position with the flat of the welt should form an angle of about 50°. It should cut right through epidermis (the grain) and into the dermis (the fibrous and wear-resisting property) sufficiently to let the thread lay well into it. This will be nearly half-way through the leather, whatever the substance may be, as it is the substance of the sole that will have to decide the thickness the thread will have to be that is to lie in the channel.

The thread being embedded into the firm part of the sole gives not only solidity to the stitch, but leaves the scarf-skin, or grain, free to form a covering for the stitch.

When the channel has been cut, as from B B, and round the toe to C, Fig. 5, it can be opened with any blunt instrument. This is that you may see that the point of the awl comes out in the pit or centre of the channel, and to give the stitch room to fall into it while you are stitching. The grain edge of the channel, G, can be turned over for about two inches. This is to prevent the stitching-awl from notching it, which would make it very irregular and unsightly when finished. When you have set about a dozen stitches, again repeat the process by passing the left-hand thumb-nail along from the last stitch for another two inches.

One of the most essential things to give a good result, and save disappointment, is, in rounding up the sole, not to cut it too close to the welt, more especially on the outside, unless the wearer wears most on the inside, then, of course, the system is reversed.

Prior to stitching the sole on (which is generally done when a boot has been welted) the waist will have to be sewn down with the sewing-awl. It does not matter so much about a channel being cut in the old leather, as the waist can be blacked, which helps to hide the stitch, though if the leather is sufficiently thick to admit of it, it will make a much neater finish.

The sewing is started at D, Fig. 5, and the sewing-awl used till you get to B, the first stitch on the new leather. Then the stitching-awl is used; but, before I go any further, I must tell you that at these two points, B and C, the sewing and stitching should be so arranged that a stitch is set from the old to the new leather, across the graft at B, and from the new to old at C, so as to make these (the weakest points) quite solid.

The stitching-awl is put into the same sort of handle, and is a similar instrument to the sewing-awl, with the exception of it being flat the reverse way, as shown in Fig. 6. In fact, it has now almost taken the name of "the square awl." It will be seen by this figure that when put into the handle it cannot be straight, but has a bow and pitch, at A and B. This makes it more handy to get into awkward places, and gives from pressure on the handle a power that could not otherwise be obtained.

The action and use of this awl are very peculiar—it must not be wriggled about as explained for the sewing-awl, but passed through by one rapid and almost straight jerk.

First, the boot is held on the knees by the strap, toe towards you, on its side, with the sole to the left, and the upper to the right, with the thumb of the left hand pressed firmly against the bottom of the sole, just beyond where the point of the awl is to come out, as shown by E in Fig. 5. The awl is then laid on the upper, with the point against the flat of the welt. It must then be pushed through by one sharp push, just dropping the elbow a little in doing so, sending the point through into the channel that was cut in the new sole, as shown at F, Fig. 5, and also at B B, Fig. 7, the curved motion being indicated by arrow at the top, B.

By looking a little at Fig. 7 a good idea can easily be gained of how a hand-made boot is really put together. It is what a boot would be were you to cut it right through in a transverse direction at the centre of the sole. The key to the various parts will be seen in the description of the diagrams.

The stitching is continued right round, as far as the new leather goes, then the old is sewn as on the other side. Then the channel is again opened, and the stitches that are within it rubbed down well with the bone. Here and there a little paste is put in. This is rubbed in even all round, by putting a piece of rag over the right thumb, and the nail put in the channel, and rubbed up and down all round.

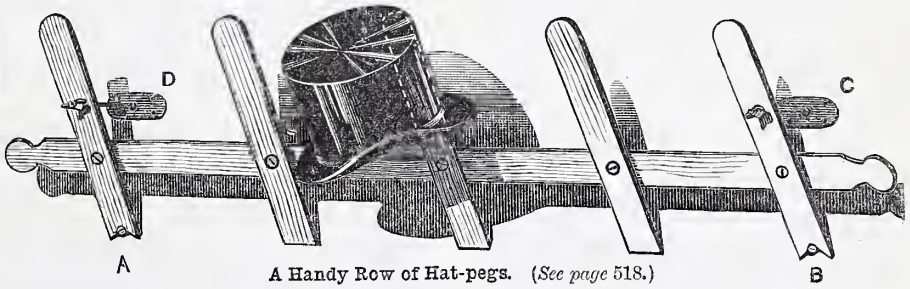
The boot is then held in the left hand, with the heel towards you, and the channel is laid down with an old file, by taking strokes in an outward direction from the centre of the sole, encroaching each time upon the channel in a direction towards the toe, as shown at A B, Fig. 8, which is, of course, continued all round.

The boot is then held in the same position as at first, and a bone or long stick is held with one end in each hand, and the channel is rubbed hard up and down from C to D, and so on until the whole is well rubbed down. Both these actions throw the thin narrow strip of grain (H, Fig. 5) over on to the edge, and it forms a sort of burr all round.

The boot is then held with the toe towards you, and with the back of the knife the edge is scraped in an upward direction to throw this burr on to the top of the sole. The knife is then held flat on to the sole, and the burr cut off level with the top of the sole. The stitches are then rubbed down a little on the welt side with the tapered bone, wetting with the mouth a little every now and then while using it. The bottom is then well and evenly hammered all over.

Before the stitching is commenced (as the stitch is wanted to show up bold on the welt) the fudge-wheel (Fig. 9) should be run round. This will make an impression on it as though it were stitched, and if the awl is put in exactly in the wheel-marks it will do a deal to make the stitch regular.

But to get a bold and even stitch this is not all that is necessary, for there is a mode of setting the stitch that is the principal factor in producing this *desideratum*. Each time that the awl is taken out put the left-hand bristle in first, as usual, and in putting in the other one, on the right side, let it pass on top of the other. This will throw up the stitch towards the edge, and if carefully done each time the stitches will form one straight line, as shown by the diagram (Fig. 10). The stitch can be set at, say, 12, 14, 16, or even 18 to the inch, according to work, but 14 will do well for ordinary work, while 18 is seldom necessary for repairs.




**A Handy Row of Hat-pegs.** (*See page* 518.)

After the stitches are rubbed down, the wheel (first warmed) can be carefully run round, letting each cog run between each stitch. This will, in every sense of the word, prick up the stitch, or a prickstitch can be used between each stitch, as shown by A, Fig. 10. The thread should not be twisted much.

The boots are then finished in the same way as described in Vol. III., page 113, *et seq.*, with the exception of ironing up with a double iron, instead of a fore-part iron. A double iron (Fig. 11) is in reality a jigger and fore-part iron combined; the guard A being run on the welt side, and the guard B on the sole side.

For the heeling and other details I must again refer you to the first paper in No. 112, and those that have followed.

And, so saying, I finish my series of six papers on repairs; and six more are in preparation on making, in which I will try my utmost to bring you on—as in these—in progressive form, till you are able to make and repair boots and shoes, not only good enough for yourself, but so that you may at any time, should it be necessary, or to your advantage, be able to take work from others, and recompense yourself in the way that all who try deserve to be recompensed.

## A HANDY ROW OF HAT-PEGS.

BY J. C. KING.

We all like something we can make in the way of useful household furniture, especially if it can be made without trenching too much on our spare time and spare money; and if it be with some practical advantages we are rather proud of showing it to our friends and expatiating on its merits. During the 1889 Exhibition in Paris, when rents were so high for visitors, the rooms and entries of many of the humbler dwellings were found to be scantily provided with hat-pegs and stick-racks. The S-hooks with knobs were few or absent, which was so much the better for the hat, which somehow so easily comes off that form of hook, or, if it stays, receives a bulge imparted by the knob.

Nailing up a wooden rail for hooks in a French wall leads, in point of fact, to the creation of dilapidations, for which the owner of the apartment does not forget to make you pay on leaving, if the nail does not come away long before, and make you wish you had put your hat on the bed-post or the table. Some friends staying in Paris during the Exhibition found no hat-pegs at their lodging. Something had to be done, and that quickly. The handy man of the family went out, and soon brought back materials: a piece of pine 5 ft. long, 2 in. by 1 in. size, and six pieces 12 in. long, 1¼ in. by ⅝ in.; six screws 1½ in. long, and four screws 3 in. long; and two bits of copper wire 12 in. long. A file, gimlet, hammer, screwdriver, chisel, and sand-paper were part of this young fellow's belongings, so the hat-pegs were made by screwing the short pieces on to the long piece, as shown in sketch; rounding the ends at top and notching the two end pegs at bottom, as shown at A, B, and at the distance of one-third from the top of end pegs boring a hole for the copper wire, which was fastened to two wedges of wood securely fixed in the wall, and a brass screw turned tightly into the wedge, with a leather shield to save the wall from ragging up. Two pieces of copper wire looped under the screw-heads, and held tight against the leather, as shown at C, D, fixed it. The whole concern rested on two screws and hung on two others, with the top ends about six inches from the wall. The whole job only took half an hour, and served for months for hats, coats, and dry umbrellas; and when the lodging was left the room owner gladly gave two francs for it rather than have it unscrewed from its place.

I must not omit that it was admired by visitors so much for its handiness that one of the party gave it a stain, to look like mahogany, of red and black ink mixed—very little of the latter—and some gum to stop the grain; and a coat of spirit varnish made it look like a "fabrique de Paris."

## A BOW SAW FOR DEEP CUTTING.

BY OPIFEX.

Introduction—Advantage Claimed—Materials—Construction — Dimensions — Sides — Cross-piece—Levers—Handles—Tightening up.

Finding the ordinary pattern bow saw to be unsuitable for a special piece of work which required rather deep cutting, I lately made the tool here illustrated, and as it answered its purpose so satisfactorily, I offer the suggestion, hoping it may prove useful to some of the readers of Work.

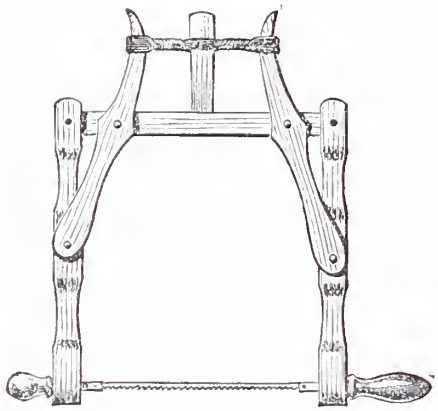
The *advantage claimed* for this saw is that it is twice as far-reaching as one having the cross, or fulcrum piece, placed in the usual position, which is, I think, a point of considerable importance to those who do not possess a band saw, etc.

*Materials.*—All the woodwork is of good, close-grained beech, which should be well seasoned and free from shakes of any kind. The only other items are four small bolts, 2 in. by $\frac{5}{16}$ in.; four washers to match; two copper rivets, 1 in. by $\frac{3}{16}$ in.; about 36 in. of strong clock gut; and, of course, the handles and saw blade.

The *details of construction* will be easily gathered from the drawing, and I shall not occupy more space than is necessary to describe them very briefly.

The *sides* of the frame are 15 in. by 1¼ in. by $\frac{5}{16}$ in., but these dimensions may be varied proportionally to suit any size of saw—a remark which also applies to all portions of the saw.

The *cross-piece* at top is 15 in. by 1½ in. by $\frac{5}{16}$ in., and is mortised at each end into



A Bow Saw for Deep Cutting.

the sides, the tenons being held in position by a rivet passing through the centre of each. The shoulders of the mortises should also be slightly rounded and the joints made an *easy* fit, so as to allow of a certain amount of give-and-take movement when tightening up and slackening the saw.

The *lever pieces* may be of ½ in. stuff, and for these the wood should be carefully selected, that the grain may run perfectly straight. They are attached to the sides and cross-piece by the bolts already described, the squares of which should be filed round and the nuts fastened up with washers at the back.

The *saw handles* may be bought at any tool-maker's, etc., for about 1s. 3d. the pair; or they may be easily made, as they consist of two beech handles fitted with brass shanks, having a slit in each to receive the onds of the saw, which is secured in position by a small pin passing through the brass shanks.

The shanks pass through suitable holes—which should be carefully bored with a clean-cutting bit—in the lower ends of the side pieces, as shown in the sketch.

*Tightening up.*—Holding the upper ends of the levers as tightly as possible with the hand, bind them round with six turns of the clock gut, knot the ends firmly, and insert the "tightener," which may be 6 in. by 1 in. by 1¼ in., and slightly tapered. Give two twists to the gut, and the saw will be found to be sufficiently rigid.

## A NOVEL USE FOR PHOTOGRAPHS.

BY ALEXANDER MARTIN.

Introduction—Advantages and Disadvantages—Description and Construction of Shelves—Mirrors — Securing Photos — Mounts—Candle Sconces—Medicine Cupboards—Conclusion.

*Introduction.*—In this novelty-loving age there are constantly being produced all kinds and conditions of things, claimed by their makers as being new and novel. Very often the novelty is of such a nature that after the freshness of the idea has passed away the article loses its only charm, and is thereupon laid aside in the lumber-room or destroyed. One novelty, however, recently seen by the writer, and no doubt by many of our readers as well, is of a more permanent nature, and one, he ventures to think, will have a long lease of life. It consists of using photographs as a means of ornament: little shelves, mirrors, cupboards, etc., for hanging on the wall are decorated with carte-de-visite, cabinet, or other sized photos. These little articles are in great request in every house, as by their means, when of pleasing shape and harmonious colour, little odd spaces of wall may be filled up and made interesting. The photos, again, are an additional attraction in themselves, and increase the interest with which such things would be otherwise regarded.

*Pros and Cons.*—It may, perhaps, be urged as an objection to this use of photographs that those placed on view will become so well known that they will be disregarded. But they may easily and readily be changed as often as desired; every day fresh faces may meet the eye, and even though not changed often, there is a subtle beauty in a well-executed photograph which will long retain its influence on the beholder.

These articles are particularly pretty when enamelled with any of the delicate shades of Aspinall's enamels; so any wood that is most convenient may be used in making them up—even different woods may be used in the same job without detriment, as all will be coloured alike with the enamel. This is an advantage which will be duly appreciated by many.

*Description and Construction of Shelves.*—The little bracket shown in Fig. 1 is of very simple construction; its back board is all of one piece of wood, ⅝ in. thick, shaped as shown. The little shelf is placed against this back board, and supported by a shaped bracket underneath. Both shelf and bracket are fastened from behind with screws. The back board is drawn one-eighth full size, so that in making it, each measurement from the drawing in Fig. 1 must be multiplied eight times. The little shelf is 10 in. long by 5 in. broad, and ½ in. thick; and at each of the front corners there is a quarter circle of 2½ in. in diameter cut out. The bracket underneath is also ½ in. thick, and shaped as shown.

The illustrations, it may be said, will all be found grouped together in a full-page cut. The smaller illustrations are mostly drawn on one-eighth scale, or on a scale of 1½ in. to 1 ft. The diagrams exhibiting working drawings of different parts and modes of construction are drawn full size.

*Mirrors.*—The mirror shown has bevelled edges; this is the usual kind of glass for such articles, and though costing more money than plain glass, is well worth the extra cost. Bevelled edged glass is so well finished at the edge that ⅛ in. is sufficient "cover" for it—*i.e.*, the opening for the glass should be

$\frac{1}{8}$ in. all round *less* than the exact size of the glass. The opening in this bracket is $7\frac{3}{4}$ in. by $4\frac{3}{4}$ in., to accommodate a plate 8 in. by 5 in., and it may have a $\frac{5}{8}$ in. bevel. A section of the rebate necessary for the glass is given in Fig. 3, where a blind back is shown sprigged in behind the blocking, keeping the glass in position. Care must be taken that the mitres of the glass bevel fit the corners of the opening as nearly as they can. Strictly speaking, they should fit accurately, but practically it is difficult sometimes to get them right; in that case, they must be "humoured" to make the best of them. If plain glass be used, it is a much more simple matter to put it in, but a full $\frac{1}{4}$ in. all round must be allowed for "cover."

*Securing Photos.*—The method of fixing the photos in their places so that they may be readily and easily changed is an important one. In the bracket under consideration, three openings might be cut, $3\frac{1}{2}$ in. by 2 in., with a rebate behind each to allow the carte-de-visite to be placed in it. A thin sheet of clear glass in front would, of course, be requisite to protect the face of the photo, and a thin slip of wood, about 1 in. wide and $\frac{1}{8}$ in. thick, might be fitted tightly into the rebate behind the photo. This would keep the carte always in position, and it would not be a difficult matter to remove and change it. But another and a better way is that indicated in Fig. 1, where the three cartes are shown placed in a mount of some sort, which mount is then placed behind a sheet of glass inserted in the large opening, 10 in. by 5 in., prepared for it. The mount is made the same size as the rebate for the glass, into which it therefore fits closely, and behind it is placed a back, $\frac{1}{8}$ in. thick, with two movable cross-bars working on a centre pivot. These bars are made to project $\frac{1}{8}$ in. beyond the edge of the back, so that when the back is placed in the rebate behind the mount containing the photos, these cross-bars enter a little groove made for them in the frame. To facilitate the entrance, the bars are thinner at their extremities, as shown in Fig. 4, which is a section, full-size, of this part of the work. The black portion of this figure represents the glass; the white portion behind, the mount; the hatched portion behind that, the back; and the bar is shown outermost of all. In Fig. 5 is given a sketch of the back, showing the two cross-bars in the position they must assume to get it out and into its place. This is exactly the arrangement of movable back which is found in the common drawing-slate known to us all as children.

*Mounts.*—The "mount" containing the three photos must here get a few words to itself. It may be of cardboard, wood, silk, or other material. A cardboard mount is, perhaps, most easily made: a sheet of cardboard is made the exact size of the rebate, and has three openings cleanly cut in it to show the three cartes. This card may then be made like the leaf of a photographic album by means of other cardboard strips, covered with a sheet of stout paper all behind, which paper is cut to admit the carte being pushed up into its position—just as in an album. Or a simpler fashion is to glue a strip of cardboard of about the same thickness as the photo is round the exact position the photo is to assume, in order to keep it in its place. The back then put on behind it will keep it firm and fast. This mount may be made of wood—oak, mahogany, walnut, beech, chestnut, or any other wood—and left its natural colour, as when protected by the glass there is no danger of its becoming soiled. Little slips of thin wood must be fastened on behind this mount, as in the cardboard mount, to keep the cartes in position. Another way of finishing the mount is to cover it—either the cardboard or the wood one—with silk or plush of a delicate shade. A nice pale azure-blue or a pretty salmon colour would contrast nicely with the photographs, and with a white or a cream-coloured enamel on the woodwork. This must be left, however, to individual taste, as what would please one might not please another. Two little brass plates are shown on the top edge of Fig. 1; these are to fasten the shelf to the wall, and are screwed on at the back of the back board.

*Candle Sconces.*—The article sketched in Fig. 2 is of a different kind; it has no shelf, but has a pair of candle sconces attached. These may be had at various prices, from about 3s. per pair upwards, and they form a very great attraction both by day-light and by candle-light. The mirror between them catches and reflects their light, and the photos above could not be in a better position for being seen to advantage. This figure is also drawn one-eighth full size, and is made out of one piece of wood. A suggestion might be made as to placing a cabinet photograph where the mirror is, making the opening to suit; but unless specially desired to be so made, the mirror ought to have the preference.

Another arrangement is given in Fig. 6, where a cabinet photograph is placed on each side of a mirror, and a shelf is attached. This might be made with the back board, $\frac{5}{8}$ in. thick, all in one piece, but it would be better to form it with top and bottom rails half-checked into the side rails, and the centre divisions half-checked into top and bottom rails, and placed into them from behind. Before half checking them, the rebates round all the openings should be run. The shelf, 19 in. long by 5 in. broad, and $\frac{1}{2}$ in. thick, is supported on two brackets, also $\frac{1}{2}$ in. thick. The glass and photos are placed in position, as already described in connection with the first of these articles (Fig. 1). This also is drawn one-eighth full size.

A shelf with accommodation for five carte-de-visites is shown in Fig. 7, to the same scale as before. This is, however, shown of different construction; two posts, $1\frac{1}{2}$ in. square, with turned knobs at their lower ends, have a rail at top and bottom mortised into them, and underneath the bottom rail is placed a shaped piece of wood $\frac{1}{2}$ in. thick. The posts and rails are rebated to receive mount, glass, and back board as before. Above is placed a shelf $4\frac{1}{2}$ in. wide, which is supported with two brackets placed on the face of the posts. Both these and the shelf are $\frac{1}{2}$ in. thick, as well as the back ledge put on above all. The wall-plates should, for sake of strength, be placed, in this instance, on the posts underneath the shelf.

A more elaborate shelf is given in Fig. 8. It is framed together in the same manner as that last described, and is drawn to the same scale. Two cabinet photos are shown above the glass, which is dome shaped on top. The shelf, $\frac{1}{2}$ in. thick, is 4 in. wide at each end, curving out to 6 in. wide in the centre. A row of turned spindles under the shelf adds considerably to the general effect. A full-sized section of the post, showing it beaded and checked, or rebated, for the glass, etc., is given in Fig. 9.

Another simple little shelf, formed in the same manner as those just mentioned, is sketched in Fig. 10, while in the next figure is shown a larger one. This has a double shelf above the two cabinet photos shown, and is surmounted with a balustrade. The two posts enclosing the portraits are carried up to the topmost shelf, which should be checked to allow them to reach the top of the shelf. The wall-plates should be fastened to the tops of these posts. The four turned pillars at the corners of the shelves keep them equally apart, while the brackets underneath sustain them under any weight they may be called on to bear. The shelves are 21 in. long by 6 in. broad, and are $9\frac{1}{4}$ in. apart. The posts are 1 in. square, and rails $\frac{3}{4}$ in. broad and 1 in. thick. The turned pillars are 1 in. thick, and the spindles are $\frac{5}{8}$ in. at their thickest part, and 2 in. long over the shoulders, the pins at each end for fixing to shelf and spindle rail being beyond.

*Medicine Cupboards.*—A handy little medicine cupboard is shown in Fig. 12, drawn nearly one-eighth full size. The gables are 6 in. wide. As, however, the doors should be made to suit the size of photo used, they shall first receive our attention. A moulded rail is formed as in Figs. 14, 15, or 16, these being all alternatives for the same purpose, and are drawn full size for the sake of clearness. This rail is mitred together exactly like a picture-frame, and has the glass, mount, and movable back put in as before described. The gables are held together by the top and bottom of cupboard being dovetail-raggled into them, as shown in Fig. 17, also drawn full size, showing the gables and shelves to be $\frac{5}{8}$ in. thick. A shelf 4 in. broad should also be raggled into the gables, about half-way between the top and bottom of cupboard. A shaped spandrel is fixed under front edge of cupboard, while the back ledge at top and bottom is also shaped as seen in Fig. 12. This back is $\frac{3}{8}$ in. thick, and is set into the gables as shown in section in Fig. 18. The doors must have something to stop against when closing. A little stop is inserted in top and bottom of cupboard inside the doors, so that they may close against something solid. A sketch of this stop is given in Fig. 19, full size; in this sketch the dotted line shows the extent the stop is inserted into the wood, and it should be so placed that both doors will get the benefit—*i.e.*, immediately behind where the two doors meet. A little slip-bolt will be required on the left-hand door, and a lock on the right-hand one.

The remaining illustration (Fig. 13) shows another arrangement of a medicine cupboard. It has only one door, however, and at each side is a corner shelf for the accommodation of a vase or other article of vertu. The construction of this cupboard is very much similar to the former one, with the addition of the side brackets and shelf. Another plan would be to frame the back with the side shapings, and top and bottom rails, with a panel grooved into them, and the gables top and bottom of cupboard placed against this back. The door, of course, is formed in the same manner as the others, any of the sections given in Figs. 14, 15, and 16 being alike suitable.

*Conclusion.*—Amongst the many ingenious arrangements that have been made for keeping and displaying photographs, this idea of utilising them as decoration for useful articles, differing so much from the usual methods of storing our friends' counterfeits, will probably long retain its hold on the public taste. It is, of course, impossible to sketch all—or anything like all—the different forms and combinations which may be assumed; those given must suffice, leaving the ingenious reader to follow up—if he will—the lines placed before him in these pages.

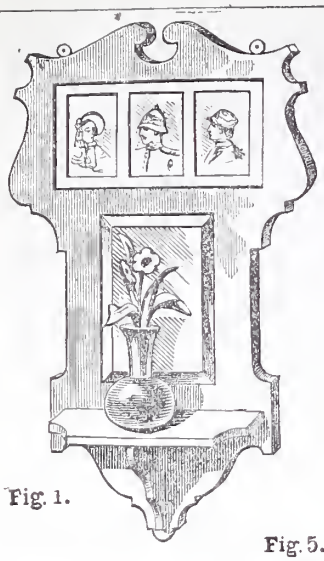


Fig. 1.

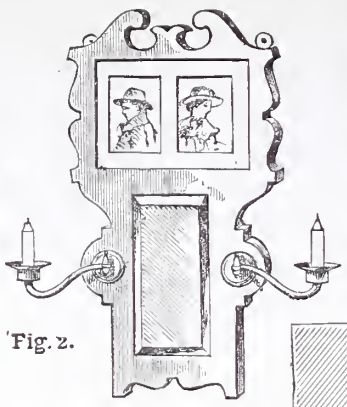


Fig. 2.

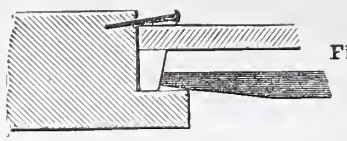


Fig. 3.

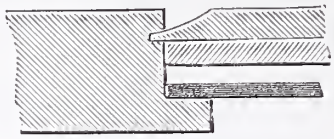


Fig. 4.

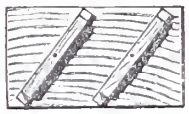
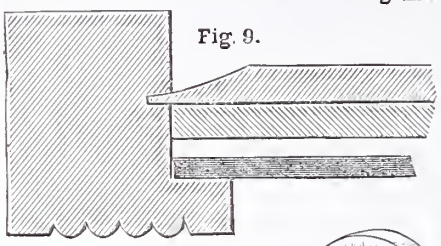


Fig. 5.



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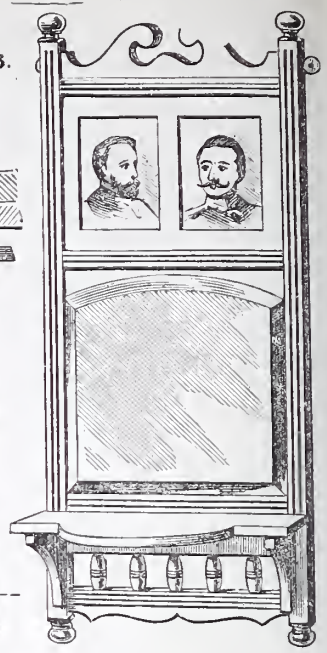


Fig. 8.

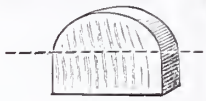


Fig. 19.

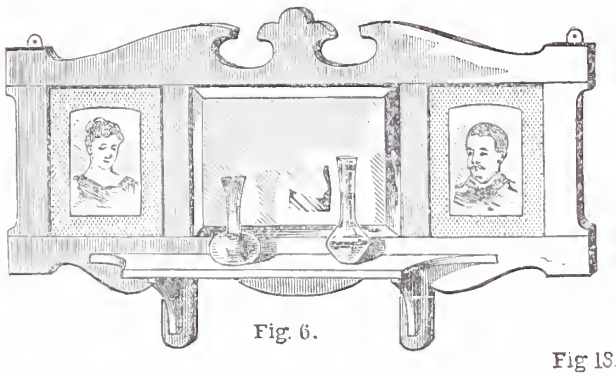


Fig. 6.

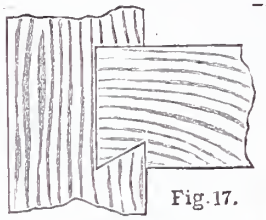


Fig. 17.

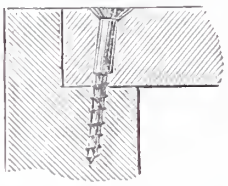


Fig. 18.

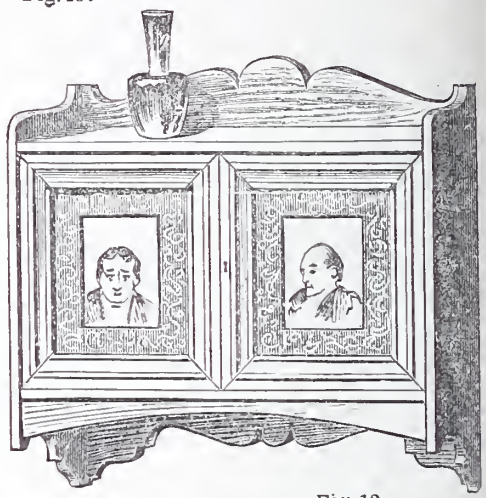


Fig. 12.

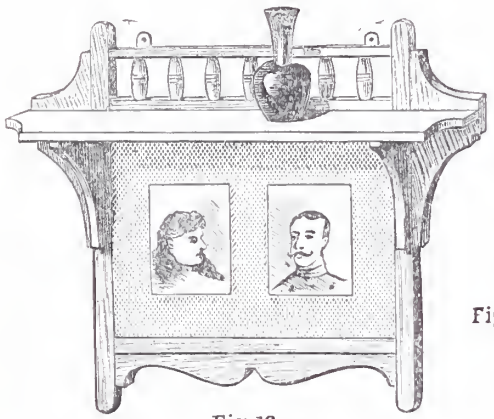
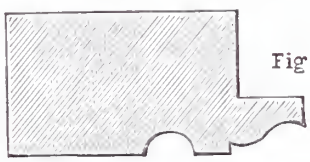


Fig. 10.



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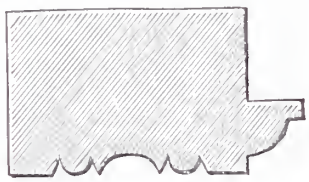

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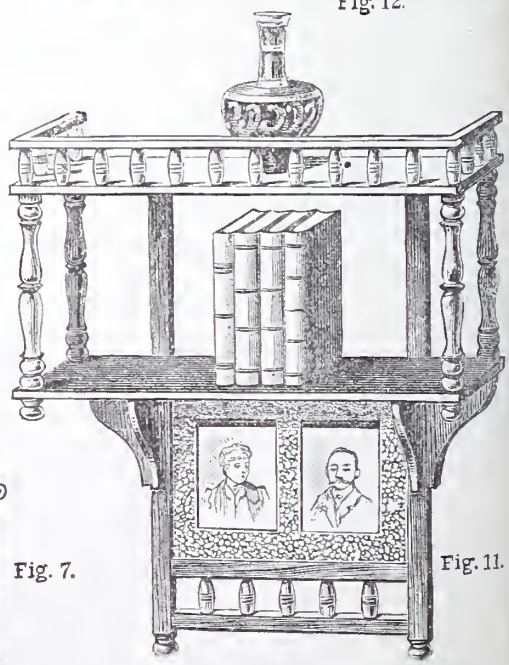

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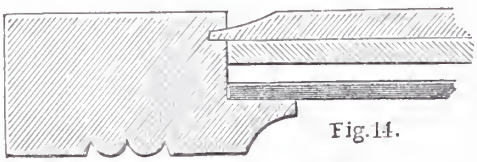


Fig. 14.

Fig. 13.

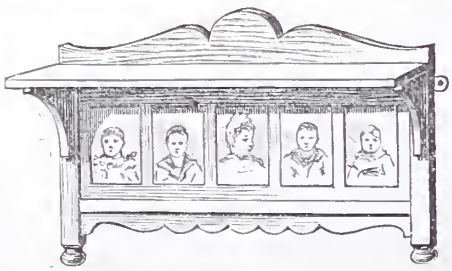


Fig. 7.

Fig. 1.—Bracket. Fig. 2.—Photo Frame with Mirror and Sconces. Fig. 3.—Rebate for Glass. Fig. 4.—Groove for Cross-bars of Back. Fig. 5.—Back with Cross-bars. Figs. 6, 8, 10.—Brackets with Shelf, Mirror, and Photos. Fig. 7.—Bracket for Five Photos. Fig. 9.—Section of Upright in Fig. 8. Fig. 11.—Small Bookshelf with Top Shelf for Bric-à-brac. Figs. 12, 13.—Medicine Cupboards. Figs. 14, 15, 16.—Alternative Mouldings for Rails. Figs. 17, 18.—Details of Jointing. Fig. 19.—Stop for Door.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

ENAMELLING, ENAMELLING STOVE—NICKEL-PLATED PARTS—RUBBER TIRES, CEMENT, METHOD OF FIXING—WIRED TIRES REQUIRING NO CEMENT—SPLICING TIRES—FITTING MACHINE TOGETHER AND TESTING BEFORE ENAMELLING—RE-FITTING UP—ACCESSORIES.

HAVING got our wheels and frame ready for the enameller and plater, the remaining work after these processes have been gone through is the fixing on the rubber tires and the fitting of the machine together. As to enamelling, the machine may be enamelled by baking in a stove, or it may be enamelled with a brush; the former is, however, by a long way the best: indeed, all good work is stove-enamelled. But for the mechanic making his own machine, the fitting up or providing of an enamelling stove is out of the question. It is a concern that costs £9 or £10, so if his machine is to be made a good job it must be sent out to a practical enameller, who will do it at from 15s. to 20s.; lining, if wanted, a few shillings extra. If it is to be done in the stove, it must be done before the tires are put on the wheels; if with a brush, the tires may be on or not, at option. For an enamel, or japan, to put on with a brush, I would recommend the Club hard-drying black enamel, which is sold by the Silico Enamel Co., and at most cycle shops. It is the best I have tried, and dries in a few minutes; for this reason it is somewhat difficult to apply, one part being dry before another is coated. It should be put on with a brush about an inch broad, covering a good bit of surface with a stroke of the brush. Two coats will be required on all parts that have been polished bright, so the whole may have two coats with advantage. It is to be understood, however, that this brushing process will not give results at all to equal stove work. It is only a substitute for the real thing, and is only used by makers on a cheap trashy class of machines. All the parts to be plated are, of course, removed from the frame before enamelling.

The plated parts of our machine comprise the following (although it is a matter of choice which to plate and which to enamel): handle-bar with its extension tube, brake-lever with the brake-rod (B, Fig. 35), lamp-bracket (Fig. 33), cone collar (Fig. 38), seat-pin (Fig. 30), the wheel hubs before wheels are built, cranks, pedals, bottom ball-bearings, pedal shaft, brake-spoon pin (Fig. 34), adjusting screws (Fig. 40), and all bolts and nuts about the machine. For Figs., see page 436.

We now give our attention to the tires, which are attached to the wheels after they have undergone the enamelling process. Our wheels are 30 in. by ¾ in. ordinary crescent; we therefore require two tires of these sizes, and I should here advise the procuring good rubber, somewhat about 4s. 6d. or 5s. per pound, as such tires are cheapest in the long run. The rubber may be either red or grey, so long as it is of good quality. Our tires are fixed on the rims with a cement made for the purpose, and sold at 1s. and upwards per pound, according to quality. Having thoroughly cleaned the rim, place the tire on it without the cement, in order to see if it requires stretching; because if it requires stretching it must be pulled equally all round the wheel, else you will have thick parts and thin parts, making a lumpy wheel.

Having melted the cement over a fire or a gas-jet, using an iron ladle with a spout for pouring (Fig. 43), have the wheel mounted on a spindle caught in the vice or driven into a post, then with a red-hot ⅝ in. iron rod heat up the rim all round by revolving the wheel; this done, pour the cement from the ladle, which, if properly melted, will be as thin as hot glue, and will run freely in an even stream all round the wheel, the ladle being held stationary and the wheel turned slowly with the left hand. Now place the tire in position before the cement is allowed to cool, and give it the necessary stretching, if any, taking care to place it in the rim without twist. There is generally a little ridge on the extreme top of the rubber tire, left there in the process of moulding: this ridge forms a good guide for placing the tire evenly in the rim. We now requisition a tire heater (Fig. 41): in this case a gas tire heater. The curved top piece of this instrument is perforated, and emits a number of gas-jets, the gas being led up through the shank from the rubber tube, said tube being attached to an ordinary gas-bracket with the burner removed. These heaters are made with the jet-tube from three or four inches up to nine or ten inches long; five or six inches is quite long enough. The rim is heated on the under side at the spokes with this instrument, the rubber tire being worked gently sideways with the fingers; the heater re-dissolves the cement in the rim, and when that takes place the tire rolls freely and the cement oozes out at the edges of the rim. This is continued all round the wheel, about ten minutes being sufficient for the purpose. See that the rubber is without lumpiness when setting it in the re-dissolved cement, as any flat parts can be easily remedied by pressing the tire from both sides towards it while the cement is hot. If too much cement has been put into the rim from the ladle, it will ooze out too much and smear both rim and rubber tire, making the latter (as it will not come off clean) very unsightly; there should only be as much cement in the rim as will make the rubber float when it is re-heated. If a tire is put on in the way I have described above it is sure to stay on, assuming that the cement is good. All that is required in fixing a tire is to make a proper union between the steel rim and the cement and between the latter and the rubber; the cement, if of a good quality, has the property of adhering to both these substances, iron and rubber, with great tenacity. The part the workman plays is to complete the union in a proper manner between them.

I have handled a lot of wheels made by a well-known firm, in which their method of enamelling is to dip the wheel, minus the tire, in a vat of stoving enamel, then to bake it in the stove. The result of this is that the hollow rim that is to receive the tire is enamelled the same as the other parts of the wheel, and on this enamelled surface the cement does not hold as on the clean metal. Their method of putting on the tire seems to be to heat up the rim, pour a light stream of thin cement, and to place the tire on, pressing it all round, and dispensing with the re-heating process, the result being that only a partial adhesion has taken place, the cement cooling too quickly to allow of a proper union with the tire, and which only re-heating will effect properly. I have had wheels treated in this way for tire fixing, where not a particle of the cement had found adhesion with the rubber; you could push the rubber out of the rim with the thumb without difficulty, and when removed half round the wheel the remainder would peel off by its own weight, and this on a machine costing about £18.

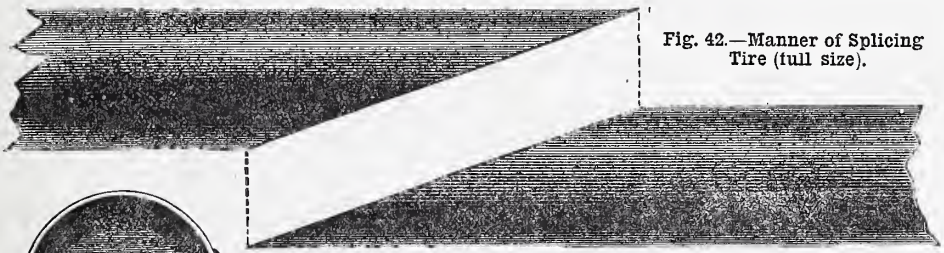


Fig. 42.—Manner of Splicing Tire (full size).

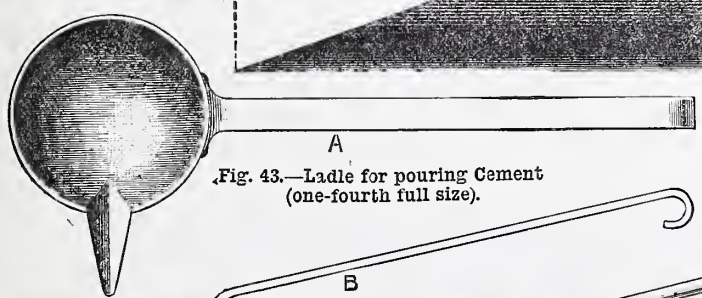



Fig. 43.—Ladle for pouring Cement (one-fourth full size).

Fig. 41.—Gas Tire Heater (one-fourth full size).

I would advise, therefore, a careful re-heating, with the jets not too large, in case of damaging the enamelled rim; or if the wheels are to be done with the brush, I would advise that the rubber tires be fixed in their places before painting.

It may be mentioned that there are tires in the market that require no cement; they are fixed in the rim by a wire passing through their centre as a core; it is pulled by screwing at the wire ends which are fastened to the rim. I have not seen them, so cannot speak of their advantages, or otherwise, from experience. There are tires also that require no cement, on account of the formation of the rim, but of these I need not speak further. I believe the best thing yet is the good old method of fixing by cement, and where it fails of its purpose it is the inevitable result of defective workmanship.

One method of making rubber tires is to mould them in long, straight lengths, then to make them to fit size of wheel by splicing. This splice sometimes gives way and has got to be repaired. A good solution for

this purpose is sold in most of the cycle shops.

A tire too large for a wheel, or a tire to be adapted to a smaller wheel, has to be cut and re-joined. It is done by splicing in the same way. The method of doing this is shown in Fig. 42. A clean cut with a sharp thin knife dipped in water is made slanting as shown, the cut being about two inches long; this cut is made on both ends of the rubber, and both from the upper or outer side of the rubber, so that one side of the splice will lie embedded in the cement. Both cuts must be exactly the same length, and made straight and smooth; these cuts are smeared with the solution above referred to, and the tire laid aside *before joining* for an hour or more; after that time the two splays are laid carefully together and pressed with the fingers; they may then be beaten with a bit of wood, when the joint will be found to adhere so that you could not pull it asunder, and you may proceed at once to fit it on the rim, and to use it on the road immediately.

The solution referred to is sold in one shilling bottles. Accidental cuts in tires may be repaired with it by cleaning out the parts carefully and smearing them with the solution, after which they may be kept open for an hour or so, when they may be pressed close, and the wheel is then ready for use without further waiting.

After the tires have been set in the rims and put aside for an hour or two, all superfluous cement must be cleaned off; it will come much more readily off an enamelled surface than off the rubber; allowing it to get on to the rubber should therefore be avoided as much as possible.

Now I will assume that you have got your frame and wheels done nicely in an enamelling stove, and the other parts enumerated in this chapter well plated, and that you have put on the tires as above directed. What remains now is to fit the whole together to complete the job. Having had the whole job fitted up complete before it went out to the enameller, you will have no difficulty in the re-fitting. At this point I would impress upon anyone making his own cycle the necessity of fitting up his machine complete, every item in its place, and testing the whole before it goes out to enamel; he should see that his two wheels are running in line with each other, so that when running straight they will make but one track; he should see that all moving parts move freely, such as brake and handle-bar adjustment, seat-pin adjustment, etc. etc., that all set-screws and bolts are performing their work effectually, that no nuts are made too easy in the threads, and therefore liable to drop off; he should also mark all parts that go in pairs, so that he will know how to replace them at the final fitting up: such, for instance, as the ball-bearings in the bottom brackets, cranks, pedals, etc. He should lift his rear wheel off the ground and drive it at great speed, to see that the chain runs freely, does not threaten to come off, and does not make any undue noise. Then, if he has facilities, he should further test his machine by getting on to it, or getting a rider on to it, and running in circles and figure 8 on a floor or a smooth clean court, so as not to damage the tires. This operation will discover any cracks, flaws, or other defects, which should by all means be cured before going to be enamelled. If it passes through this ordeal without sign of failure in any part, then the maker may congratulate himself on having done a creditable bit of work.

I will assume that the cycle builder has done all this, and that the enameller and plater have satisfied him with their part of the work, and that he has everything ready to re-fit up: this, I assure him, will be the most agreeable part of the whole task. But as this paper is about long enough, I will leave him till my next and concluding paper of this series, in which I will assist him in this pleasing operation, and show, by illustration, his machine completed and fully equipped for the road, and which I hope will be to him a thing of beauty, and if not a joy for ever, at least for a long time to come.

The accessories not mentioned in these papers, and that are necessary to equip the machine, are lamp, bell or horn, tool-bag, spanner, and oil-can. These I will notice shortly in my next, which will conclude with a few hints to the mechanical cyclist how to take care of his machine: such hints being intended for the benefit of cycle owners and users generally, and apart from own cycle builder, and which, it is hoped, will be duly appreciated by them.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 78.—The City Polytechnic.

Having called attention in the last number of Work to the classes for the study of wood carving at King's College by the united action of the Carpenters' Company and the authorities of King's College, I must do the same in behalf of the City of London College, White Street, Moorfields, E.C., otherwise known as the City Polytechnic, in union with the Society of Arts, the Government Department of Science and Art, and the City and Guilds of London Technical Institute, whose forty-fourth annual session for 1891-92 is now in progress. Lectures and lessons are given in technical drawing and drawing office practice, building construction, machine construction, civil and mechanical engineering, quantity surveying and land surveying. Application for further information with reference to terms, fees, etc., should be made to Mr. David Savage, the Secretary, at the College. The principal lecturer is Mr. Henry Adams, M.Inst.C.E., M.I.Mech.E., F.S.I., etc., assisted by Mr. A. B. Hoskin, science teacher.

### 79.—Goldsmiths' and Jewellers' Trade Classes.

A contributor to Work, Mr. H. S. Goldsmith, who has taken up and successfully dealt with two branches of goldsmiths' work in his papers on Brooches and Earrings, calls attention to the fact that, for the first time in London, a course of lectures, amounting to about thirty in number, on goldsmiths' work and the manufacture of personal ornaments will be given by Mr. Harry Stapleton on Friday evenings from 8.30 to 9.30 p.m. at the Polytechnic Young Men's Christian Institute, Regent Street, W. Only those who are engaged in the goldsmith or jewellery trades will be eligible to attend the lectures. The classes, I believe, will have started before this number of Work appears. It may be useful to add that the instruction afforded will embrace the following: (1) The principles and methods of manufacturing the various kinds and styles of personal jewellery; the exhibition and description of the tools generally used; the simpler gold alloys and their solders, together with the various methods adopted in finishing gold work. (2) Special lectures will also be given dealing with the subjects of chasing, engraving, and enamelling: special classes being also held for designing and chasing, as applied to goldsmiths' and jewellers' work. (3) Other information than that which may come under the foregoing heads, likely to be of special advantage to all engaged in the various branches of the trade, will also be included.

### 80.—"Cyclist and Pedestrian Guide to the Neighbourhood of Dublin."

This guide, which has been prepared and produced by a cyclist well known on both sides of St. George's Channel as one who can hold his own when in thorough condition, both for long and short distances, against all comers—Mr. R. J. Mecredy—appears to be a model book for the purpose for which it is intended, and might well be imitated in the production of similar volumes for various parts of England and Wales and Scotland. The plan of the book is simple but useful. Descriptive matter relative to any particular place, and the means of reaching it, are given in the centre of the page, and then, as marginal notes on the left hand, are the successive distances from one place to another mentioned in the route until the destination is reached, and on the right hand the condition of the roads. First of all, all the various exits from Dublin are dealt with, with some noteworthy runs. Then follow straight-away and circular rides from the General Post Office, Dublin. The book is well illustrated by cuts, and is rendered still more complete by an excellent index, in four columns, of which the first contains the name of the place; the second, the direct route; the third, reference to page; and the fourth, the distance in miles and yards. No cyclist resident in Dublin, or visiting Dublin, should be without this exhaustive and well-arranged volume.

### 81.—Pictorial Astronomy for General Readers.

Messrs. Whittaker & Co. have added to their Library of Popular Science a volume entitled "Pictorial Astronomy for General Readers," by George F. Chambers, F.R.A.S., of the Inner Temple, barrister-at-law, the author of various legal and scientific works, among which is the "Handbook of Descriptive and Practical Astronomy," produced at the Clarendon Press, Oxford, in three volumes. Of course, the volume now under consideration is an inexpensive book of moderate compass, and is based, to a limited extent, on Hinds' "Illustrated London Astronomy," which appeared some forty years ago, but is now out of print, and whose illustrations have consequently been utilised for Mr. Chambers' book. The mode of treatment will perhaps be best understood from a short summary of the subjects of the successive chapters, and which, after the preliminary introduction in explanation of the various branches of the subject which are embraced under the general term "Astronomy," deal with the solar system, the sun, the inferior planets, the earth and the various phenomena connected therewith, the moon, the superior planets, eclipses, transits, and occultations, comets, meteors, the stars, clusters and nebulæ, telescopes, the spectroscope, the history of astronomy, the utility of astronomy, tables of the planets and satellites, and a catalogue of celestial objects. A sufficient index completes a book that is well and succinctly written, and being in simple language, is as well calculated for the use of the young as those of riper age.

### 82.—Finsbury School of Practical Amateur Mechanics.

I am requested to state that the classes for Cabinet Work and Carpentry, Wood Carving and Engraving, Wood Turning, Metal Working, and Mechanical Drawing, carried on under the superintendence of the Principal, are now in active operation. The Editor.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Answers by Post.**—Correspondents generally are requested to bear in mind that no letters with reference to subjects treated in "Shop" can be answered by post, and that in future the Editor will decline to forward sealed letters addressed to writers in "Shop" under initials or pseudonym. This has been rendered necessary by the following letter, recently received from a member of my staff:—"Parties have been writing, wishing me to answer their questions by letter, and not through Work, offering to pay me well for doing so. But as I wish to act honourably both towards you and towards the readers of Work, I ask you to again give correspondents to understand that all questions sent to Work are to be answered through the 'Shop' columns."—Ed.

**Notes on Hand Saws.**—Chopstick writes:—"Having read the article by M. Powis Bale on p. 421, I cannot resist the temptation to write a short criticism of the same, and I will state, at the beginning, that I am speaking from practice, while Mr. Bale is quite evidently speaking from theory alone. First, as to the form of teeth most suitable for different kinds of work. These most decidedly are for a hand saw, which everyone in the trade will know is meant for cutting across the grain only; the form shown in the article at Fig. 1 is the best. For a rip saw, that shown in Fig. 2. As to Fig. 3, it is most unsuitable for a hand saw of any kind, but is the right shape for a cross-cut for cutting logs, but for which is recommended the ridiculous shape shown in Fig. 7. Now as to the size of the teeth. For a hand saw, five teeth to the inch, and for a rip saw, three to the inch, is the best. And now a word or two as to sharpening and setting. The latter should be done first, and I advise everyone to stick to the old-fashioned set, and discard all patent spring delusions. With this and a proper taper saw file (a 4½ in. for a hand saw, and a 6 in. for a rip saw) I can, and so can everyone else if he tries, sharpen a saw so that it will cut any and every kind of wood, which is what is wanted, unless we can afford a separate saw for every kind of wood. In sharpening (after the setting is done, mind), keep the teeth of uniform size, all the same level, and your saw will work clean and easy. A good test is to hold the saw teeth upwards, with the point resting on the bench and the handle about a foot higher, then place a needle on the teeth at the highest point, and it should run to the bottom without falling off. I can sharpen a saw so that it will do so; can the author of the paper? I will guarantee that he cannot, or he would know more of the subject upon which he wrote. One more point I must touch upon, and I have done. It says: 'That for straight-grained wood the square tooth answers fairly well, but for cross-grained the tooth requires to be bevelled.' Now, the fact is just the opposite, which anyone can prove by a trial, though this is much more apparent in machine saws than in hand saws; but the fact is the same, nevertheless. I am sorry to take up space in this way, but I think that we practical men should have our say, as well as those who speak from theory only. The latter is a good thing, no doubt, but practice will stand on its merits, in certain cases, far better."

**Sheet Metal Work.**—Tinker writes:—"As a reader of Work from the first number, I read with great pleasure the articles on sheet metal work, and also the replies of Mr. Alexander in 'Shop,' as they are always very concise and to the point. But the best of us make a slip sometimes, and there are one or two little slips that I am sure were not intentional, and which I will point out. In Vol. III., No. 120, p. 252, in answer to Blacksmith, *re* oil-bottles, R. A. gives the size of a 2 quart bottle as 19½ in. by 6¾ in.; but that size when made up would hold nearer 3 quarts than 2 quarts. The size to cut a 2 quart oil-bottle is half a double plate, or 17 in. by 6½ in. As I happened to be on a gross at the time, I measured one, and found it held the best part of half a pint over the 2 quarts. There is also a slight slip or two in R. A.'s last paper on 'Oval and Cylindrical Vessels in Sheet Metal Work.' In No. 127, p. 359, in explaining the way to cut the rim for an oval kettle (and it is the correct way), the process explained is all right, but the drawing is wrong (Fig. 12), as there are no straight pieces in the drawing, but all flue, which would convey an opposite impression to the description of the cutting-out of the rim. Also in the bottom line of the middle column, p. 359, R. A. says, 'middle plate cut in two pieces, 17 in. by 17½ in.,' which should be 15 in. by 15½ in. In conclusion, I hope Mr. Alexander will take these little corrections in a right spirit, as I am sure there is nothing comes from him (or any other contributor) but what he honestly believes to be correct, and no doubt he, as I should myself, takes great pleasure in giving others that are not so competent, every possible practical help."

**Notes on Hand Saws.**—A. R. (*Scorrier*) writes:—"Whenever I see an article on saws, sawing, or on wood-working machinery of any description, it attracts my special attention. Now, one man's opinion may vastly differ from another's practical experience on the same subject. In No. 131, p. 421 of Work, M. Powis Bale gives his opinion in reference to hand-saw teeth. As the object of Work is to enlighten its readers, I venture to write as follows, but with due respect to M. Powis Bale: Figs. 1, 2, and 3, on p. 421, represent hand rip saw teeth, of which M. Powis Bale says Fig. 1 is undoubtedly the worst form. Herein I disagree with M. Powis Bale. I will allow that there should be a little more rake than represented in Fig. 1, but not near as much rake as in Figs. 2 and 3, which M. Powis Bale claims to be the better form. I do not hesitate to say that if any man tried to work a hand saw with rake in teeth as represented on p. 421, Figs. 2 and 3, that he found a difficulty in working it, and that if he persisted in working it that his saw soon became buckled. If the readers of Work have followed the articles by M. Powis Bale on saws, they might have noticed the following statement that the teeth of a circular saw driven by steam-power can be worked with more rake than a vertical or frame saw, because it is driven at a high speed. I suppose there are but few men that have had greater experience in sharpening of circular saws than myself, and the rake represented in Figs. 2 and 3, p. 421, for a saw to be worked by hand, is more than I should give in teeth of a circular saw for general work driven by steam-power. In reference to teeth, Fig. 7, p. 421, I can say nothing of its merits or demerits in reference to its cutting qualities. I believe it is generally understood that the ordinary teeth in two-handle cross-cut saws, if the angles are suitable for the work it has to do, are best. There are many forms of teeth claimed to be of American origin, but even in that country the ordinary teeth are principally used. I might give several reasons why the ordinary tooth is preferred. Again, I might write in reference to the M shape tooth (Fig. 6, p. 421), proving that the general hand-saw tooth is preferred, but defer writing until a future occasion."

**Testing Accuracy of Framework.**—G. P. (*Elgin*) writes:—"With reference to a communication from J. C. K. (*London, N.W.*), headed 'Testing the Accuracy of Framework' (p. 427), I am exceedingly surprised to see such an erroneous statement made by one usually so accurate as he is. He writes with the intention of showing that the method of testing the accuracy of framework described in p. 326 is incorrect, but only succeeds in showing that the diagonals of a trapezium *may* be equal. Now, Mr. Scott refers to picture-frames and other rectangular objects, namely, objects which have their opposite sides parallel, and their angles right angles. But objects which have their opposite sides parallel have their opposite sides equal; and, therefore, picture-frames must have their opposite sides equal. Now, all

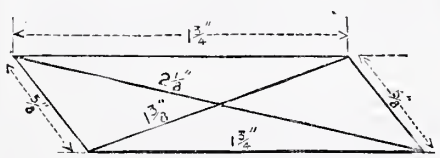



Fig. 1

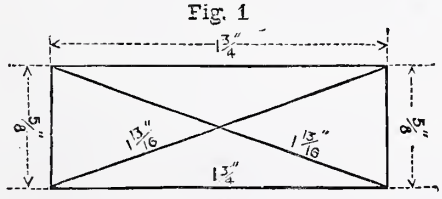


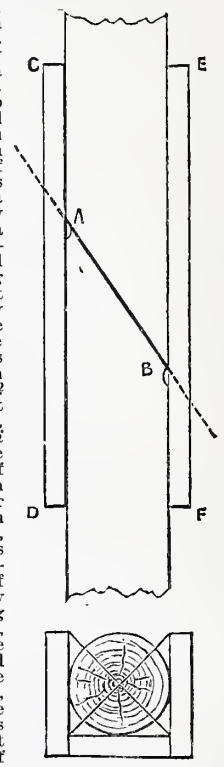

Fig. 2

Diagrams showing how to test Framework.

picture-frame makers that I have ever seen take great care, when making a frame, to make the opposite sides of it equal. They first make the moulding for one side the required length, and then they adjust the moulding for the opposite side until it is exactly the same size. Again, if a figure have its opposite sides equal, but its diagonals unequal, the angles will not be right angles. (Fig. 1.) But if a figure have its opposite sides equal and its diagonals equal, then its angles are bound to be right angles. (Fig. 2.) This can be proved with the aid of Euclid, Book I., as follows: ∠ B A C = ∠ D C A (I. 8). ∴ A B is parallel to D C (I. 27), and A B = C D. ∴ A D is parallel to B C (I. 33). ∴ A B C D is a parallelogram. Now ∠ A D C = ∠ B C D (I. 8). ∴ ∠ A D C = ½ ∠ A D C + ½ ∠ B C D. But ∠ A D C + ∠ B C D = 2 rt. angles (I. 29) ∴ ∠ A D C = 1 rt. ∠; ∴ ∠s D A B, A B C, and B C D are each equal to 1 rt. ∠. I hardly think that J. C. K. will now protest against this method of testing the accuracy of framework, since it is proved here on the strength of information which has been handed down to us from the time of Euclid, about 300 B.C., and the accuracy of which is of such a high standard of excellence that no one has been able to dispute it through all these centuries."

### II.—Questions Answered by Editor and Staff.

**Splicing a Mast.**—Nauticus.—I am not clear as to whether Nauticus wants to know how to make a "ship's splice," or other method of joining the parts of a mast together, or whether he merely wishes to know how to "scarf" together two pieces of round timber. As the latter method is probably what he requires, I will describe it, merely premising that if correspondents would only state clearly and fully what they wish to know, they would get much more satisfactory replies. Nauticus's difficulty seems to be to draw a straight line over a round. A mast-maker would do this by making a small groove or nick on each side of the mast, as shown at A and B, into each of which a small batten is fixed. With these as a guide, it is easy to draw the line required with a straight-edge.—L. L. H.—[Thus far, my good friend L. L. H.; but supposing that it is the scarfing that Nauticus is in difficulty about rather than the splicing or binding the scarfed ends with cord, is it not possible to help him a little more effectually? I think so myself, and that it may be done in this way, and the *modus operandi* shown by adding a little to L. L. H.'s drawing. If Nauticus made a wooden trough after the manner of a mitre-box, shown in plan by the steps C D, E F, on each side of L. L. H.'s mast, and in section below, and cut a saw kerf in each step as shown by the dotted lines extending from A and B outwards, taking care that they are truly vertical, he would then, after dropping the pole into the mitre-box, be able to saw each piece across at the same angles to form the scarf without any trouble whatever. If the mast lies too loosely in the box, the pole should be steadied by a small wedge, care being taken to wedge each piece on the same side.—Ed.]




Scarfing a Mast shown in Plan and Section.

**Printing Type.**—W. G. C. (*Sierra Leone*).—Small founts of type are made up and sold by Squintani & Co., Farringdon Street, E.C. Possibly the rubber-faced type made and sold by Richford and Co., Snow Hill, E.C., might suit you better than the ordinary kind.—D. A.

**Writing Desk.**—A. C. (*Blackfriars*).—Your desk being made of wood ¾ in. thick, and having a margin of only ⅜ in. around the fretted part, I am afraid you will find the difficulty of fastening by dovetails greater than you can get over. It might be done with great care, but would require skilful hands, as there is only ¼ in. to spare after cutting the sockets. The mitred dovetail would be the neatest and strongest joint in your case, but I can hardly advise you to try it on such delicate work unless you have made it on a larger scale. You might fasten the parts together with screws, but that would not be at all a workman-like plan. The best method for you to adopt will be to mitre the corners. This will prevent end grain being seen, and in appearance will be the same as the mitred dovetailed joint. The strength of a plain mitre, even with glue, will, however, not be sufficient, and must be increased either by keying or blocking. To key the parts together, after having glued them, take a small saw, such as a dovetail saw; cut diagonally from the corners in, say, two places in each. Into each cut then glue a piece of veneer, and when the glue has set, trim off the surplus projecting veneer. This makes a strong joint when properly done. Blocking is easier, and is done by just gluing strips of wood to the inner angles of the desk. I do not know in what way you intend to support or back up the tret. It will be very apt to get broken unless you do something of the kind, as I strongly recommend you to. If you do, then make a box of thin wood, and overlay the fretted parts outside it. The joints of the inner box can be made as strong as you like, while those on the frets can be simply mitred, as the frets will be stuck on with glue.—D. D.

**Fine Cutting (Picture-frame Cutting).**—If you want to make a fine cut, of course you must use a fine saw. Of course, I am supposing you are possessed of the necessary skill. You cannot do better

than get one of the Britannia Co.'s circular saw benches.—D. A.

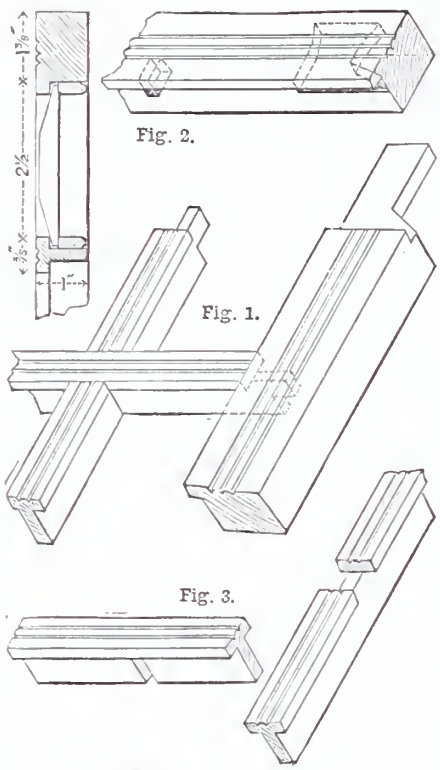
**Old Hall-marks.**—C. F. (*South Shields*).—If you want the very best books on this subject you will have to get "Hall-marks on Gold and Silver Plate," 6th edition, by W. Chaffers, published at 16s. by Reeves & Turner, 196, Strand, London, W.; or, "Old English Plate," by Wilfrid Joseph Cripps, M.A., F.S.A., published by John Murray, Albemarle Street, at about the same price as the other. Personally, I prefer the "Old English Plate;" it is more readable, and better illustrated. In these books will be found tables of

Old Hall-marks.

date letters used in the assay offices of the United Kingdom, with an account of French marks, and many German, Belgian, and Dutch ones; in fact, they are as complete as it is possible to make them, and they are well worth the price they are published at. After these works, the next best is one of the excellent South Kensington Museum handbooks on "Gold and Silversmiths' Work;" it is published at 1s. in a paper cover, 1s. 6d. in cloth, and is printed for the Science and Art Department, South Kensington, to whom application should be made. In that book the matter is very shortly dealt with, and merely the first letter of each cycle of twenty years is given. One alphabet is used in regular order—from A to V, omitting J and U or V; that, of course, will make the number to twenty letters, instead of twenty-six. As neither of these books may be easily got at, I give the first letters and the shields from the cycle beginning 1678-9 up to the present time, the present letter being Q. For details of the first introduction of letters for the makers' mark instead of a symbol, and for several other matters, the shilling book will be found useful; but the others are the ones to possess.—H. S. G.

**Sleepers.**—CARPENTER (*Durban, Natal*).—In reply to your query only an approximate answer can be given, as the statistics, if obtainable at all from the companies, could only be got with considerable delay. The sleepers on nearly all the lines in Great Britain are placed transversely, with the exception of the Great Western, where the continuous sleeper is in use. There will be in these, together with the transverse pieces for keeping the gauge, almost the same amount of timber as there is in the transverse sleepers of the regular gauge. I have, therefore, reckoned the amount of timber in the broad gauge as if the sleepers were laid transversely, as on the other lines; and as next May the B. G. will entirely disappear from this island of ours, I shall not be much out. The following paragraph, taken from "The Working and Management of an English Railway," by Findlay (of the London and North-Western Railway), one of the best authorities of the day on such subjects, will be useful to you:—"The improved form of permanent way actually in use upon the London and North-Western Railway at the present time. It consists of wooden sleepers laid transversely, and which are of well-seasoned Baltic timber, into which creosote oil has been forced under pressure to the extent of 3¾ gallons to each sleeper. The sleeper, which is 9 ft. long by 10 in. wide by 5 in. deep, when creosoted weighs 150 to 160 lbs. Each 30 ft. of rail rests on ten sleepers. A certain number of iron and steel sleepers have been laid down on the London and North-Western Railway experimentally, the first step having been taken eight years ago. The results have been varied, a percentage of the sleepers having failed, while, on the other hand, a larger percentage appear to be standing well." From the above it appears that the sleepers are 3 ft. apart, so, as this railway is under extremely good management, I shall consider this as the average pitch for the sleepers on all the railways in Great Britain, the sleepers on some lines being closer while on others they are wider apart. Now the number of miles of railway in Great Britain open for traffic at the present time is 16,114·75. Taking the sleepers at 3 ft. pitch, we obtain the grand total of 28,414,760 sleepers for a single line of rail. The life of a sleeper varies greatly and from several causes. Sleepers cut from the same kind of trees, grown on almost the same spot, vary very considerably; those cut from trees growing in the valley and damp ground standing much less wear and tear than those obtained from the same class of tree growing higher up on the hill or mountain side. Again, sleepers obtained from trees grown under precisely the same conditions vary as regards length of life, on account of the positions they occupy on the line, those most subject to alternations of moisture and dryness, and beat and cold, decaying much faster than those placed under more favourable conditions, especially as regards drainage. One of the most favourable conditions of a line, for lengthening the life of the sleepers, is to have it thoroughly well drained. The length of life again varies with the species of wood; oak, though too dear to be used in this country, lasts much longer than any other kind. From particulars obtained from a good authority, I find that a sleeper decays and is useless any time between three and twenty-five years, according to the above conditions; so I think if I take eight years as the average life I shall not be far wrong. If we now divide the total number of sleepers in use on our railways by 8, we shall obtain 3,551,845, or over 3½ millions yearly, as the number actually needed to replace the worn-out ones on a single line, but all railways in Great Britain have double lines, with the exception of a very small percentage which will be entirely counterbalanced by those lines which have four sets of lines, so that we must double the 3½ millions, when we obtain the great number of over 7 million sleepers needed yearly. This, of course, takes no account of the sleepers used in the miles of sidings. Baltic fir and similar classes of timber are almost universally used in Great Britain, and the method of preserving them by injecting creosote oil is the general method employed. The timber used comes from the Baltic provinces, Norway, Sweden, and America. The home forests would not supply the smallest fraction of the timber needed. Indeed, there are no forests here in your sense of the term.—P. B. H.

**Bookcase.**—S. C. (*Ashton-under-Lyne*).—I give you three sketches, showing how the doors are mortised, together with the measurements as far as I can. The height and width of your doors you must decide for yourself, as you alone know what




Mode of Mortising Doors of Bookcase.

size the bookcase is. Those referred to are about 2 ft. 6 in. wide, by 2 ft. 2 in. high out to out. Fig. 1 shows part of one top rail, style, and two bars. Fig. 2 is a section through one style and one bar, showing how the glass is fixed in, etc. Fig. 3 shows an easy way of making the joint where the bars meet. The fronts of the horizontal bars are housed out, and the backs of the vertical bars are notched out to pass over the part left on the horizontal bar. Any turner will do the turning required; it is a very simple job. You will not have any difficulty in getting the bevelled glass in Manchester; but as the glass is rather a serious item, I should advise you to make inquiries as to price at several glass merchants. If any other troubles crop up as you go along, let me know, and I shall have much pleasure in putting you right.—E. D.

**Bicycle Tires.**—W. H. F. (*Rye*).—If you have an invention that will prevent pneumatic tires being punctured, and that makes the tire independent of compressed air, then you have hit upon something that any of the makers of tires will be glad to hear about, as that is just what they have been as yet in vain trying to discover. Write to the Dunlop Pneumatic Tire Company, Dublin; or the Clincher Tire Company, Edinburgh. The firm mentioned by you is unknown to me. You could communicate with Brown Bros., 7, Great Eastern Street, a firm which I know to be reliable.—A. S. P.

**Stoving Enamel.**—W. W. (*Manchester*).—Stoving enamel can be had in two tins for first and second coats for about 1s. a tin. Time on stove, one hour at 300 degrees of heat. The tins are labelled to show which to apply first. The two tins sufficient for one bicycle.—A. S. P.

**Mounting Etchings.**—W. F. B. (*Rochester*).—Surely your own ideas of the fitness of things ought to be sufficient to tell you how to paste etchings, etc., in a book. The colour of the paper must depend entirely on the nature of the etching, drawing, or painting; white, cream, and grey would seem to be the most appropriate. It must depend on your own judgment entirely whether or not you surround them with lines disposed in the form of an Oxford frame.

**Lithographic Printing.**—A BEGINNER.—Papers on the "Art of Litbography" are now appearing in WORK, and will soon be completed; but up to the present time no articles have appeared on lithographic printing.

**Slimy Sponge.**—A BEGINNER.—Wash your sponge well in hot soda water with a little soap, then rinse it well in cold water, squeeze the water well out of it, and let it dry. This done, use it as a sponge with water only and not with soap, and squeeze the water well out of it before putting it again into the sponge dish.

**Mail Cart.**—A NEW READER.—You will find directions for building a mail cart in No. 30 of WORK, and a reply to a correspondent respecting mail-cart wheels in No. 51.

**Bicycles.**—F. S. (*Kidderminster*).—It is probably as well that you and your friends gave up solving the puzzle of the bicycle, and it would have saved some time, no doubt, if you had never attempted it, especially when it was plainly visible that the description had not been written by a man who was of a mechanical turn. To get you out of your difficulty I send sketches and a condensed description of the specification. What the inventor intends to gain by his arrangement I do not know, as the seat must be thrown very far back, and the ordinary chain driving seems to me far more mechanical and a great deal simpler. The condensed specification runs as follows:—"My improvement consists in contracting the hub so that the main driving spindle shall pass through the wheel and toothed hub revolving round the spindle. The spindle carries an internal toothed wheel, the teeth being semi-circular and gearing into similar teeth on the hub on one side of the wheel. I make a drum or hub of suitable size, D (Fig. 1), having teeth on the outside, T, into which drum I place a disc or cone, C, at each end. Fig. 2 shows a side elevation, with a few spokes and rim of wheel, the cones being joined together by a spindle, J, extending above and below crank, K, the said disc or cones being made suitable for ball bearings, now in general use. The said discs being eccentric, and having the hole bored near the edge, E, I place the driving spindle, S, in and through, the said spindle carrying an internal toothed gear wheel, G, so slipping into, or engaging, with the teeth on the drum, D; the said toothed gear wheel, G (Figs. 1 and 2), on the spindle exceeding the size of the one

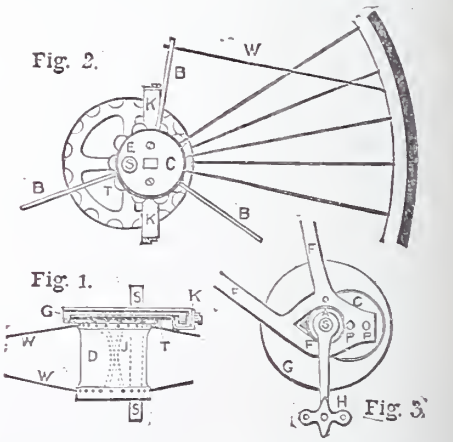


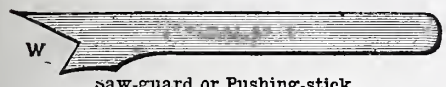

Fig. 1.—Plan. Fig. 2.—Side Elevation, Frame and Cranks removed. Fig. 3.—Side Elevation.

on the drum, or hub, D, according as the eccentric is placed out of the centre of the disc, C, aforesaid. The gear wheel would be placed in the space O, between the cranks, K, in Fig. 1; the double crank running round the gear wheel is placed on the outside. The gear wheel, drum, and wheel being complete, I secure them to the frame fork ends, F (Fig. 3), or angle arms, by pins, P, to the cones, C; the spindle moving in bearings, A, in or on the said fork ends of frame, H, the pedals, F, being movable on C to gear up." Some of the letters marked on the drawings are not explained in specification. The above is what appears in the specification, and, as I said before, where the improvement is, I can't see, but you will be able to see for yourself.—P. B. H.

**Guard.**—SAW-GUARD MAKER.—I know of no maker of a guard such as you require, and am of opinion that should such a guard be invented it would be a disadvantage, as in feeding timber to a circular saw the hands should be perfectly free. To be satisfied that there is no maker of such a guard, I wrote to one of the principal firms of wood-working machinery in England, and received the following reply:—

"DEAR SIR,—We have your favour of the 12th inst., but regret we are not acquainted with any guard suitable for the purpose you require, or we should be glad to give you the information desired."

In cutting thin, and especially short, stuff, we always use a pushing-stick in form of annexed sketch. The stick is from 12 in. to 15 in. long, and




Saw-guard or Pushing-stick.

when the saw is nearly through the cut, the stick, which is kept on the bench and near the right hand, is used by placing the end, W, against the piece of wood being sawn, and the piece is pushed to the saw without endangering the right hand. The left hand merely steadies the outside piece. In reference to your shield—not being able to cut above 10 in. deep with it—I suppose your bench is made to carry saws that will cut up to 10 in. deep, and your shield is made in accordance with it. Should you write Mr. Taylor, stating what you require, he may supply you with a shield suitable for larger saws. If I were near by so that I could see your bench, I might be able to suggest something. I might say that for the work you have to do, I would strongly recommend a band saw; you would find it a great advantage.—A. R.

**Cement.**—W. J. C. P. (*No Address*).—The query about a cement to resist "heat and moisture when applied to broken ware" is decidedly vague, and I was at the outset considerably puzzled by "the stitches which appear like lead on both sides." Anyhow, by a process of exhaustion, and by the noting down of things that W. J. C. P. seems not to mean, I have arrived at some sort of idea of what he does mean. As W. J. C. P. hails from Jersey, he probably means by "ware" the earthenware marmites such as are used for the preparation of bouillon; by "heat," when applied to broken ware, he probably means the fire; and by "moisture," the contents of the vessel which eventually will be served up as soup. This is all I can find in the query to go upon. The "stitches which appear like lead on both sides and do not show where or how the stitch is joined" are undoubtedly what are known to the initiated as rivets, and the leaden appearance is perhaps to be explained by the fact that the brass wire which was used for the rivets was tinned over to prevent any possible action of acid on the wire. As to this method of "stitching" broken ware, I cannot do better than refer W. J. C. P. (and so save my own time and space in WORK) to No. 53 of WORK—that is, page 4, Vol. II.—where he will find full instructions and diagrams of all the tools required. Now to go back to the cement question. It is not easy to give any advice without knowing what the ware is and where the crack or fracture lies. If a portion of the rim of a vessel is broken out, white-lead spread upon tape, and wrapped round the article, makes an almost unbreakable joint when thoroughly dry and hard, or, to keep up W. J. C. P.'s metaphor, will make a most serviceable kind of "patch" on the ware; this is assuming that the personal appearance of the ware after mending does not matter very much. Marble or alabaster, scraped into a fine powder and mixed up into a thin creamy paste with gum (the best and purest that can be got), make an excellent cement that will stand heat and a certain amount of moisture. It answers, to my personal knowledge, in positions such as the handle of a brown earthenware teapot, but I question whether it would stand the direct heat of a fire at all. I have heard, and read too somewhere or other, that if the outer discoloured portion of an oyster shell be removed, the white, flaky stuff inside, ground to flour and mixed with white of egg, forms an exceedingly good cement, and will withstand moisture and heat. In composition it, of course, resembles the one I have mentioned above. If the article W. J. C. P. wishes to mend is at all heavy, and it is to be lifted on and off the fire with any weight of liquid in it, I should advise him to rivet it in addition to any cement he may decide to use. This reply may seem long, but is mainly the fault of W. J. C. P.'s badly expressed query.—H. J. L., J. M.

**Inspectorship of Factory, etc.**—A FAITHFUL READER.—I regret that it is not in my power to tell you "the things required to obtain a situation as factory or workshop inspector, where to apply, and when examinations are held, if any."

**Tips.**—G. F. J. (*London, W.*).—I well know the difficulty there is in getting a good shape tip for London West-End bespoke work. I have made every inquiry, but failed to find a man. This answer will be read by a good many practical workers in iron and brass; it may prove of some use to you and many others. A good shape being one of the greatest drawbacks to the production of good tips by men not acquainted with the boot trade, I will undertake to give, free of charge, to any workman (the Editor has my address), paper patterns, or drawings, of good and fashionable-shaped heels, and hints as to what is really wanted. It is a long-felt want that has never been supplied, and having suffered under it myself, I am willing to do all I can in the matter. It is a good opening for some energetic reader of WORK.—W. G.

**Pack Sheeting.**—R. S. (*Darwen*).—It will depend a good deal on the quality of the wrappers whether you could treat and utilise them as floor-cloth. They might be made available for the purpose, but I am afraid you would find in the end that they would cost you far more than if you were to buy the floor-cloth ready. If you want to use them up in this way, try painting them with several thick coats of oil paint; but without proper plant it will be hopeless for you to try to make anything like a good floor-cloth. With regard to the mark on your table a good deal will depend on the extent of the injury. If it is slight, and the polish only is damaged, it may be only necessary to touch up with French polish. On the other hand, if the wood is injured, you will have to scrape or paper down, or even to plane off the surface and repolish the top as if it were new.—D. D.

**Anti-vibrator.**—DENNISTONE.—The "difficulty" which you have anticipated in respect of the brake action being interfered with may be got over by the arrangement shown in accompanying drawing. If the brake at present on your machine is long enough when full on to reach the wheel when the spring is extended to its fullest, you need not alter it, but can get over the difficulty by attaching foot-rests to the ends of levers, as shown at D, Figs. 1 and 3, by which you may apply the brake with your feet and hand combined. If your brake-

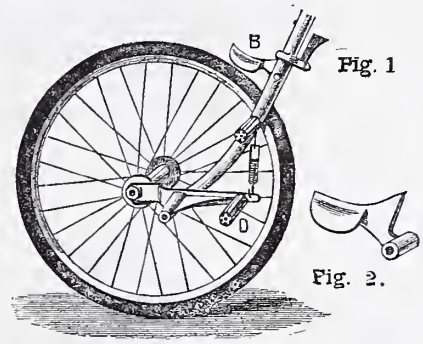



Fig. 1

Fig. 2.

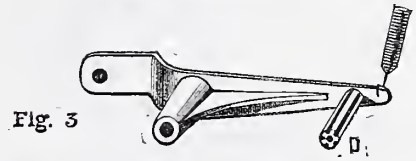


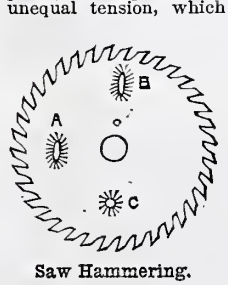

Fig. 3

**Anti-vibrator. Fig. 1.—Wheel complete. Fig. 2.—Form of Rigid Brake-spoon. Fig. 3.—Oscillating Lever with Foot-rest attached.**

spoon does not descend far enough, you could make a new one of the form shown at Fig. 2; the back part of the casting, B, being made far enough back, could be filed down until the brake-spoon rested in the right position, and then the whole screwed up tight and rigid. In the latter case, of course, the brake would be applied by the feet only.—CYCLOPS.

**Rushes.**—J. D. (*Clitheroe*).—The best and most practical advice I can give you if you want to reseat with rushes is when undoing a seat to notice how the rushes are twisted, and copy the method.—D. D.

**Saw Hammering.**—J. S. (*Keighley*).—You wish to know the difference in the effects of a blow on a saw-plate when struck with the cross-faced hammer and when struck with the dog-head hammer. The cross-faced hammer is used for straightening and not to regulate the tension of the plate; a saw-plate may be perfectly true, but of unequal tension, which may not be discovered until the saw has been set to work. Unequal tension may be discovered by bending the plate with the hands, as stated in WORK, No. 119, p. 235. This may be removed by using the dog-head hammer, the face of which is rounded so that the effects of its blows will extend equally as shown at C in this sketch of a circular saw. The effects of blows delivered by the cross-head hammer will be as at A and B. The blow at A will be struck with the transverse face of the hammer, and the blow at B with the face parallel to the handle. In some cases the cross-faced hammer will generate a similar effect to that of the dog-head hammer, by striking first with one face and then with the other face of the hammer, crossing the blows, distributing the hammer effects more equally than if the blows were in one direction. In WORK, No. 119, p. 235, I gave instructions as to how to take out a loose place in a circular saw. It may be taken out with the dog-head hammer alone; but it must be understood that sometimes a loose place is caused when it cannot be taken out with the dog-head hammer, and the cross-faced hammer has to be used. I refer to a place caused by over-heating when working the saw, causing blister.—A. R.



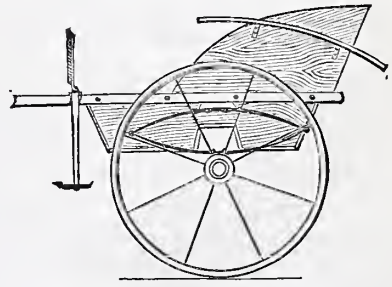

Saw Hammering.

**Stain.**—W. J. H. (*Reading*).—I fancy you have been misled as to the name of the stain you require, acacia being the technical name for gum arabic, which is rarely used for staining purposes; but this gives no clue to the colour you require. If you can send us a sample of the colour, I shall be pleased to assist; meantime, read carefully through "Shop" for the last three months. Many hints appear on staining and varnishing walking-sticks, which are equally applicable to umbrellas.—LIFEBOAT.

**Painting Texts for Church Walls.**—G. M. H. (*Derbyshire*).—Yes, they are commonly painted on zinc. From this you should have your scrolls cut, and, as far as possible, so arrange them that the joinings may come where the "returns" and "turnovers" of the scrolls occur. Both for painting and fixing, you will find it more convenient to have your work in detached pieces than to have the whole soldered together before beginning. Sheet zinc is sold by the pound, and the price per foot will vary with the gauge; but you may roughly set it down at 1½d. or 2d. Zinc texts look best fixed up with plain brass-headed nails. As ground colour, scarcely any other than buff is in ordinary use; but care should be taken that it does not too nearly approach the colour of the walls. What is called a "blush buff" will tell best on some walls, on others a greyer tone will be more effective. On the turnovers a positive ground colour will be used. When the ground is thoroughly dry, the gilding should be first put in, and to prevent the gold leaf from sticking in wrong places, adjacent parts should be dusted over with powdered whiting. All gold work should be boldly outlined with black, as should also the edge of the scroll, so as to cut it off distinctly from the wall. G. M. H. will find choice of alphabets published for church decorative work. The characters are most readily put in with stencil plates, and finished with the brush. Sacred names and initials are usually put in with gold or red, and subordinate characters with blue. The drawback to zinc is that it is liable to cockle, and the text may instead be painted direct on the wall itself. The space to be painted has first to be gone over with a preparation, which stops suction and prevents damp coming through. This is made by dissolving gutta-percha and shellac in naphtha; the solution must be so thin as to work freely, but not so thin as to run. When this method is employed, texts are often painted without scroll-work, and in that case the lettering is set out on the wall, and each separate letter is first painted over with the solution, and again, when this is dry, with colour.—S. W.

**Anti-vibrator.**—W. E. H. (*No Address*).—You are right in supposing that on lifting the machine the wheel would drop down; but obviously it could not drop more than 2 in. If you object to this, you could screw a stop-pin in the fork side just above where the lever rests, so as to catch it when going too far up. With reference to the wheel catching the mud-guard, its altered position places it so much further away from the fork top and guard that you need not fear this happening, provided you have the spring strong enough.—CYCLOPS.

**Oxford Cart.**—G. J. W. (*Antrim*).—I cannot form a very clear idea of what you want, either from the name you give or from your sketch.



Oxford Cart. (Scale, ⅓ in. to 1 ft.)

From the latter, however, I gather that the cart you require is to carry two persons only. I therefore give a sketch of a simple and easily built vehicle (scale, ⅓ in to a foot), and refer you to Vol. I., No. 19, p. 295, where you will find an article on a "Battlesden" cart, which will help you, as many of the details are similar. To give dimensions of the various parts would occupy too much space for these columns; besides, these will altogether depend upon the size of the animal you intend the cart to suit. But if you follow the scale given, you will

have a cart for a "polo-pony" size—*i.e.*, 14 hands high.—OPIFEX.

**Papers for Watchmakers.**—E. T.—There is the *Horological Journal*, published monthly (1st of each month), at Northampton Square, Clerkenwell (price 3d.), which may be had through any bookseller, or direct from the Secretary, Horological Institute, as above. I have taken it the last twelve years, and find it very useful. Then there is the *Watchmaker, Jeweller, and Silversmith*, published at 68, Fleet Street, London (5s. per annum, or 6d. monthly), in which useful information is to be had. I know of no others of much utility.—A. B. C.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Spray Diffuser.**—POTTER writes:—"Will any reader give me directions for making a machine to work by hand for blowing insecticides in the form of fine spray, as it is very much wanted in large greenhouses?"

**Measurement of Paraffin Barrels.**—PARAFFIN writes:—"Will you inform me through WORK how the measurement is reckoned in paraffin barrels? For instance, on the end of the barrel is '120 tests;' what is the meaning, and how is it reckoned?"

**To Preserve Stone.**—H. L. P. (*Montrose*) asks:—"What is the best preservative to prevent from decay a church steeple built of carboniferous sandstone and exposed to the sea air? Has it been used anywhere with success?"

**Coal-dust Bricks.**—G. R. (*Swinton*) asks:—"Will any reader of WORK kindly inform me what the coal-dust bricks are made of? I understand they are made of coal-dust, pitch, and other ingredients, but what are the component parts? Is it a patent? If so, who is the patentee and manufacturer?"

**Heating Small Greenhouse.**—NEWLAND asks:—"Will some reader of WORK kindly tell me how I can fit a heating apparatus to two Rippingill oil stoves with 3 in. burners? I want to keep the frost out of a small greenhouse 12 ft. by 5½ ft. The stoves by themselves are not sufficient. I think some system of a boiler and piping might answer, but I do not understand the working of a hot-water apparatus."

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Bread-cutter.**—C. P. WEBB writes, in reply to JEAN (see No. 127, page 366):—"A simple bread-cutting machine may be constructed as follows: Take a piece of beech, or other hard wood, 18 in. by 12 in. by 1 in., planed smooth, and nicely squared; then take a strip of iron, ½ in. thick, ¾ in. wide, 19 in. long; heat one end and bend up 1 in. close, then bend up the whole in half, so that you leave a space between the two sides of ½ in., as shown at A (Fig. 1); drill two holes, countersunk one side as shown, on one of the shorter sides of the board at 1½ in. from the side; cut out a piece ¾ in. wide by ⅜ in. deep; screw this piece of ironwork on, as at A (Fig. 2). Now cut two pieces of the same iron—one 2 in. long, the other 7 in. long; drill a hole at ½ in. from each end of the longer piece, and a hole ¼ in. from one end of the shorter piece, and two holes—countersunk—at the other end; cut a small piece, ¾ in. wide and ½ in. deep, out of the side of

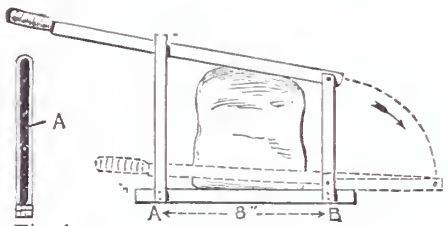



Fig. 1. Fig 2.

Fig. 1.—Guide for Knife. Fig. 2.—Machine complete.

the wood base at 8 in. clear from the other. Rivet these two pieces together, so that they work easily, and screw them on to the block as at B (Fig. 2). Now take a knife, with a blade stout and sharp, and about 16 in. long; at about ½ in. from the point drill a hole. Pass the blade through the groove in the upright, edge downwards, and rivet it loosely to the end of the iron at the other side. All this will be better understood by a reference to the sketches. The machine is now completed. To use same, place the loaf on the board, just overlapping, and with one motion press and push the knife by the handle, which will cut off a slice; lift the knife and repeat until the whole is cut up."

**Heliograph.**—C. P. WEBB writes, in reply to R. N. (see No. 129, page 398):—This little instrument is used for the purpose of signalling by means of flashing the reflection of the sun's rays, according to a pre-arranged code, and is most simple in its general principles of construction. I am not cognisant of the details of the instrument in use in the Army Signalling Department, but one made in accordance with the following instructions will be found thoroughly effective: Take two pieces of any hard wood, say, 12 in. square, and hinge them together on one side so that they open in the form of a hook; at the opposite side, and about 1½ in. from the edge, place a small thumb-screw for the purpose of opening and closing the boards to give proper elevation to the instrument. Now procure a small circular mirror, 6 in. diameter, fitted into a tin back and rim, which can be obtained at a turnery or hairdresser's shop. From the exact centre of the tin back cut out a circle 1 in. in diameter and clean off the quicksilver from this space at the back of the glass; this is for the purpose of seeing from the back that the mirror is directed towards the spot it is desired to signal to. Draw a line across the back, and at each end, close to the edge, solder a very small ring, also a similar ring on the edge half-way between the two; the positions are indicated in Fig. 1, A, B, C. Now take two strips of iron—say ⅛ in. thick, ¾ in. wide, and 9 in. long—and bend them as shown at E and F (Fig. 1). Drill small holes through them, G, H, I, J, K, L, and rivet them together at H and I. This will be fully shown by a reference to the sketch. Take a steel knitting-needle, pass it through the hole J, then through the two side rings at the back of the mirror and through the hole K; secure the ends that it does not slip out. The glass will now swing in a frame, as it were. Affix this portion

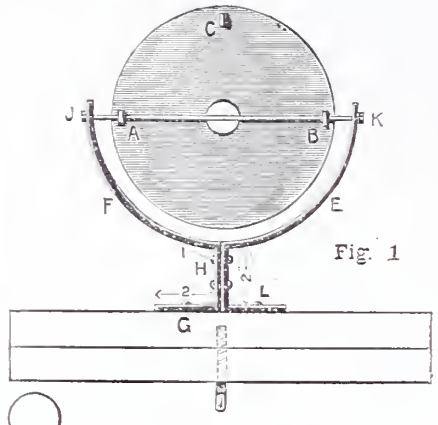



Fig. 1

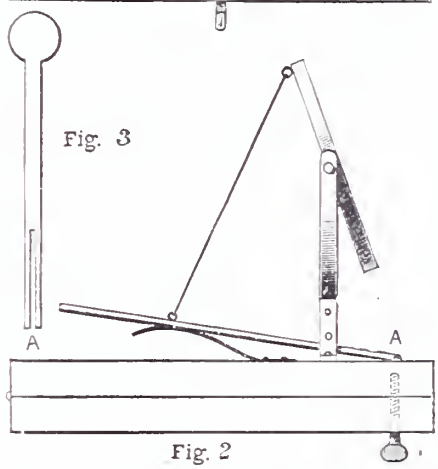



Fig. 2

Fig. 1.—Front View of Helioscope. Fig. 2.—Side View. Fig. 3.—Lever hinged to Stand.

to the stand by screws through the holes G, L, in the centre of the stand, about 3 in. from the edge. Take a piece of hard wood, 9 in. long and ¾ in. thick; shape it as Fig. 3; hinge the end A on to the stand at about 1½ in. from the front edge, as shown at A (Fig. 2). Get a small piece of steel spring, attach it to the stand, and bend it so that it comes under piece A in Fig. 3. Now get a piece of moderately strong wire, say about 9 in. long, make a hook at one end, which put through the ring at the top of mirror, and clench it; attach the other end to the lever, and the instrument is complete. Upon tapping the end of the lever the mirror will oscillate and flash the sun's reflection. It is a very simple matter to arrange a code of signals. If this explanation is not perfectly clear, I shall be happy to further elucidate it through the medium of 'Shop.'"

### V.—BRIEF ACKNOWLEDGMENTS.

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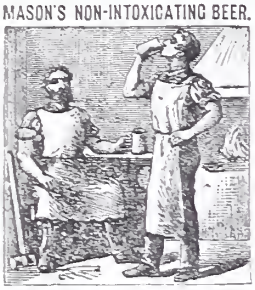

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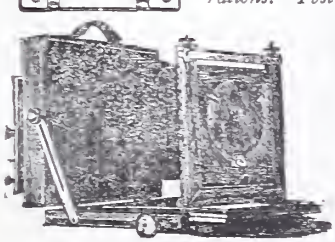

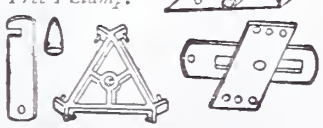

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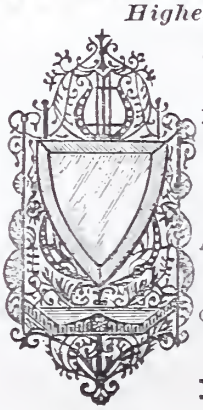

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BY F. JERMAN.

INTRODUCTION—DIFFERENT KINDS OF DRESSERS—MODERATION IN ORNAMENT — GENERAL DESCRIPTION AND DIMENSIONS—FRONT FRAMING—FRAMING AT ENDS, RAILS, AND BEARERS—POT-BOARD — SHELVES AND STANDARDS — DRESSER TOP AND SIDE BOARDING—DRAWERS—DOVETAILING—CUPBOARD FRONT—BACK—WOOD AND TREATMENT—CONCLUSION.

ARTICLES of furniture in daily use are very often made without consulting the wants of the inmates of the house for whose use they are intended. This remark is especially applicable to the ordinary kitchen dresser. In terrace houses the dresser is generally mentioned and described in the specification, and put up by the builder of the house, who gets his notion from a few words running after this fashion :—"Provide and fix in kitchen a dresser formed of 1 in. clean deal frame, sides, and top, 2 ft. wide, with two drawers and two cupboard leaves in bottom, all on stout bearers, with 1 in. deal shelves and pot-board. Put small bolt and turn-button to cupboard door, and fix two dozen cup and jug hooks at edge of shelves." The reader will see that not much idea of design is given in this clause : the size also is very lightly passed over. In consequence of this, dressers in most houses are erected in a character approaching sameness. Go into one of a terrace of houses, look at the dresser, and you have seen all of them. They can hardly be called articles of furniture, being generally landlords' fixtures, not to be taken away when the tenant removes.

Sometimes we see them without any shelf room provided, making the article look like

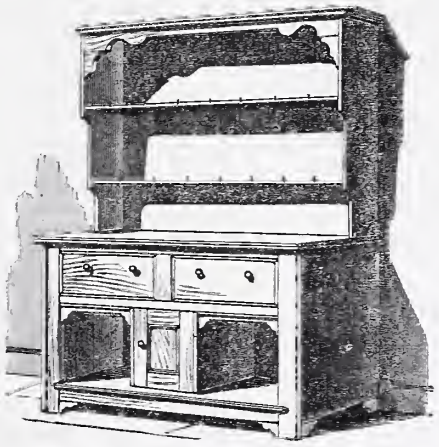


Fig. 3.—Perspective Sketch View of Dresser.

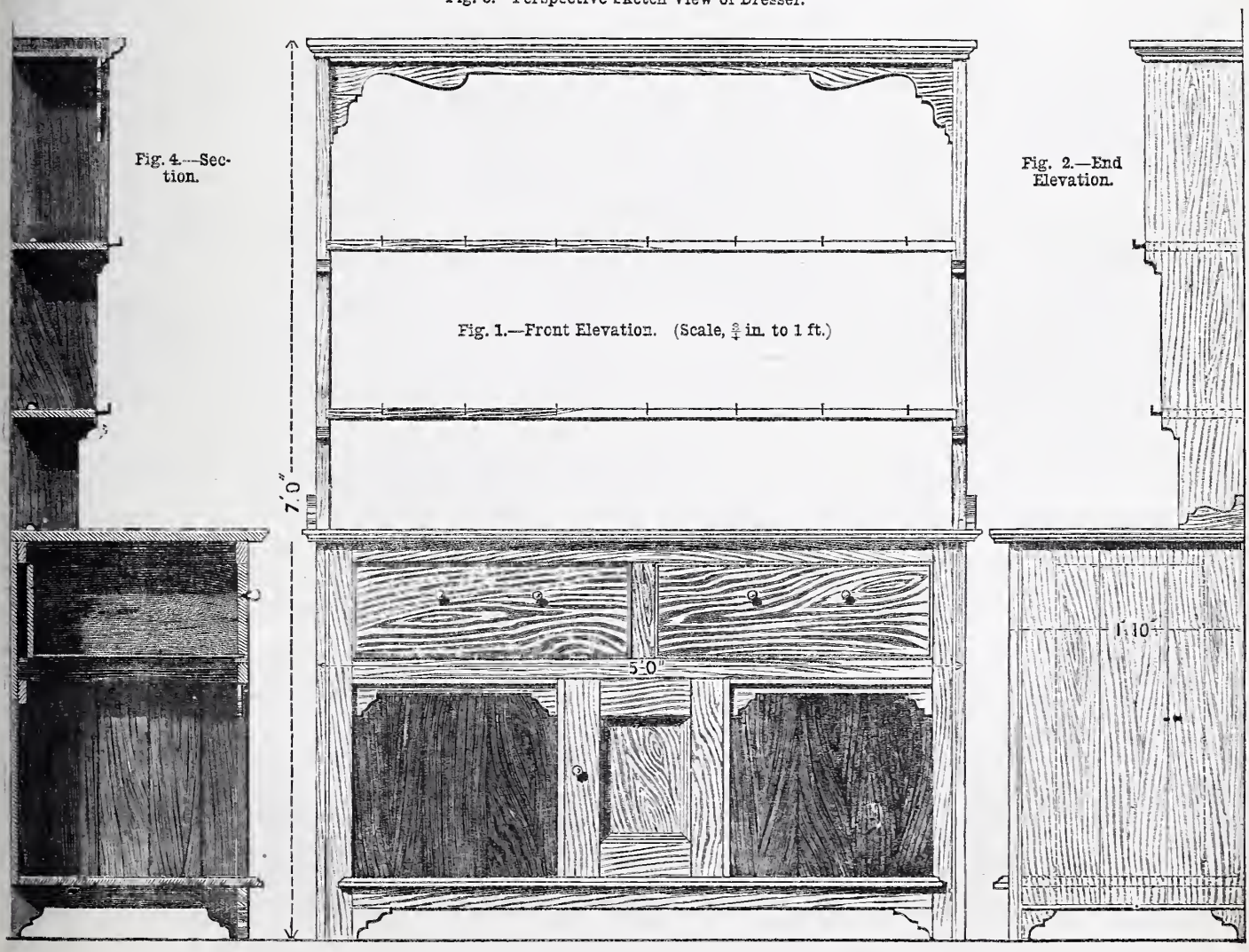



Fig. 4.—Section.

Fig. 1.—Front Elevation. (Scale, $\frac{3}{4}$ in. to 1 ft.)

Fig. 2.—End Elevation.

a very plain buffet or sideboard. On the other hand, a gaunt-looking stretch of shelves, knocked together without any thought of proportion, and reaching close up to the ceiling, serves the purpose of a dresser in some kitchens.

By this introduction I do not wish to convey to the reader an idea that a dresser should have a quantity of meaningless ornament, panelling, and mouldings stuck on; but that it should be strongly put together, at the same time with an eye to effect and proportion. Cut work can be introduced here and there, formed with the keyhole saw; and it is surprising how a little of this kind of ornament takes the baldness and commonplace look out of a simple design.

The dresser shown here, I think, fills the conditions mentioned above. It is made in two portions, the shelves and end standards forming one part, and the top, with two drawers, cupboard, etc., the other. In case of removal this will be found very convenient. The shelves must, however, be firmly fixed to the wall with L irons to prevent any likelihood of its tipping over. The total width is 5 ft., the breadth 1 ft. 10 in., and the height—7 ft.—is very convenient, being at the same time not out of proportion with the other dimensions; 3 ft. 2 in. from floor to top will be found suitable, at which height I have shown it.

The framed front had better be commenced first. It is formed of 3 in. by 1 in. upright pieces and 2 in. by 1 in. rails tenoned into them. A piece of 2 in. by 1 in. is also tenoned into the rails in the middle between the two drawers. The two upright pieces have beads worked on their edges, the length being 3 ft. 1 in., and the rails are 4 ft. 6 in., plus the tenons at each end, which will make the total length of rails 4 ft. 8 in.

The two ends are framed in a similar manner with the same sized stuff, but the stiles have cut ends to form supports as shown. Two rails are fixed at the back, in the position shown in section, tenoned into the sides. The framing and back rails can now be put together, the front to be screwed to the sides and the latter kept $\frac{3}{4}$ in. back from the face to allow for the matched boarding. Bearers must be fixed, two to each drawer, formed out of 2 in. by 1 in. stuff, with $\frac{1}{2}$ in. rebate, in which the drawer slides. They are tenoned into the front, halved, and then nailed on to the rail at back. The length, including tenon, of these bearers will be 1 ft. 9 in. Figs. 14, 15, and 16 show the method of fixing them.

The pot-board can be got out in two pieces. The sizes are to be found in Fig. 6, the total length being 4 ft. $10\frac{1}{2}$ in. and the width 1 ft. $10\frac{1}{2}$ in., cut out at angles to allow for stiles, etc. It projects 1 in. from the front, and has a moulding worked on its outer edge (see Fig. 9). The board has a bearing on the bottom rail of the side framing, shown by dotted lines in Fig. 6. It is also nailed at the front and back. Care should be taken in marking out these boards, so that they will fit closely together when in position without any crack between them. This pot-board is a very useful feature in a kitchen dresser, as a stand for pitchers, etc. The recesses on each side of the cupboard may serve as a place for boots and shoes. A $\frac{3}{4}$ in. board may be placed half-way up 20 in. in length and 9 in. in breadth, nailed to little ledges on each side, so as to give more shelf room if the recesses are used for this purpose. The divisions for cupboard are formed of $\frac{3}{4}$ in. stuff, rebated in front for door.

The end standards are 1 in. in thickness, 3 ft. 10 in. high, and with diminishing widths of 11 in., 9 in., and 7 in., and a hollow cut below each shelf. Grooves are cut $\frac{3}{8}$ in. deep for the shelves, 10 in. from the bottom for the first shelf, and 15 in. is the width between the first and second shelves. The shelves measure 4 ft. $10\frac{3}{4}$ in. by 11 in. and 4 ft. $10\frac{3}{4}$ in. by 9 in., fitting into the grooves in the end standards. As large articles are put away on the top shelf—such as tureens, etc., which are not used every day—it is generally made the widest. The shelves should be at least 1 in. thick. If they are any less in thickness they will require supports, which in some measure decreases the shelf space, and prove in the way when large dishes, etc., are placed there. A small strip is nailed on 3 in. or so from the back to keep plates, etc., upright in their place. Fourteen jug and cup hooks are shown to be screwed into the edges of shelves. The cornice of dresser (Fig. 7) is 2 in. deep, and a 11 in. by $\frac{1}{2}$ in. board is fixed at the top, but this latter can be omitted if desired. The cut spandrel beneath the cornice is formed of pieces of $\frac{1}{2}$ in. stuff fitting into a shallow groove in the sides. The upper piece is 4 ft. $10\frac{1}{2}$ in. long by 3 in. deep, and the two brackets below same are 4 in. by 3 in.

To return to the lower part of the dresser: the top can now be cut out, glued up together, and fixed. It is made of 1 in. stuff, and measures altogether 5 ft. 4 in. long by 2 ft. wide, and has an ogee mould worked on its edge. Two pieces of 7 in. by 4 in. are cut out of $\frac{1}{2}$ in. stuff, and screwed to the top in order to keep the shelves and standards which go between these pieces in place. The $\frac{3}{4}$ in. boarding at sides can now be nailed to the framing; the edge at the bottom is rounded as shown, and the edge against the wall is rebated for the boarding at back.

The knife drawers are made of $\frac{5}{8}$ in. stuff, cut to the sizes shown in Figs. 10 and 11, and with a groove $\frac{3}{4}$ in. from the bottom cut in the front and sides. These and the back are dovetailed together (see Figs. 12 and 13). It will be seen that the sides are dovetailed to the front in a different manner than they are to the back, the pins and sockets not being cut so deep in the front as at the back in order to let the drawer have a plain face, and allow the joints to be seen at the sides only. This is known as the lap dovetail. The dovetails in front must be cut out with the chisel only, but the tenon saw can be used in the sides and back for making the horizontal cuts for the sockets, which are then cut off with the chisel.

It is very important that drawers should be dovetailed together, as a great strain is put on the front when it is pulled out, especially if the contents are heavy. If the drawers are nailed they will not keep together very long. When all is ready, coat the dovetails with thin glue, hammer them together, then slide the bottom in the grooves from the back, and nail it up to the back piece, which is made less in height than the other sides to allow for same. Square blocks are then glued up in the ordinary way to the bottom of the drawers. Two wooden knobs screwed to each drawer will be required for pulling them out.

The cupboard front measures 18 in. by 15 in., and is formed of 3 in. by $\frac{3}{4}$ in. stiles and rails framed together with $\frac{3}{8}$ in. panel, and a small moulding run round outside same. Hang with a couple of butt hinges, and fix a brass turn-button to fasten door. Two 3 in. by 1 in. cut brackets are screwed below the bottom rail to the stiles. Half-inch spandrel pieces cut out of 20 in. by 3 in. stuff are fixed over the two recesses, and a bead is run round at the top against the rail to hide joint.

The back of dresser can be covered with $\frac{1}{2}$ in. boards, laid horizontally all up through; or, if preferred, the lower portion only may be treated in this manner, leaving the wall showing behind the shelves.

The wood used may be red deal, this being easier to work than the white, all to be painted at completion, except the top, which can be made of beech or sycamore, left clean planed off and not painted. The latter wood is very suitable for this purpose. Bread-plates and articles of a like nature are made of it, and as it has a very even grain splinters will not appear, no matter how hard it is scrubbed. If the remainder of the dresser is painted a stone colour it will form an excellent contrast with the white sycamore top.

The sketch (Fig. 3) will give an idea of how the dresser will appear in execution. Should there be any points which the reader may not be clear upon, I shall be glad to correspond with him through your "Shop" columns.

## ARTISTIC LITHOGRAPHY.

BY MISS ADA J. ABRAHAM.

### Practical Work—Conclusion.

To lithograph a written circular or letter, pin the original to a drawing-board at each corner, then take a sheet of transfer paper, cutting it to the necessary size, and if the sketch is not subsequently required, gum the top of the transfer paper to the top of the letter, that being a safer way of securing it from slipping than if drawing pins were used; in such case make it further secure by using a paper weight, and all tracings should be done in the same manner. It should not be fixed at the bottom, as then it can be frequently lifted up to see if the lines are being followed correctly. The student must not forget that there is a right and wrong side to the paper, and he must use a hand-rest so as not to touch the paper if possible with the hand, or the heat will make it curl up.

Now write over the original very carefully either with the pen or brush, and be sure to notice the different thicknesses of the lines, and any peculiarity in the writing, not forgetting the stops, etc. If there be any ruling, place a small piece of cardboard on either side of the paper, and let the ruler rest on this, in order to avoid touching the drawing.

The ruling pen should be filled by means of an old brush, and not dipped into the ink, else the outside of the pen will soon get inky, and so smear the ruler, and likewise the drawing. The pens and brushes should invariably be tried first to see if they make lines, or dots, of the desired thickness; and this, mentioned now, should be followed out in every case.

After the writing is done, the artist's part of the work is so far finished, and it can now be handed over to the printer, who will first transfer it to stone, and then print the impressions from the stone. But the artist should always insist on seeing a proof first, to correct any mistakes. The drawing should be sent perfectly flat, and no tracings or writings should be rolled when drawn with lithographic ink.

If a mistake is noticed when the proof is submitted, or any of the lines do not print as black as the rest, it is necessary to retouch

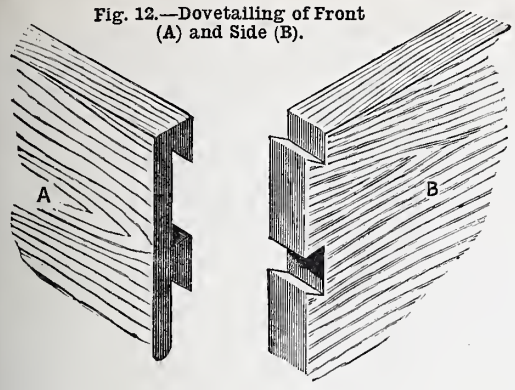



Fig. 12.—Dovetailing of Front (A) and Side (B).

Fig. 5.—Detail of Part Plan —A, Recess; B, Cupboard.

*** Figs. 6, 7, 10, 11, 15, 19, are on Scale of 1½ in. to 1 ft.

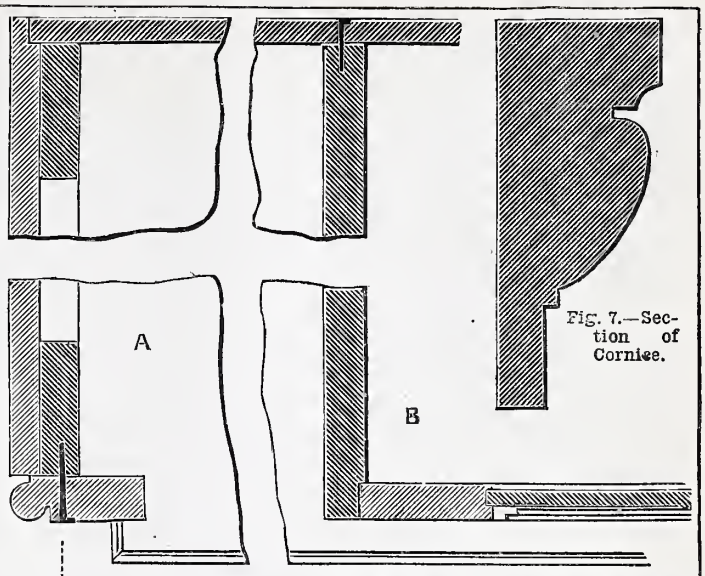



Fig. 7.—Section of Cornice.

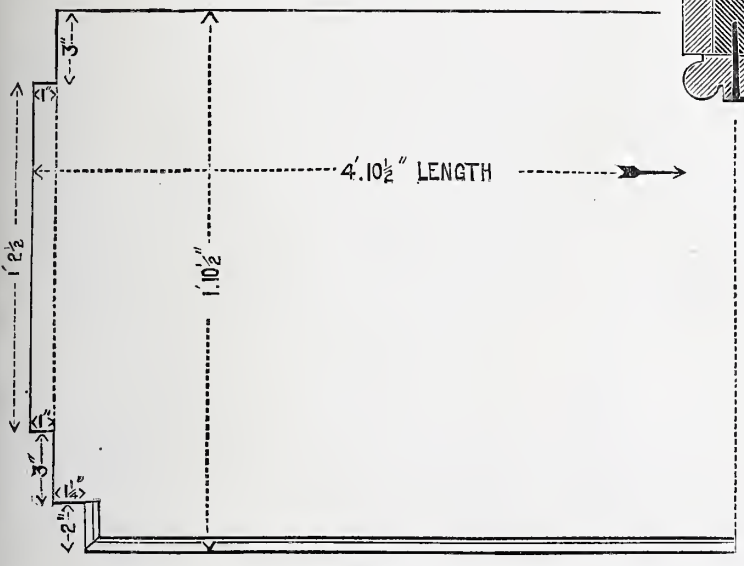



Fig. 6.—Plan of Pot-board, showing Dimensions.

Fig. 8.—Section of Shelf.

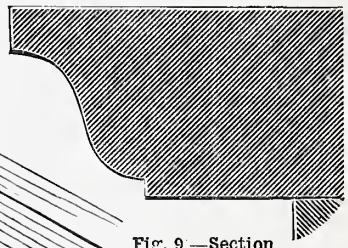


Fig. 9.—Section of Pot-board.

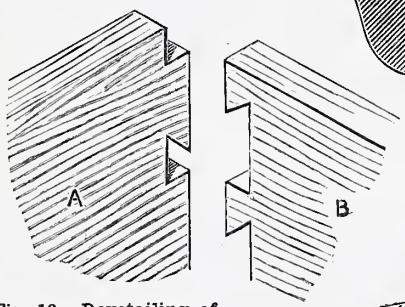



Fig. 13.—Dovetailing of Side (A) and Back (B).

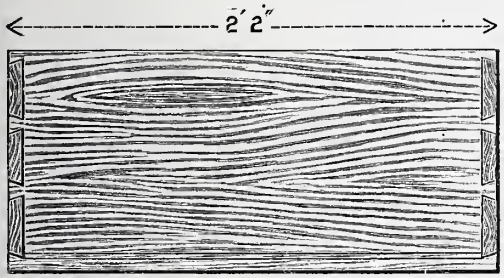



Fig. 10.—Front of Drawer from inside.

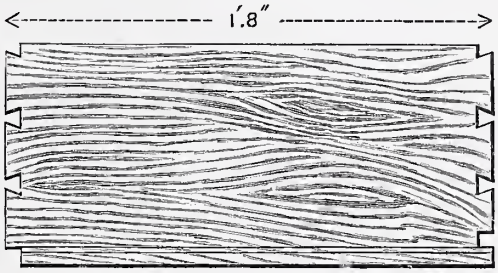



Fig. 11.—Side of Drawer.

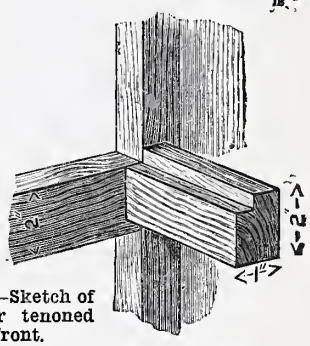



Fig. 16.—Sketch of Bearer tenoned into Front.

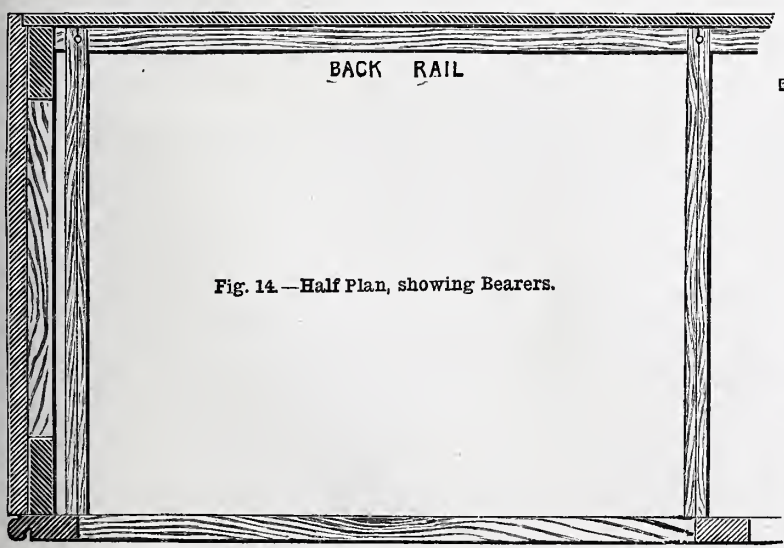



Fig. 14.—Half Plan, showing Bearers.

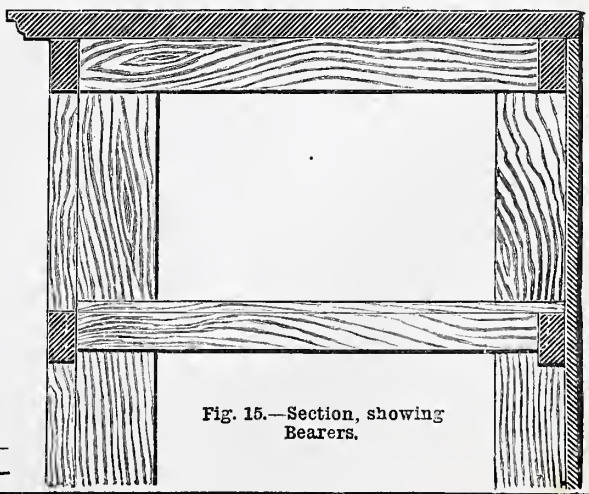


Fig. 15.—Section, showing Bearers.

up the stone in those parts, first preparing it with the acetic acid as previously alluded to. The artist must be sure to go over the same lines as those already drawn, and this requires a very neat piece of work to avoid making double lines, as he must bear in mind that the drawing is the reverse way to the original sketch being now on the stone.

Any writings or tracings when done on paper should be made, if anything, rather thinner than required, as they may spread slightly in the transferring.

To proceed to the subject of drawing on the stone itself, a tracing of the subject must be made on the ordinary, or végétal, tracing paper, according to the clearness of the sketch; then gum the top corners of the tracing to the stone, taking care to reverse it, slip a piece of the red transfer paper underneath, with the red face to the stone, and go over the tracing carefully with the tracer, lifting it up now and again to see if it is going down satisfactorily. If the drawing is to be worked in chalk, the red line should be made as faint as possible, for although the liquid ink would penetrate through the chalk, it may prevent the lithographic chalk from adhering properly to the stone. If the outline should be too strong, a little talc brushed lightly over the stone will remove some of the red chalk without destroying the tracing. Should the tracing require any alterations, it can be washed off the stone with a clean sponge and water; but the stoue must be allowed to thoroughly dry before re-tracing and proceeding with the work.

Some artists use a looking-glass to work with, but it is not advisable to make a practice of doing so, as it is not then easy to do without it, and there is really no difficulty in getting into the habit of working the reverse way to the original sketch.

In ink work the student must not think because the drawing appears nicely shaded on the stone that it will necessarily print so; perhaps the ink is a little thinner iu those parts where it appears lighter or browner in colour, which will help to give the illusion, but it will all print equally black wherever the ink has touched the stone, therefore any tinting or shading required must be worked in lines or dots. The best teacher is the student's own experience, which he can obtain in an easy manner by working in various ways on a stone and then having it printed.

Black-and-white drawings on polished stones are generally shaded or tinted in lines in imitation of etchings, stipple being reserved for colour work; and whether the drawing be done in stipple or chalk, the outline and markings should be all made first before any tinting is begun, and in the case of ruling that should be done first of all. If any large space for solid is required, it is better first to outline it with the brush, then make the drawing, and fill in the solid last.

To etch the drawing after the work is completed, the stone must be placed flat on the bench, and the brush filled with the etch passed lightly once over the drawing, leaving it as evenly as possible on the stone, taking more as required (being careful not to leave a line showing where the etch is renewed), and the drawing must not in any way be rubbed, which refers especially to chalk work.

Should there be a quantity of solid on the stone, the work does not require the acid as strong as if there be a great deal of strong tinting and very little solid; and also light tinting does not require such a strong etch, but it is impossible to lay down any decided rule for this.

In very particular chalk work it is better not to touch the drawing with the acid brush at all, but to slightly tilt the stone and pour the etch over it, allowing it to run down; and there are special troughs made with fixtures on which to place the stones, and which can be moved to tilt them in any direction; but in any case the etch should be put on as evenly as possible, and allowed to dry before sending the stone to the printer, when he again etches it. Some printers prefer to etch the stone entirely themselves, but it is better that the artist should do this first etching himself, as it is the most important, and he knows exactly how the drawing has been worked, and can therefore judge the necessary strength the etch should be better than the printer; besides which, he is sure the work is not rubbed in any way when it leaves his hands, which might otherwise be the case.

It is a very dangerous practice to cover stones with paper before the gum is dry, as it would stick, and when the printer washes it off it would not be his fault, if some of the work were rubbed at the same time. Some artists are very careless in leaving their stones to be etched until the last minute; for good chalk work the stones should be under etch about twelve hours, but stipple does not require so long. In fact, for some commercial work it is better to etch the stone, and almost immediately afterwards roll it up.

If the drawing were over-etched—that is, having used the acid too strong—the work would disappear in the printing, the acid eating through the ink, especially in fine work; and if not etched sufficiently would not print clearly. But after trying once or twice, the student will soon find out the desired strength it should be.

In lithographing printed letters such as Fig. 23 (page 231), the student can only be advised to do them carefully as he would do on paper, and to use his own judgment whether to gum out the letters and fill in the stone solid, or rule round the letters and fill in the spaces, leaving the letters open, it being possible to do them either way, if the letters are required to be left white upon a coloured ground. If the letters are coloured it must be just *vice versâ*, the letters filled in solid, and the spaces left, but when spaces are gummed out the ink should be dissolved in turpentine instead of water, to prevent it mixing with the gum, otherwise parts that are not required would perhaps roll up black.

A very effective monochrome drawing can be done by printing it in two colours—namely, a drawing stone, and a tint. Do the drawing as if it were only to be done in black and white, and have it printed either in red, sepia, grey, or black, according to taste and the nature of the sketch; then have an offset taken from this just the same as if it were a tracing, using the drawing-stone as if it were a key-stoue, and fill in this second stone solid, excepting the high lights (the red impression on the stone from the original drawing will show where the high lights would come), and if a grained stone be used, the solid can be shaded off or left sharp as required. If the drawing is printed in a dark sepia, aud the tint in a very pale shade of the same colour, the white paper being left for the high lights, a very pretty effect can be obtained from the one drawing.

In the case of small cards, or drawings, it is possible to do several on the same stone, only they must be placed in proper positions to allow for cutting and trimming them to the size required.

I took for our last subject, as an example, a chromo-lithograph in half a dozen printings, namely, gold, yellow, blue, pink, brown, and grey, showing the working of each colour, and at the same time making it applicable to any drawing in any number of printings. As I went into the matter as fully as space would permit, I need not say much on the subject in addition to the supplementary remarks I have felt called upon to make in this my concluding paper on the method of lithographing circulars and letters.

It seems to be a general idea that chromo-lithographic drawings are worked on the stone in colour, but this is a very great mistake, and gives an entirely false notion to anyone unacquainted with the work; for to refer back to the first principles of lithography, every colour is worked on the stone with the lithographic ink, which is black, and after the stone has been etched, the ink being of no further use, is washed off, and the required printing ink rolled on the stone whilst it is damp, it being necessary to do this for each impression taken; and as the printing ink adheres to the preserved portion of the stoue, it does not make the slightest difference whether it is black or coloured. The following is a good and useful order for printing: gold, silver or bronzes, yellows, blues, pinks, reds, browns, light greys, dark blues (if any), dark reds, and dark greys.

Some artists begin with all the light colours, and gradually work down to the strong ones, but I should advise the artist, from practical experience, to get a strong colour on the proof at au early a stage as possible, as it will throw all the other colours back to their proper places, and so do away with the necessity of using extra colours, or re-proving the whole thing again.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

### Dog Muzzles and Gas Globes.

Dog Muzzles—Nose Wire—Cheek Wire—Nose Rings—Drop Wire—Gas Globes, First Stage, Second Stage, Final Stage.

**Dog Muzzles.** — What the present canine generation really think about the manner in which their noble heads are encased within cages provocative of tantalization, I, and everyone else, I believe, will be unable to determine, unless trausmigration of souls is a truth (which I doubt), and at some time or another is closely connected to spiritualistic revelation, when, perchance—but let this drop; it is but an exceediugly improbable theory.

The dogs themselves, however, do not appear, generally, to take any more notice of the metallic obstructions to their complete happiness than they would of a pimple—both are encumbrauces which certainly annoy them, but which they accept in good spirit. Pinch a dog; pull his tail; and the treatment is different. He will not endure it. But as muzzles exist, I will for a time be the dogs' unwilling foe by letting out a few remarks as to how these guards are made to prevent them from nibbling their benefactors and from kissing each other.

There are so many different patterns of muzzles that it would be well-nigh impossible to describe them all without wearying the reader by giving him several pages of particulars; and as I am limited to space in proportion to the several articles I have

undertaken to write upon, I must confine myself to the unit one in dealing with them.

In passing, I might mention that there are several patented muzzles, during the wearing of which dogs are permitted to eat and drink at will, without there being a possibility of their biting anyone. It is obvious that, did opportunity offer, a description of either of these would be of but little use, as in such a case the patentees would be very suspicious that some readers

where shown separately in other diagrams, are similarly lettered to secure identity.

*Nose Wire.*—To the bench, or to loose boards for the purpose, are driven a number of short iron pegs, in the manner shown in Figs. 112 and 113. Those in the former diagram are used for forming the nose or crown wire, while the pegs, supposed to be in Fig. 113, are those around which the side or cheek wire is bent. A straight wire, with an eye-hole of the shape indicated, is

first two pegs, on the inner side of the fourth, outside the fifth and sixth, and so on, finishing up at the other end in an eye-hole. If more than one muzzle is to be made of the same size, follow the hints I give for ascertaining the proper straight lengths of wire necessary in my remarks on the formation of hooks in the paper concerning fire-guards.

*Nose Rings.*—When the nose and cheek wires are ready, solder them together at

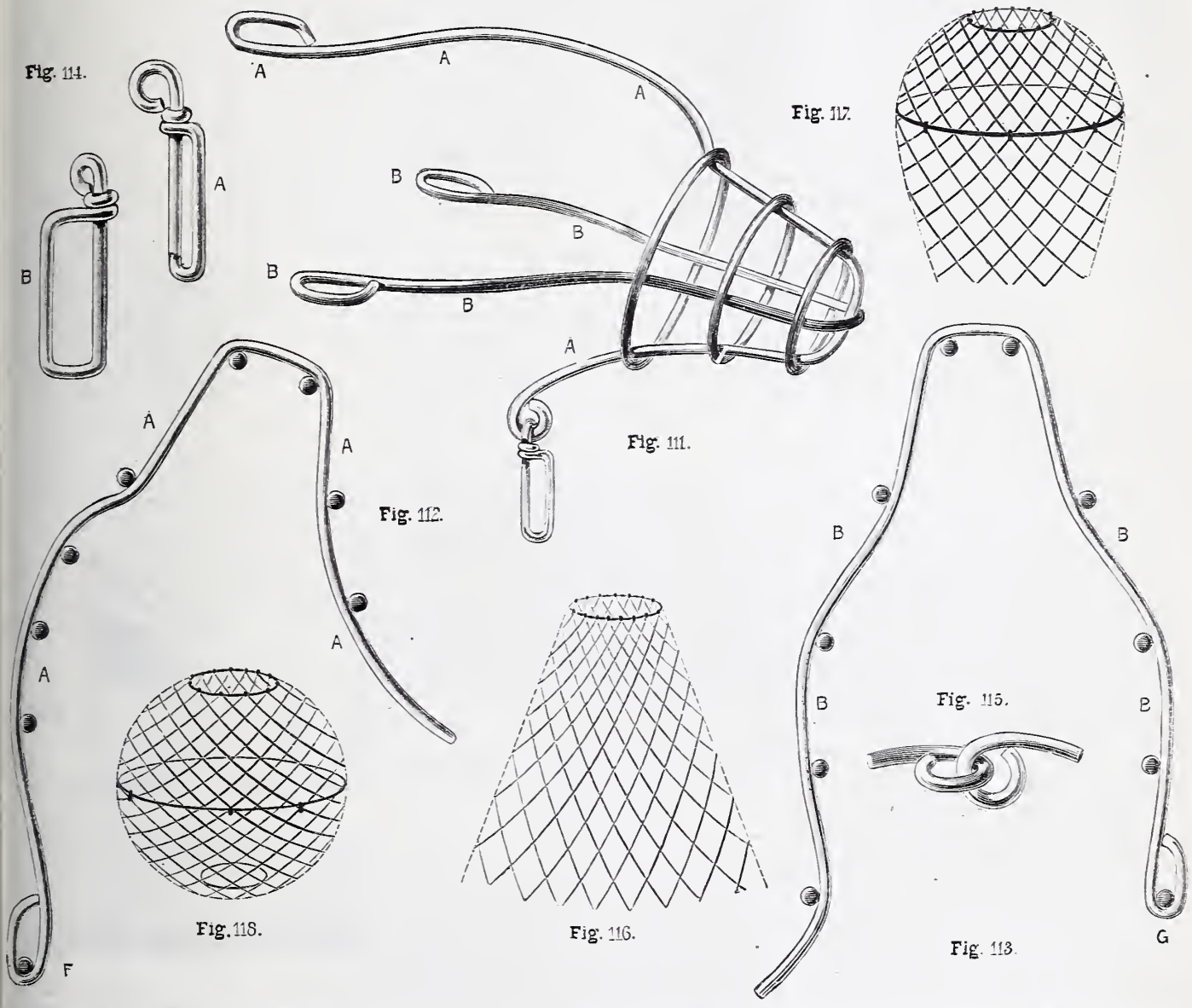



Fig. 111.—Common Pattern of Dog Muzzle. Fig. 112.—Nose or Crown Wire laid upon Bench and bent around Pegs. The Wire is hitched on to Peg F, and bent in due order outside and within the remainder as shown. Fig. 113.—Cheek Wire laid upon Bench and bent around Pegs. The Wire is hitched to Peg G, and treated in same manner as shown in Fig. 112. Fig. 114.—Two Views (A and B) of Eyes for Strap. Fig. 115.—Eye-holes to complete Nose Rings. These Holes are at the bottom of the Rings, and must be squeezed closer than shown here. Fig. 116.—Gas Globe of Crimped Wire: First Stage. Fig. 117.—Ditto, Second Stage. Fig. 118.—Ditto, Third Stage.

ight avail themselves, without permission, f the manufacture of such. It may be hat is generally vulgarly termed a "come-own" from patent muzzles to the very ommon pattern shown in Fig. 111, but this the article I propose to deal with.

The dog for whom the instrument of tor-ure is intended would be the best judge as o the sizes required; but, unfortunately, iese animals cannot make their desires nown to us; therefore it is necessary for ie choice to be left to our humane judgment. reference to Fig. 111 will show that I have ttered the wires represented. These wires,

hooked to peg F (Fig. 112), while the wire is carried in and out among the other pegs, as represented in that diagram. Continual practice will be expedient to accustom the operator to properly bend the wires, as, although it is easy enough to guide them properly around the different pegs, it will be noticed that, upon release from them, they will spring out considerably.

*Cheek Wire.*—In Fig. 113 is represented the cheek wire in plan. An eye-hole is formed at one end and hooked on to either extreme peg, from which it is continued, in the manner shown, on the outer sides of the

their junction. Three oval-shaped rings are then required, a small one for the front of the nose, a larger one for the middle, and one still larger for the back. They will be soldered in position outside the nose and cheek wires, with their eye-holes uppermost. Each of these ring wires will be formed round an oval block or ring fixed to the bench. An eye-hole will be formed, hooked to a peg at the head of the block, and the wire drawn round it, and the end passed through the first hole and squeezed down tightly over it (Fig. 115).

*Drop Wire.*—As most people may know,

there is a drop eye-wire underneath the muzzle, attached loosely to the lower eye-hole. It is shown in Fig. 114, on the right-hand side of which is a side view of it, while on the left is shown a front view. It is such a difficult matter to illustrate portions of wire-work in an understandable manner, that I have shown this hook, or rather two of them, as hanging upon a block. Solid articles, such as furniture, can be made clear by variations of light and shade; but with such open work as I am labouring with at present, it is impossible to obtain many degrees of light and shade. In Fig. 114 the main portion of the hook is supposed to be exposed in full before the reader, while the top eye-hole is receding from him. On the left-hand side the reader may imagine that he sees the main portion edgeways, projecting from the paper, while the eye-hole is flat and full before him.

This hook is for the reception of the strap, which also travels through the remaining eye-holes in the nose and cheek wires. Fig. 114 is drawn to a much larger scale than the diagrams, Figs. 111, 112, and 113.

I wish to whisper a hint into the ears of my amateur friends who possess dogs, as to how they may obtain the proper shape to make a muzzle to fit their particular canine companion. Come in, take a seat, while I ask your jealous professional brethren to wait outside, lest they condemn me for assisting you. First, catch your dog. Next, coax or compel him to stand close up against a wall, while a shadow of his head is cast sideways upon the latter by the rays of a lamp close by. Then pencil along the outline of the shadow of the head, if the dog will allow you to, after which he may be released. Measure the dog's head from the nose to between the ears, and also the sketch from the nose to the ear. If they coincide, well and good; if not, reduce proportionately the sketch within the original outline until satisfaction results.

You may then, to arrive at the length the nose wire must be, place a piece of string against and completely along the outline, having just so much as will cover it entirely. If a piece of paper or card be hung to receive the shadow, the outline upon it can be used as a guide for the necessary pegs around which to bend the nose wire.

**Gas Globes.**—I will now pass from articles devised to prevent our four-footed friends and foes from giving us sundry bites, to articles invented to debar a more serviceable friend and more dangerous foe, viz., fire, from annoying us.

The utility of gas globes must be evident to all. They secure gas jets from the approach of pieces of paper, etc., that may happen occasionally to be blown about an apartment, curtains from being forced into direct contact with the same, and in numerous directions affect good by guarding the flame and debarring it from being the means of creating damage by setting fire to inflammable material.

*First Stage.*—I must refer my readers to my article upon "Splicing" (No. 123, page 292). There they will observe that I show a cylindrical piece of work, which is obtained by a certain number of straight crimped wires put together, and then bodily bent round and spliced. It is from such a piece of work, but consisting of many more wires, that these globes are made. A comparatively small ring is put *outside* the top end of the work, the wires at that part being drawn close together, and those which the ring comes in contact with turned over on to the latter. There will be a considerable decrease in the size of the meshes adjacent to this ring when it is fitted, the work having a tendency to assume an appearance similar to that of Fig. 116. In order to secure the ring in position whilst the wires are being permanently fixed to it, it is advisable to, at first, turn over one here and there, say, in about four different spots.

*Second Stage.*—The next operation is the fixing of a large ring, which ring will be placed *within* the wires composing the globe. This will be found a more difficult part to accomplish. The ring must be pushed into the work gradually, the bottom wires in Fig. 116 being occasionally drawn apart as this is done.

The length occupied by the work during these movements will decrease to a great extent, and, consequently, the bottom meshes will become more open. When the ring is pushed in to the proper distance, the curves of the wires will look something similar to those shown in Fig. 117, and the ring is secured by being tied in six or seven different spots.

*Final Stage.*—The placing of the bottom ring will be found a more difficult job than fixing the top one; it should be smaller than the latter. While being finished, if the work does not appear to be assuming a truly globular shape, it can be made to do so by bringing equal and steady pressure to bear upon it, one opening of it being in direct contact with the bench. If all is properly done, the globe will look like Fig. 118.

While fixing the bottom ring, *outside* the wires, gradually gather the loose ends together with both hands, until they can be easily grasped in one hand only; then slip the ring on, and temporarily secure it by fastening a wire here and there, previous to turning all of them over on to it.

It was my intention to also give particulars here of the more ordinary pattern of gas globes, but as the present paper has occupied sufficient space for this week upon this branch of industry, I must postpone descriptions until a future time.

## HOW TO MAKE A PAIR OF LEATHER SLIPPERS.

BY W. GREENFIELD.

This brief article, in reply to a query put by Novice (*Stockport*), necessarily assumes this form, as it is too lengthy for "Shop."

I have come to the conclusion that you want the most simple way of making a pair of slippers. Your *nom de plume*, and asking what tools you need, tell me you are not far advanced in the trade, but I wish you had told me what you wanted to make them—pumps (single sole) or welts (double sole), or if you only want to make them riveted or pegged, which is often done for rough wear.

Had I but known which, I should have answered before, but as it is, I have waited till I had time to tell you the way to make a proper pair of slippers. You can, in this style, make them light or stout, according to the substance of the tops, and as they are leather they are worth a good sole. Of course, I conclude your tops are already cut and closed, as you only say make.

This class of slipper is easily repaired, and is by far the best way to make them; that is certainly why I have decided upon them, as I feel sure that a number of readers will welcome the answer to your question, and it will form a good stepping-stone to boot making.

Of course, you have lasts that fit you; if not, you must get a pair.

A shoemaker's necessary kit for what you ask is as under:—Knife, pincers, hammer, sharpening-strop, sewing-awl and handle, lap-iron, piece of smooth board, rasp, buff-knife, and fore-part iron. Bottom stuff and grindery:—Pair of in-soles, pair of out-soles, pair of welts, pair of stiffeners, pair of split

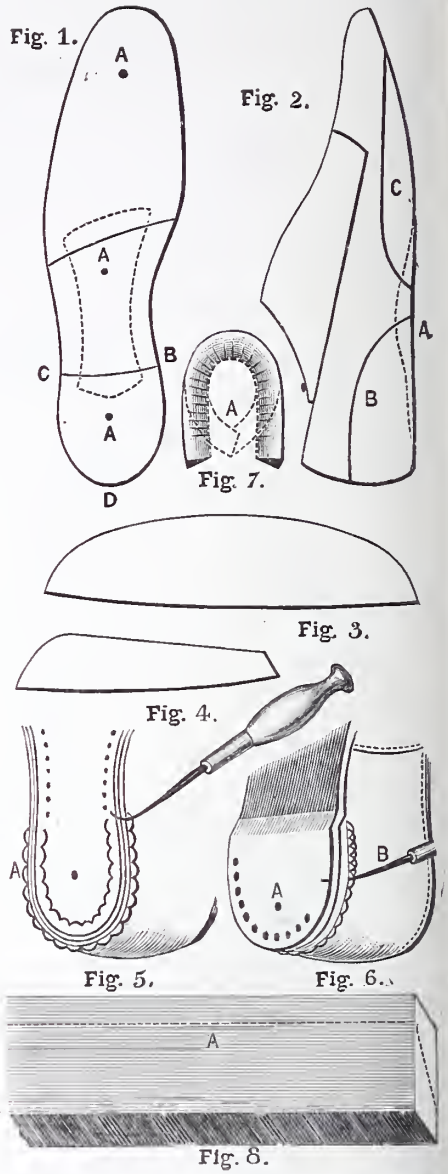



Fig. 1.—In-sole blocked on Last. Fig. 2.—Filling up Waist. Fig. 3.—Stiffeners. Fig. 4.—Side Linings. Fig. 5.—Sewing in Seat and Welt. Fig. 6.—Lift under Sole to form Heel. Fig. 7.—Mode of twisting Split Lift. Fig. 8.—Mode of cutting Leather for Split Lift.

lifts, piece of felt, four side linings, lasting tacks, ball of No. 9 patent hemp, ball of wax (soft for winter, hard for summer), bristles, ½d., sheet of No. 1½ sand-paper, ink, ½d. (shoemaker's), and one hard heel-ball.

The leather can be prepared as shown in No. 112 of Work. While the in-soles are wet, block them on the last, grain side to the last, with three tacks, as shown at A, A, A, Fig. 1; stretch them all round with the pincers, and put a tack in here and there to keep them down over the side of the lasts. Let them get nearly dry, draw out the side tacks, and round up to the shape of the last. A

slipper last should be dead in the waist, and it ought to be thin at the top. These two points are to make them fit tight in the quarters; but if the last is a boot last, then the waist must be filled up by putting a piece of stout soft belly inner-soling in to fill it up and make it almost straight at the bottom, as the plain line, A, Fig. 2; the dotted line, B, showing the curve or drop there generally is in a boot last.

And now I must refer you to back numbers of Work, otherwise I should have to encroach too much on our space.

The next thing to do is to fit and hole the in-sole, and by referring to Vol. II., page 796, No. 101, you will find all this fully explained in the answer to A. B.

Next comes the fitting the welt. This you will find in the answer to H. G. (Vol. II., page 733, No. 97).

The stiffeners are the shape of Fig. 3, only they are about 9 in. long and 2 in. wide; they are skived a little at the bottom, and round the top they are skived to *nil*. Their place in the slipper is shown by B, Fig. 2, and they are put in between the upper and lining.

The side linings are skived in a similar way. They are the shape of Fig. 4, and one is put in at each side, as shown at C, Fig. 2.

Next comes the principles of lasting, and these you will find fully explained in the answer to Snobby (Vol. II., page 717, No. 96), with one exception—slippers must not be pulled over tight in the waist, or it will tend to make them loose in the quarters.

And now you must be referred to the last article on "Boot and Shoe Repairing," which appeared, as you may remember, in No. 137, and is on "Welting and Soling Hand-sewn Work." From this you will see the way to sew your welt, only it will have to be sewn in from B, up the waist and round the toe to C on the other side (Fig. 1), and after you have sewn to C, sew your seat round from this point to B, passing D; or the seat can be sewn in first and then the welt, as A, Fig. 5. Then you put a shank in—that is, a piece of leather in the waist, as shown by the dotted line—or the whole can be filled up, as the bottom of the fore-part, with felt, as will be seen in the above-named article, which also tells you how to put and stitch the sole on; and in this case the waist can be sewn, as for a slipper it is hardly necessary to stitch it.

For slippers, a heel need not be built, as it is for a boot, but the sole left long at the back, and this can form the heel-piece. Of course, it wants to be thicker here to form the heel, and this is done by putting a whole lift and a split lift under the sole at A, Fig. 6. A split lift, or rather a pair, is a strip of thinnish sole leather, about 6½ in. long, and about ¾ in. or 1 in. wide. This is well wetted and split down the centre, holding it flat on the board and knife quite slanting, and follow the dotted line as shown in Fig. 8. Each piece is held flat on the lap-iron and twisted round, letting the thin edge from the centre (as A, Figs. 7 and 8) hold it together at the ends, as shown by the dotted lines in Fig. 7; and while held in that position, with the left hand keep tapping it gently with a hammer in the centre; this will make the wrinkles lay flat, which the thin edge will form itself into. It is sure to spring back a little, if only in drying, and it will then be its proper shape, as Fig. 7. The ends will want tapering, and the front of the whole lift as well, and then they can be put under the sole and a nail driven in at A, Fig. 6, to hold them in position. The heel can then be trimmed up, as shown in the answer to M. M. (Vol. II., page 568, No. 87).

The way to cut and lay down the channel you will see in the article I have spoken of above on "Soling," etc.

The way to sew down the heel is shown in B, Fig. 6, and how it is done is told as above in Vol. II., page 568, No. 87. And the way to finish, set up stitch, iron, etc. etc., good enough for the purpose you ask (or, any way, for your first three or four pair), you will find by searching the pages spoken of above.

To make the heels wear longer, a few nails can be put in the back, as shown in Fig. 6.

I know I have given you a lot of searching, but my experience was gained by searching for detail, and, if you can but see it, there are many more awkward corners turned in some of the above answers than I could tell you in any straightforward article, unless it was very long.

## HINTS ON NETTING.

BY LANCELOT L. HASLOPE.

This short paper was suggested by and is in reply to a query by J. H. (*West Bromwich*), as to the *modus operandi* of netting, and the tools required. For illustrations of the netting needle, mesh, mode of making stitch, etc., the reader is referred to Vol. II., page 425, otherwise No. 79.

The tools required for making nets are very simple. They consist of a needle to hold the twine or other material used, and a spool or mesh to form the loops of the net upon. They are usually made of some kind of hard wood, generally box, and can be purchased from most ironmongers and woolshops for a few pence. If J. H. could get a sight of them, he would doubtless be able to make them for himself of the exact size he requires.

The knot used in netting is the weaver's knot, or sheet bend, shown in page 65 of Work, No. 109. There are two methods of making it used by netters. The most common way is called "under edge" netting. This is easy enough when you know how to do it, but it is complicated and quite impossible to describe without the aid of elaborate illustrations. The other mode is called "over edge netting," or "braiding." As this is much simpler, I will do my best to describe it. The first thing to do is to make the "foundation." A piece of small cord or stout twine, about a yard long, is joined together at the ends with a sailor's knot and then fastened to the handle of a door or other suitable place. If the net to be made is small, the left foot may be put in the loop. The needle having been filled with twine, one end of the twine is made fast to the foundation. The spool is held in the hollow between the forefinger and thumb of the left hand, the fingers being extended along it, as a pen is held in the right hand. To form the first stitch the twine is brought over the spool, then under it, over the foundation, and up over its own part—thus forming a clove-hitch. The hitch thus formed is now held between the tip of the forefinger and the thumb of the left hand, while the needle is passed over the foundation again and up through the loop formed; the two loops are pushed close up together and hauled taut. This is repeated again and again until as many half meshes or loops are formed as are required. When this is accomplished, turn the foundation over and slip the loops off the spool; pass the needle over the spool, round under it, and bring it up through the first loop on the foundation; draw this down until the end of it just touches the upper edge of the spool; hold it there with the forefinger and thumb of the left hand. Throw the loose twine well over to the left side of the loop that has just been taken up, and pass the needle behind the loop and bring it up in front of the spool, and haul taut. The knot is now made. Pass the needle over the spool round it and up through the next loop, round the back of it, and between it and the last loop, and when hauled taut another mesh will be formed. Care must be taken to have sufficient slack twine, so that the needle has plenty of room to work easily. In every case the stitch must be made *on* the loop taken up, and not below it, or a "slip stitch" will be formed which is fatal to good netting. Braiding has some advantages over "under edge" netting. In the first place, it can be done with greater rapidity; it also makes rather a better stitch—at all events, one that can be tautened more easily. If any difficulty is experienced in making the first row of half meshes, the spool may be dispensed with, and the loops made with the fingers of the left hand alone. In mending nets, the fingers alone are generally used in the place of a spool.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

Introduction—Object in View and List of Tools Needed—Desirable Additions.

These lessons, compiled from some years' experience, are written in response to a widely expressed wish for a column in Work which should be devoted weekly to teaching carpentry in a progressive and practical manner. It is thoroughly impossible, however, to promise that the lessons shall be "continued in our next," and it is difficult to compress a lesson into a column, but something shall be attempted. This brief introduction is written to clear the ground and to explain several matters which the papers may not have made clear to a typical pupil.

Our object is to advise a beginner, who, without experience, needs guidance, to avoid errors and mistakes into which he is apt to fall. It is presumed that the learner will know the names of a few of the more general tools, and the more special tools and adjuncts will be explained as they are required.

First, a bench. There are many now in the market that are good and suitable; do not get one that is too low, and let the sort of work you intend to favour have an influence in your choice. The smaller benches sold at the tool-shops are not high enough for an adult—from 33 to 34 in. for a man is excellent, 26 to 30 in. for boys.

In a review of a book on "Slojd" (Vol. III., page 330), the Editor recommends benches made with screw at the end as an excellent addition to the bench. I quite agree with him, and advise all who can do so to obtain a bench so fitted.

The tools necessary are dependent upon many considerations, but those which follow may be regarded as indispensable:—

Planes: A jack-plane, 17 in. long; a smoothing-plane; both 2¼ in. iron.

Saws: A hand saw, 26 in. long; a panel saw, smaller teeth, ditto; a "carcase" dovetail saw, 10 in. or 12 in.; a bow or frame saw, 12 in. blade.

Chisels: A set of eight, "firmers" and

assorted. For mortise chisels, obtain $\frac{5}{16}$ and $\frac{7}{16}$ in. sash chisels.

Gouges: Three or four, chosen to taste, $\frac{3}{8}$ in. upwards.

Gauges: Two marking and two cutting and one mortise gauges; a 2 ft. rule, one $4\frac{1}{2}$ in. square, one 9 in. or 12 in. square; hammer, mallet, a few bradawls, one pair of dividers, a bevel, two screwdrivers, two punches, an oil-stone, oil-stone slip, and oil-can; for fixing work, two or three hand-screws and glue-pot; if hard wood is to be worked, a scraper and a toothing-plane. If funds are still in hand, buy an iron stock or brace, and a selection of boring bits, a spokeshave for curved work, a spirit-level, and pair of pincers. When the use of a jack-plane is acquired, and freedom can be combined with definite stroke, well under the operator's control, a trying plane may be purchased, but it is useless without this preliminary practice.

There are several accessories which may and ought to be made by the amateur, such as bench hook, mitre cut, shooting board, etc. Explanations of all these have been given in WORK, and the index may be consulted to great advantage. In our first lesson we shall consider the plane.

## SQUARE AND OBLONG VESSELS IN SHEET METAL.

BY R. ALEXANDER.

SQUARE AND OBLONG-SHAPED ARTICLES—HOW TO MARK OUT AND MAKE UP—EXAMPLES—SQUARE VESSELS WITH UPRIGHT SIDES—DITTO WITH SLOPING SIDES—YORKSHIRE PUDDING PANS, DOUBLE BAKING PANS, BREAD TINS, AND SIMILAR ARTICLES.

A FEW simple examples of square and oblong work will now be given. To make a rectangular vessel with upright sides and of given dimensions, sides and bottom in one piece (Fig. 1), let the size of the vessel be, for example, 8 in. by 5 in. by 2 in. In this case add twice the depth of one side to the length and also to the width; this gives the size of the piece of stuff to cut it out of. I am supposing this to be a plain tin pan without wire or fold. Thus the size in this case will be 12 in. by 9 in. Mark out a square of that size on the metal, A B C D, Fig. 2. With compasses set at the depth required, place one point at the corners successively and mark the eight points × and draw lines through them parallel to the outside lines; this will be the line to fold the sides up from. If the sides are to be simply soldered up, the corner pieces of the pattern must be cut out; if it is to be lapped round at the ends, leave pieces as shown by the dotted lines. If the pan is to be wired, allow as much extra as will be required for the size wire to be used, parallel to the outside edges (see dotted lines). It will be found that wiring makes the article larger in its outside dimensions, though not in its capacity—by twice the thickness of the wire and of the tin that covers it. Thus, in the example just given, instead of the vessel being 8 in. by 5 in., it would be $8\frac{1}{4}$ in. by $5\frac{1}{4}$ in. So if an article of this description is to be made of a given dimension *outside* the wire, the bottom must be marked as much smaller all round as the thickness of the wire to be used, and a trifle more even, to allow for the thickness of the tin. When the article is to be larger at the top than at the bottom, it is cut out like Fig. 3, which we will suppose to be a pattern for an article the same size at the bottom and same depth of sides, but 1 in. larger each way at the top. After marking the corners out square as in the previous example, set the compasses to half the size larger required at the top, and from the points A, A, B, B, C, C, and D, D, mark off points E, E, F, F, G, G, H, H; draw lines from these points to the corners × and you have the required pattern. Oil tanks for paraffin stoves are made like this, only then the part we have been calling the bottom would be the top, and the bottom would be soldered in at the large part.

*Yorkshire Pudding Pans* (Fig. 5).—The pattern for these and the method of marking out is shown at Fig. 4, which is a full-size pattern of a corner; for stock sizes they are usually cut full out of the stuff (after squaring up), single, middle, and double, and are turned up from $1\frac{1}{2}$ in. to $1\frac{3}{4}$ in. (before wiring). It is marked out in a similar way to Fig. 1, but after marking the points, which give the difference in size between the top and the bottom, a line is marked for cutting the notch to allow for wiring; this notch is cut down rather deeper than twice the diameter of the wire to be used. The dotted line, A B, shows the idea. The compasses are then placed at the corners with radius × A, and the arc A C described. The portion F is then cut away; the other corners are, of course, treated the same. In working up, great care must be taken with the corners to get them true. I will try to describe the way to do it. Press the corners over the tip of the extinguisher stake and bend on the line E ×; this will commence the corners and slightly turn up the side. The bending of the sides can then be continued on the hatchet stake; or, if that is too wide, on the side of the anvil or end of crease iron, assisted by the mallet. When the sides are up sufficiently the corners are knocked together, A and C meeting, and bent round on the ends of the article, against which they should lay quite close and flat; the sides are then finished. The dishes can next be folded for wiring on the hatchet, wired and jennied, which completes them, as they require no solder when turned up in this way.

There is a tool called a dripping-pan swage, which will turn up the sides; it can be set to various depths, and is very useful for piece-work. Whilst on the subject of baking pans or dishes, a word or two on making dishes to order may not be out of place. In these there is usually a given size, and it is generally the length and width of the top and the depth; it is very seldom that the dimensions at bottom are given, that is left to the judgment of the workman. I have already shown how these dimensions may be regulated, and would draw attention again to the fact that allowance must be made for the wire, or the dish would be larger than the dimensions given. Always err a little on the safe side; thus, if a dish is ordered 12 in. by 10 in., try and work to get it $\frac{1}{8}$ in. under each way, there can then be no dispute about its being too large to go in the oven, and the slight difference in the measurement is of no practical importance in a case like this. A frequently occurring order is a double baking dish (Fig. 6). The bottom dish is a plain dish to contain water only; the inner dish that contains the meat has a well, strainer, and filling corner. The outer dish is made with more upright sides than would be the case if it were a single dish, and also somewhat deeper; 3 in. deep is a usual size for dishes of over 12 in. square. The inner pan must be cut about $\frac{3}{4}$ in. smaller each way, as it will not want to be so deep; but it must be the same distance along the sides after the notches are cut. Fig. 7 illustrates what I mean; if this is carefully attended to, the dishes, when turned up and wired, will fit each other nicely. With regard to the well, it can be hollowed in either before turning up or after; for myself, I prefer to put it in after wiring. A circle should be described in one corner so that its circumference comes about $\frac{1}{2}$ in. from each side of the dish. (See Fig. 8.) To hollow up the well, I wire a strong piece of tin with a small wire (about No. 13) and turn it round and seam it together, making a neat join of the seam at the wire, and also solder round the wire, then solder this on to a piece of tin about 1 in. larger all round; punch two or three small holes in this, and tack it to the bench with some tin tacks; place the dish over this, and work gently all over the circle described for the well, commencing in the centre. This is a much better way than hollowing on the block. Of course, care must be exercised in hollowing not to push it too far, or the stuff would split and spoil the dish. A strainer should be put in the corner where the well is, so that the gravy can be strained as it is poured out of the dish. Fig. 9 shows this. It will be seen that the angle of it is greater than a right angle; this is so, that when it is fitted to the corner of the dish, the front of it will be raised above the level of the dish. Close in the opposite corner of the bottom of the inner dish a $\frac{1}{2}$ in. hole must be punched and a plain piece of tin soldered and riveted across this corner marked A. Fig. 6 is for pouring water into the outer dish, so the reader will see that the piece of tin which covers the hole must be quite sound or the water would get into the inner dish. A pair of handles is affixed to each dish, and as this kind of handle is frequently required for many other purposes, I will briefly describe how to make it.

Fig. 10 shows a very handy tool for bending the wire into the shape required. A piece of wire of the required length is placed between the two pairs of rollers as shown in the figure; the handles, H, H, being pulled apart, the wheels at their extremity travel round the semi-circles and bend the wire into the shape shown at F. This is a most useful tool where a quantity of such things are wanted. Failing this tool, they can be bent on the extinguisher stake or in the vice by means of an improvised tool consisting of a piece of $\frac{1}{2}$ in. or $\frac{5}{8}$ in. round iron bent into the shape of a U. (See Fig. 11.) A strip of tin of sufficient width is then passed through the handles and bent over the join in the wire (which is rather a bull considering that there is no join, so let us say where the wire meets); it is then laid on the edge of a tool and knocked close, the wire sunk all to one side.

Fig. 12, A, B, C, shows these details. The handles of the outer dish are fixed on the outside, and those of the inner dish on the inside; two rivets must be put through each; a pair of wire runners are generally, though not always, fixed to the outer pan to prevent the bottom wearing out through drawing in and out of the oven. The meat-stands for these dishes are usually kept in stock; if not, the smith makes them. If I had no smith, and could not get a stand, I should make one myself.

*Square Articles with the Sides and Bottoms in Separate Pieces.*—Example, bread tins (Fig. 13). To mark out the end pattern, set out a line, A B, Fig. 14, and draw another line parallel to it at a distance

equal to the depth required, and draw E F perpendicular to them from E on line A B. Set off on each side of the perpendicular line a distance equal to half the size required at the bottom of the tin × × and on line C D. From the point F set off each side half the size required at top of tin, Y Y. Join Y × on each side of the perpendicular line and you have the pattern perfectly true and correct. The pattern for the side, Fig. 15, is drawn in exactly the same way. Allowance for seam-wiring and edge for bottom should be added on to the pattern after marking what I will term the net size. I have marked it on the side pattern, Fig. 15, by dotted lines. The end pattern will require the same allowance as the sides for wire and bottom edge; but at the sides only half as much. The reason for this is that as the sides are knocked round on to the ends, there is a double turn on the side portion, thus requiring a large notch. Of course, if the ends were to be knocked on to the sides, the side pattern would have the small notch and the ends the large one. This kind of article is very easy to make. After cutting out, place all the pieces, sides and end, with notches all one way, at the folding machine. Fold the sides first, about the same size as for a saucepan, and seam and fold them right close up, both folds one way. (See section line of fold, Fig. 19, A.) Next fold the ends, but instead of folding close as in the case of the sides, fold just over a right angle. (See section line, Fig. 19, B.) After folding thus, fold for wiring. The ends must be put into the machine with the fold *uppermost*, and the sides with the fold downwards, or they will not come right when put together. If you are very sure that your cutting out is absolutely true, the edge for the bottoms can also be folded in the machine; but it will be best at starting to throw off the edge after they are put together and wired. The way to do this is to put them together in halves first—that is, take a side and end, and slipping the side into the end, and keeping it in position with

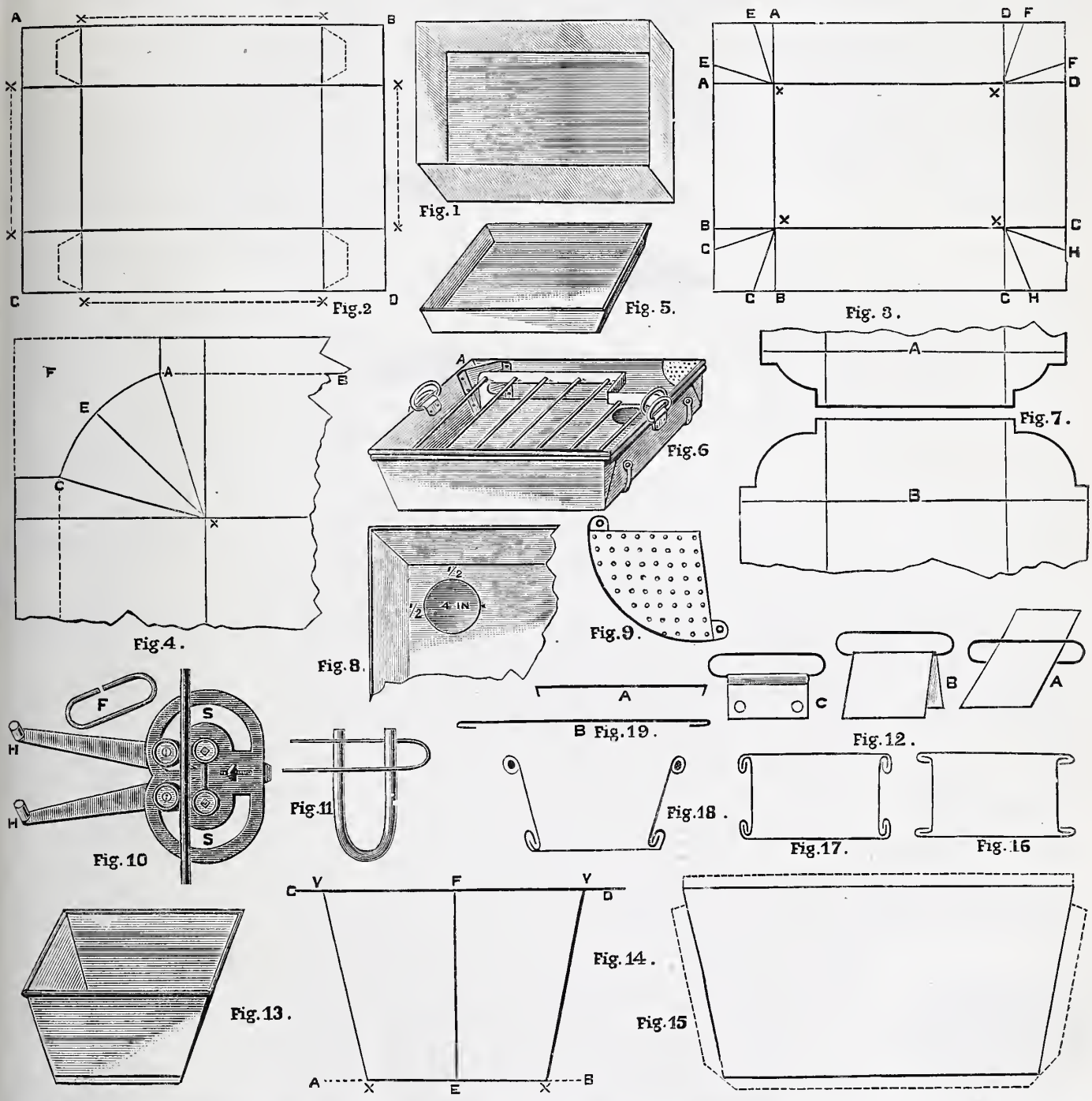



Fig. 1.—Rectangu'ar Upright-sided Vessel. Fig. 2.—Pattern for ditto. Fig. 3.—Rectangular Sloping-sided Vessel. Fig. 4.—Full-size Pattern of Corner of Yorkshire Pudding Pan. Fig. 5.—Yorkshire Pudding Pan. Fig. 6.—Double Baking Pan. Fig. 7.—Comparison between Inner Pan (A) and Outer Pan (B). Fig. 8.—Diagram showing Position of Well. Fig. 9.—Strainer. Fig. 10.—Wire Handle Former. Fig. 11.—Home-made Tool for bending Wire, etc. Fig. 12.—A, B, C, Detail of Handles. Fig. 13.—Bread Tin. Fig. 14.—Pattern of End. Fig. 15.—Pattern of Side. Figs. 16, 17.—Cross Sections of Bread Tin, showing Seam. Fig. 18.—Section of ditto, showing "Knocking up." Fig. 19.—Section Lines, showing folding of Ends (A) and Sides (B).

the forefinger, pane them together; use a bick-iron for this; then knock this seam down on the end. It will be found that this leaves rather a rounding edge. To square this up, hold the seam edgeways on the bick-iron and go along the rounding edge with a square-faced hammer; do them all like this, and then put the halves together in the same way.

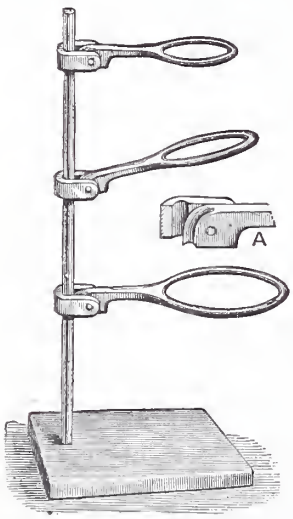
Figs. 16 and 17 are cross-sections of the tin, showing seams paned and "knocked up." Next wire them and edge for bottoms, cut bottoms with sufficient allowance for turn up, notch all four corners off, turn up on the hatchet, and pane and knock up as usual. Square the knocking up with the hammer in a similar manner to that described above. Fig. 18 is a section showing seaming of bottom.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 83.—Moor's Self-locking Retort Stand.

The Self-locking Retort Stand shown in the accompanying illustration is the invention of Mr. C. G. Moor, B.A., who has produced other useful appliances for chemical and other work, among which may be named his Chromic Acid Battery, a cheap and powerful battery for laboratory work, his "Simplex" Gas Generator, and his new Mouth Blowpipe, well adapted for the purposes of analysts, dentists, jewellers, etc. The form and construction of this new pattern retort stand will be easily understood from the annexed illustration; and the enlarged view of the locking portion of the apparatus at A, in which the portion of the slide nearest the spectator is removed in order to show how the inner end of the arm which holds the ring acts against the rod on which it slides so as to render it immovable in the position in which it is placed until there is occasion to alter it. Thus it will be readily understood that the ring can be adjusted to any height required in a moment by raising the ring slightly, and then sliding it up or down as required. When the ring is pressed down the arm and ring will automatically lock and remain perfectly steady. It is claimed by the inventor that this retort stand possesses the following advantages over the ordinary form: (1) When hot, the rings are easily moved by lifting them with the end of a file or other similar iron tool. (2) In the old form, if made of brass, the thread of the screw is apt to wear out and slide; whereas, if the set-screw is made of iron, the acid vapours of the laboratory will soon rust the thread, and make it difficult or impossible to use. The rings in this Self-locking Retort Stand are made of cast iron, and carefully annealed by a new process: this renders them very strong, and as they are of considerable thickness, no fear of burning away the metal need be entertained, as a Bunsen flame may be directed on them for any length of time without the slightest detrimental effect. The sole manufacturer is Mr. James J. Hicks, but I presume they may be obtained of or through any dealer in druggists' sundries.



Self-locking Retort Stand.

### 84.—The "Vulcan" for Pyrography or Poker Work.

What is popularly known—or it would be better to say what *was* popularly known—as "poker work," was a rough semblance to a landscape or portrait by exposing the surface of a piece of wood, jointed and prepared for the purpose, if on a large scale, to the action of heat emanating from the end of a poker or similar piece of iron heated to redness. The drawings, if they may be so called, were very coarse and rough in appearance, but of late years far more pleasing and attractive decorative effects have been obtained by the use of tools which are far lighter and more convenient to handle than the cumbrous poker, which it was always difficult to keep at the proper heat for the purpose in view. These tools have been specially designed for the work, and are supplied by Messrs. Abbott Brothers, whose advertisement will be found elsewhere in this number of Work. The apparatus is supplied complete in a box, and consists of a stoppered benzoline bottle, an extra store bottle, a metal attachment or union, a spirit lamp, an indiarubber bellows with tube attached, an extra piece of tube, a small funnel, a metal pencil cased in cork, a light pencil for ladies' use, a platinum point, two small panels, and a sheet of designs. Platinum points of different forms are supplied, some of which are shown in the accompanying illustration, and are adapted for tracing lines of different breadths, and thus producing varied effects. The spirit lamp, to be used for heating the platinum points, is first lighted, and the indiarubber tubing properly adjusted to the bottle containing benzoline and bellows, after which the platinum point to be used is heated to redness in the flame of the lamp, which is then blown out, for the heat of the point is said to be then maintained and brought to a greater or less degree, as may be required, by blowing with the bellows more or less quickly on the point, which, by this means, is kept in a proper state of adjustment to produce the depth of tint required. The design to be executed with the platinum point should first be traced on the wood with the pencil before the hot point is used. After a little practice there is no doubt that the work can be easily and quickly executed, and that pleasing effects can be produced. Most of the white wood fancy articles now so much in request can be artistically decorated by pyrography. With the apparatus—which consisted of the articles above-mentioned, complete in a neat box—Messrs. Abbott Brothers submitted for inspection a stand for a small drum clock or watch, worked in a pattern with the hot point, which presented a variety of rich tints combining, with the dark lines of the pattern itself, to produce an article that would be highly appreciated at bazaars, etc. The Editor.

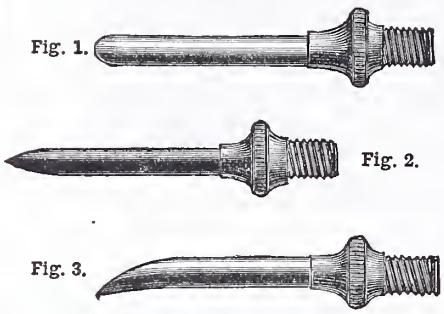


Fig. 1.—Blunt Tool used in Poker Work. Fig. 2.—Sharp Tool. Fig. 3.—Horn Tool.

## SUGGESTIONS FOR WORKERS AND HINTS TO INVENTORS.

Commercial Electrolysis. — Electricity is beginning to play so important a part in many processes for the commercial production of various articles, that a large number of inventors have, of late, turned their attention to the subject. Soda and similar products, as well as many of the metals, have been the subjects of experiment, but no very marked success has hitherto been achieved. As, however, it is generally admitted that a large fortune may be made by anyone lucky enough to discover an effective process, the efforts in question are not likely to be abandoned. Unfortunately, a good many people devote their attention to such subjects who have no thorough knowledge of either chemical or electrical matters, and an expert qualified to write a work upon the subject would find it a profitable undertaking.

Mechanical Voting.—One does not generally look to the pages of *Truth* for hints as to new inventions, but "exceptions prove the rule." Its editor points out in a recent issue that ninety-two hours were wasted last session in Parliament in the mechanical business of taking divisions, and suggests that some inventive genius might devise a more expeditious means of arriving at the desired end. Except by fitting a pair of electrical pushes—"Aye" and "No"—to each member's seat, we do not, however, well see in what way mechanical aid could be given. It might perhaps be possible to devise a dial-pointer which the voter could place in such a position as to record his vote on a current being passed through the entire series, an indicator near the Speaker's chair showing a total of so many "Ayes" and so many "Noes." There should be no great difficulty in devising something in this way if it was likely to be adopted by the House.

Phonographic Advertising.—The man who first of all avails himself of the phonograph to advertise his wares will, in all probability, distance all competitors—at all events, for a time. The novelty of substituting the ear for the eye would undoubtedly "catch on." A machine which continuously reminded the passer-by that he "ought to buy Smith's soap" would attract the most careless attention. Still more would a combination of eye and ear be likely to succeed. A life-sized face, from the lips of which the sentence could be heard, would beat anything yet in the field. The chief disadvantage would probably be that it would be too popular, and that crowds might assemble to watch the new departure to so embarrassing an extent as to necessitate police interference.

Removing Ink Blots.—An easy way of removing a disfiguring blot upon paper is not by any means generally known. The knife and rubber ink-eraser are usually resorted to, with the result of spoiling the surface of the paper. People liable to such accidents will find it useful to take a few sheets of thick white blotting-paper, and to steep them three or four times in a solution of oxalate of potassium or oxalic acid, letting them dry between each steeping. This applied to a damp ink spot will at once remove it. If dry, the spot should be wetted, and allowed to remain in that condition for some little time. The prepared blotter will then, as a rule, remove it; but in cases where the ink has been allowed to dry into the fibre of the paper, success cannot be guaranteed. With a fresh blot, however, it is always successful.

Drilling Glass or Porcelain.—Amongst things not generally known is the fact that, when it is desired to drill glass or porcelain, it is well to touch the place of the hole with hydrofluoric acid before applying the drill. This roughens the surface, and allows the point to "bite." Many people, also, are not aware that the glaze of porcelain is the substance that presents the hardest surface, and that when this has been penetrated, the boring proceeds easily enough. A hole should never be drilled right through from one side only. Directly the point of the

drill shows, the tool should be applied to the tiny orifice, and the hole cut clean in this way. Paraffin oil is a good substance for aiding progress. If the hole is too small, it is better to ream it out with a piece of tapering. four-sided steel than to use a larger drill.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**A Simple Cramp.**—J. W. writes:—"Seeing in a recent number of Work that one of the readers had been asking for a contrivance for holding the joints of mitred frames, I thought the following simple cramp might be useful to some of the amateur readers who do not care to go to the expense of buying a proper cramp:—Plane a piece of deal, 2 in. by 8 in. by 1 in., up true, and two pieces about 1 in. long by 2 in. by ⅝ in.; screw these on the large piece at an angle of 45° with the long sides, so that they form a right angle with each other, but leaving the inside corner about 5 in. apart, as shown by A and A', Fig. 1, which is drawn to scale, as shown below. Now plane a piece of ⅝ in. stuff up, of the shape shown at B, Fig. 1, and screw it in place as shown. Now cut two wedges out of ⅝ in. hard wood, 9 in. long, and about 3 in. wide at the broad end, with a notch cut in as shown at Fig. 2. These

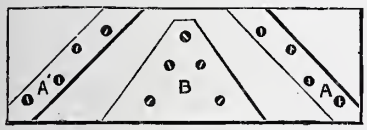



Fig. 1

Fig. 2

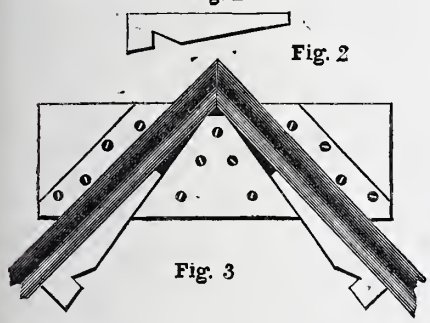


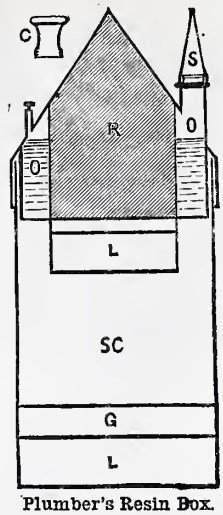
Fig. 3

**A Simple Cramp. For Explanation of Figs., see accompanying description.**

are cut out of thin stuff to allow them to slip under the front edge into the rebate. The way of using it is shown in Fig. 3: one side should be fastened in place first, then glue the joint and place the other side in position, driving the wedges in quite tight. The joint may now be fastened by running a sawgait in and gluing a piece of veneer in, or by screwing with fine screws. Now knock the wedges out, and treat the other corners in the same way. This will be found to be a very handy method, and a good deal less cumbrous than the one given in answer to the above reader, which will be found on page 229, No. 123. One man that I know well, who has made some dozens of frames of all sorts, never uses anything else. Another thing that I may say is that he always uses fine screws. Brads do not answer very well, as the wedges want driving so tight, it is apt to injure the frame if it is at all delicate."

**"Robinson" Air Engine.**—E. E. P. (*Tufnell Park*) writes:—"I notice a reply to a query respecting a motive power for organ-blowing in Work No. 132, page 446, column 1. The 'Robinson' air engine is particularly suitable for this work, being inexpensive, and costing but a trifle to work. Messrs. Morris & Henty are making these engines."

**Plumber's Resin Box.**—Reader of "Work" writes:—"I have drawn a plan for a combination plumber's resin box, which I have found very handy. It contains oil (O), resin (R), place for screws (SC), etc., and grease (G) in the bottom. I did not know if it would be of use to anyone else. The oil runs round the resin box; the resin box and oil are in one. The resin box has a lid (L) at the bottom; the spout (S) unscrews when not wanted, and the cap (C) screws on. Put the spout in with the screws. At the bottom I have parted it off about 1 in. and put on a lid (L) for grease; this is full size, and made of tin."




**Plumber's Resin Box.**

**Pocket Accumulator.**—E. R. D. (*Sherborne*) writes, in reference to reply to S. G. V. (*Boro'*) under this heading in page 443, that he "should see the portable lamp illustrated in a recent number of the *English Mechanic*. If preferred, the lamp can be made to take off, and used at a distance from the accumulator."

### II.—Questions Answered by Editor and Staff.

**Clock Cleaning.**—J. A. (*Inverness*).—Any watchmaker would be able to let you have one or two second-hand movements—lever would be best, or heavy Genève—as when buying the cases the works are usually taken out; this would be the cheapest way to go to work. Failing to get what you want like that, apply to J. Crewe, 100, Aldersgate Street, London, E.C., or W. Cardall, Ombersley Road, Droitwich, who keep good movements; but, of coursc, you would have to pay much more for them. If not able to find what you want, write to any watch tool shop and try them.—A. B. C.

**Wheels for Wire-crimping Machine.**—W. G. (*Glasgow*).—For the required set of cog-wheels, the firm most likely to suit you is the Phosphor Bronze Company, Ltd., 87, Sumner Street, Southwark, London, S.E. It seems that you must tender a pattern or patterns in wood (or wax, from which wooden ones will be made) from which to cast the wheels. You must obtain the assistance of some friendly wire-worker who owns a machine. I advise you to write to the above company, alluding to this reply, when, doubtless, you will receive duel and courteous attention.—J. S.

**Squeaking of Bearing.**—A. McD. (*Glasgow*).—If the bearing is properly cleaned out and oiled, there will be no squeaking sound there. Perhaps it is some other part of the machine that gives forth the squeaking sound. If after cleaning out the bearing with paraffin, and oiling up properly, the sound is still heard, look for it somewhere else than in that wheel. Perhaps the rim touches some part of the frame at every revolution, or perhaps the pedal nut touches the chain or a stay rod.—A. S. P.

**Cups for Bicycle Bearings.**—J. B. (*Clapham*).—Cups for bearings are usually casc-hardened before putting into their places. But as the process is both tedious and expensive, another method of hardening may be followed. Have the cups fitted in the hub-ends, then take them out. To harden them, get prussiate of potash, pound it down to a powder, and heat the cup to a red, not white, heat; sprinkle the powder all round the hollow in the cup, where the balls run; the powder will fizzle for a minute or so, then reheat the cup to a dull red, and plunge into cold water. The acid will have penetrated the metal, not through, but of a sufficient depth to make a very hard surface for the balls. The size of balls will depend entirely on the size of cups. For pedals, $\frac{3}{16}$ in. balls; for wheels, ¼ in.; for bottom brackets, $\frac{5}{16}$ in.—A. S. P.

**Price's Lathe with Vertical Slide.**—G. H. (*St. Helens*).—R. Price's address is now 125, Stratford Road, West Ham, E. The lathes will do turning, boring, milling, slotting, shaping, and wheel-cutting. Ordinary lathes will do all these, but the vertical slide gives especial facilities for milling, boring, shaping, and wheel-cutting. For milling and boring with the bar, the vertical slide is so convenient that it is a wonder those who have no milling machine can be content to do without it. It is not pleasant to do much wood-turning on a lathe intended for metal, but if you wish to do this, you might fix up wooden bars so as to continue the bed three or four feet and take the poppet and hand rest, but *not* the slide rest, which you don't want for turning wood; it would only be in the way. Mr. Price says he has made one with a gap, so I suppose you can have one if you wish. I think the watch lathe mandrel would not "jamb," but drive rather hard in drilling if made as you propose.—F. A. M.

**Taper Hole in Mandrel.**—Oliver asking More.—The taper of hole in mandrel used by Britannia Co. is 1 to 9; Milnes used formerly 1 to 12, but now he has adopted the Morse taper, and I think you had better do the same. You can't get the right taper by setting the slide-rest by the quadrant, that method is not sufficiently exact. I advise you to buy a little American drill chuck (sure to be useful) fitted on a Morse taper plug of the proper size to fit inside your mandrel nose; then bore the hole with a drill to the size of the small end of the taper plug, fix a sharp tool in the slide-rest, and, setting the cutting point at exactly the height of centres, gradually turn out the hole till the plug fits and your little drill chuck runs true. You must rub a little red marking on the plug and squeeze it into the hole; notice where the red is rubbed off, and adjust the slide-rest accordingly; the last cut should be taken with a very sharp tool and a fine feed.—F. A. M.

**Fitting Fly-wheel.**—Oliver asking More.—If the hole in your fly-wheel is ⅛ in. larger than the shaft on which it is to fit, I should either bore out the hole ⅛ in. larger, or turn down the seating on the shaft ⅛ in. smaller, so that there might be a space of ⅛ in. all round between the two; then get a piece of steam-pipe, bore it out to fit on the shaft, drive it on a mandrel, and turn the outside till it fits into the wheel; now take a hack-saw and cut right through one side of this piece of pipe. Now, if you have a keyway in your wheel, you will file a flat on the pipe at 90 deg. (or one ¼ round) from the slit, so that the key can collapse the pipe on shaft; if there is a set-screw in the wheel, it will bear on the flat on the pipe and compress it in a similar way.—F. A. M.

**Gauges.**—A. F. should write to Messrs. Sharp, Stewart & Co., Glasgow.—F. C.

**Motion.**—A. U. S. (*Birmingham*).—Your design will work very well with a few additions. The lower roller should have a light recovery spring. To maintain continuous motion you will require a fly-wheel on the axis of disc. If you will send particulars of the purpose to which you propose to apply this motion, I will give you full instruction in the matter.—F. C.

**Spindle.**—A Working Man.—Any local smith can supply you with the spring and spindle. I should think 2s. for the spring, and 1s. for the spindle would be enough.—J.

**Coach Painting.**—C. C. (*Milford*).—In the first place you want a paint-mill to grind your colours fine; such colours as Prussian blue, Dutch pink, Vandyke brown are as hard as stones. After being crushed up with a hammer they can be ground quite fine in a hand paint-mill, the cost of which will be 30s., and I am sure that you will never regret buying one. But such colours as ultramarine, green, or vermilion and brown, which you mention in your letter, should cause you no trouble in grinding fine upon a slab with the muller, as these colours are generally sold in the powder and not in little lumps as the above-mentioned hard ones. After grinding the colour upon the stone you had better let it run through a sieve or muslin. I fear that it is not the paint which is gritty, there are other things besides, such as having the room perfectly clean, using clean and separate brushes, no draughts to create a dust, etc. As you have not mentioned what it is you are wishing to paint, I will just merely show you how to mix and lay the colour on. In painting with ultramarine it is usual to give a preparation coat of Prussian blue, but as a substitute, and which will do equally as well, get some ultramarine and a little drop black and grind in gold-size and turps; get this on the panels as soon as possible, as it soon sets, and will show brush marks, besides going thick in the pot. In painting the wheels, finish off three spokes at a time; be handy in putting this dead colour on, and do not work it about much or you will have it cordy. Next get some ultramarine ground in turps, gold-size, and varnish, and give another coat; the colour which is left can be made into varnish colour by adding sufficient varnish to finish the job. This is put on when the first coat of ultramarine is dry, which will take from six to twenty-four hours, according to the quantity of varnish added. When painting the ultramarine, see that it is solid and not cloudy; when dry, and before varnishing, it should be flatted to smooth it down a little. In painting vermilion, colour all the parts which are to be red with a couple of coats of pure white lead; when this is quite dry, mix the vermilion in its pure state with gold-size and turps, and give it a coat of this dead colour. When dry, grind some more in boiled oil with a little liquid driers and finish with an oil coat of vermilion, as the colour will remain purer longer than if varnish had been added to it. In the case of blue and brown oil must not be added. Picking-out colours can be mixed dead or in oil; in dead colours the colour is simply ground in gold-size and turps, and the work can be varnished the same day. In fine-lining with oil colours these can be bought ready ground, and far purer than you could grind them, in tubes at any artist's colourman, the price ranging from 3d. to 6d. each; the dark colours can be mixed with dark gold-size, but the lighter colours must have a paler varnish added to it to help in drying. It can be varnished over the day after. Papers on coach painting are in preparation, and will appear as soon as room is found for them; do not be afraid of asking any questions, as hitherto coach painting has been a mystery, and still is, to a great many. "Coach Painting, by Arlot, is 6s., and Boag's "Guide to Coach Painting" is, now it is published, 12s. 6d.; if too much, wait until practical papers appear upon coach painting.—W. P.

**Van Painting.**—Wright.—You do not state in your letter the kind of brown you wish the van to be painted in, as there are a great many varieties of

browns, ranging from the dark vandyke up to the bright crimson lake, this last-named but expensive colour being merely a glazing colour, and does not possess much body, therefore, the under coats have to be finished in colour to match as near as possible the finishing coat of lake. If the van be a new one, paint and fill the woodwork up as directed in "Shop," No. 65, page 209, and the last coat of lead colour must be made up very dark so as to make the after coats look solid. Commence by giving the top, back, and side quarters a coat of dead black; when dry (in a few hours), give it a coat of black japan. If the japan sets too quick, so that you cannot work it about, add a little varnish or a drop or two of boiled oil—not too much, or it will never dry. The next day we begin to colour the carriage work and the panels; if the common browns are used, we can get any shade from light snuff to dark plum or chocolate by mixing the following: burnt sienna, raw sienna, umber, black, yellow and orange chrome; by mixing one or two of these colours you can get a distinct colour. This powder colour must be ground in gold-size and turps only, and will, when painted, dry in a few hours. Get a pot and place some of the colour in it, and after the dead colour is dry on the van, we put sufficient varnish to the colour in the pot to give it another coat of varnish colour; this last coat is merely a glaze, but should have sufficient body in it to cover. If, however, a lake is required (and it is generally used on vans), we first give it a coat of imitation lake composed of rose-pink and Indian red ground in turps, boiled oil, and liquid driers; the next day grind the crimson or purple lake very fine in gold-size and turps, and give it a coat of lake, afterwards finishing in varnish colour; leave for a few days to dry, then rub the mouldings level with stone and pick them out black, first with dead black, second with black japan. Next flat the whole of it down with a wet cloth and pumice-stone powder, doing a little at a time, and washing each piece off well and wiping it dry, or the water will stain. We then pick the wheels, springs, and shafts out with dead black; when dry, give the van and carriage work a coat of varnish; leave for a week if possible to dry, then flat or scour the varnish down again. It is now ready for picking out or fine lining; we therefore edge the black with a fine line of vermilion, lemon or yellow chrome, or pick it out with a quarter line of vermilion in the centre of two fine lines of white, or there can be centre and fine lines of red according to taste. The inside of the van will be painted light buff. The reason why varnish is flatted with powdered pumice-stone wet is to get it smooth and dull so that the last coat of varnish will flow out and not cess, as it certainly would if not flatted. When the fine-lining has been done and quite dry, we varnish the body and carriage work in a warm room well ventilated at the top and free from draughts, keeping the heat at a temperature from 65 to 70 deg. until the varnish is set and dry.—W. P.

**Cornish Valve.**—B. W. W. B. (*Whaley Bridge*).—Unless you give more particulars I cannot tell whether the valve is to act as an admission valve to the steam casing merely, or in place of slide valves. And what of cylinder dimensions, steam pressure, etc.? 20 h.-p. may mean anything. But if you know what volume of steam has to pass through the valve at each lift, you can deduce diameter from that. When the lift of the valve is one-fourth the diameter, it is fully open. There are sketches of some Cornish valves in WORK, Vol. I., page 513, though forms are modified. If you give fuller particulars, I will sketch out a suitably proportioned valve.—J.

**Watch Parts.**—C. A. B. (*London, E.*).—Screw Ferrules.—For ordinary work you might manage with about three screw ferrules; one large, about ¼ in. diam., one $\frac{5}{16}$ in., and one ⅛ in. These are generally made in two pieces to hold the pinions, etc. You merely unscrew the two screws, and pass the pinion, or whatever you wish to turn, between the two halves and screw up tight; file up a centre on each end, and begin the turning. Wax ferrules are simply thin brass or ivory with a hole in the centre and a groove turned on its edge. The article (pinion or cylinder) being filled with sealing wax, the ferrule is made slightly warm (and the waxed article too) and dropped over the pinion or cylinder and held in place till cool; then commence turning as with screw ferrule. Wax ferrules are used on very short or awkward pieces where you cannot put a screw ferrule. Bows.—Gut is used for large work and ferrules, and horse hair for small work and ferrules where gut will not go. For turning a Geneva centre pinion, get a piece of round steel wire larger than the hole in pinion, run a centre on each end, then harden and temper to a purple colour; broach out the hole in pinion till the old set hands arbor fits it nicely. Now turn the piece of wire you tempered down to fit the hole (having previously, of course, put on a screw ferrule), and see that it fits nicely all the way through the pinion, then proceed as if it were a solid pinion. I shall be pleased to advise further if necessary.—A. B. C.

**Fret Machine.**—T. W. R. (*Kendal*).—The idea of the fret machine which you suggest seems feasible enough, but there are several details which will have to be modified considerably if your sewing-machine stand is only of the ordinary light description. In saying this, it must be understood that these points can only be determined by actual experiments, which, of course, I cannot undertake to make. One of the chief modifications which seems necessary is the distance at which you purpose placing the pin on the wheel J. If this pin is, as you say, to be about 2½ in. from the centre, you will get a saw stroke of 5 in. How you are to manage this with a fret saw of the usual length is beyond me, even supposing that the fly-wheel is heavy enough, and your strength sufficient to drive it. About 1 in. from the centre will probably be nearer the mark. The length of the rod K is not of much consequence, but be careful not to have it so long as to have the board D in the way of your knees when working the machine. It ought to do as well by carrying it downwards as upwards. The bar F, I am afraid, would not be a sufficient support for the arms of the saw when you are cutting stuff. In turning the wood to the saw there would be an inevitable tendency to twist the back of the frame, which, I fancy, would be against accurate work. You could, however, easily carry out from the back of the table a board on which guides could be fixed for the back of the saw-frame to work in. They would obviate any tendency of the frame to swing round, and diminish the risk of the rod F jamming. This could be prevented by making F round instead

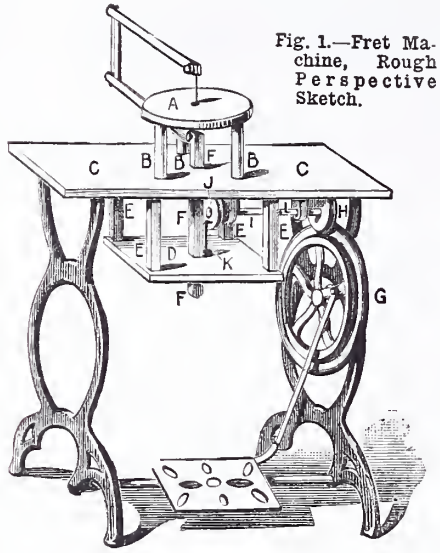



Fig. 1.—Fret Machine, Rough Perspective Sketch.

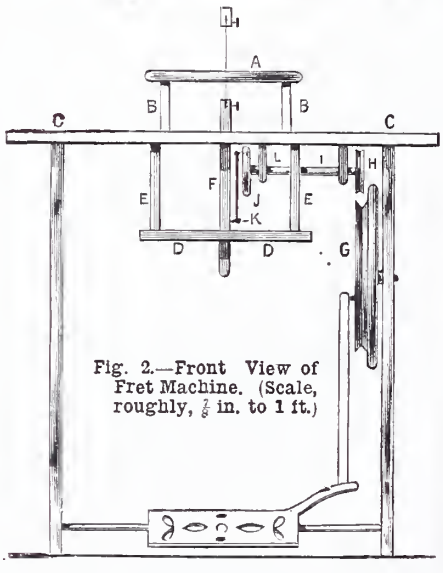



Fig. 2.—Front View of Fret Machine. (Scale, roughly, ⅛ in. to 1 ft.)

of square in section. I do not, of course, know whether you intend making most of the parts of wood—*i.e.*, all that can be—or whether you intend them to be of metal. I, however, imagine the former from your sketches, and if so, the cost of the machine may be less than that at which you could buy one, otherwise it would probably be more economical to get one ready made. The tilting-table may be dispensed with, as it is of comparatively little use, even for inlaying purposes. For ordinary fretwork it is not required. In any case the table should only be made to tilt sideways. Write to the Britannia Company, Colchester, for one of the supports they use for their tilting-table. It will cost you a mere trifle, and you will probably have no difficulty in understanding how it is to be fixed, and in doing what is necessary. We are always pleased to assist our readers, so you need not look on your inquiries as an offence. I wish all inquirers in "Shop" would be as lucid in stating what they want to know, and, whenever they can, would follow your example of sending a rough drawing or two. Inquirers can then be helped more satisfactorily to themselves and with infinitely greater pleasure to the members of the staff to whom the questions may be submitted, than is sometimes the case. I wish you success in your efforts to make the machine, and shall be glad to hear how you succeed.—D. D.

**Dry Battery.**—D. O. W. (*Ipswich*).—I have not had any experience with the dry battery described on page 639 of *Cassell's Magazine* for 1885, so cannot say what the relative proportions of the ingredients may be, nor how it will compare with the Leclanché cell, nor can I say anything about the solution of zinc chloride and ammonium chloride employed in moistening the mixture of manganese peroxide, ferric oxide, and plaster of Paris. The cell appears to be much like the Gassner patent dry battery, and is most likely covered by Dr. Gassner's patent. The lasting qualities of the Gassner have been recently tested by me, and I can highly recommend it. I put a small cell, 6¼ in. by 3½ in. by 1⅞ in., on a 2 in. bell and kept on ringing day by day at the rate of nine hours a day until I got 118 hours' work out of the cell. The power of the Gassner is restored by charging it with an electric current as we charge an accumulator. The battery is sold by Messrs. T. Gent & Co., Faraday Works, Leicester, and wholesale by Mr. P. C. Brewster, 12, Addle Street, London, E.C.—G. E. B.

**Electric Alarm for Clock.**—F. T. (*Silvertown*).—The article on "Electric Time Alarums" appeared in No. 32, published on October 26th, 1889. All back numbers of WORK may be obtained by ordering them of your newsagent or bookseller.—G. E. B.

**Dynamo for Lighting Lamp.**—R. W. D. (*Poplar*).—A small dynamo for lighting one 16 c.-p. lamp, and with power to spare up to 20 c-p. if required, should be of the following dimensions:—Cores of F.Ms., Siemens pattern, 5 in. by 4 in. by ⅝ in. Laminated armature, H pattern, 4 in. by 1¾ in. F.Ms. wound with 4½ lbs. No. 22 double cotton-covered copper wire, connected in shunt with the armature coil. Armature wound with ten ounces No. 20 double cotton-covered copper wire. The armature should be driven at a speed of 2,500 revolutions per minute. To light up a 16 c.-p. lamp this machine will absorb $\frac{1}{10}$ horse power, and to light up a 20 c.-p. lamp will take ⅛ horse-power. I do not expect you will get enough power out of your small model engine to drive the machine, but you can try it when you get the machine.—G. E. B.

**Battery for Lighting Model Church.**—VEGA (*Weston-super-Mare*).—You will require quite 4 pint bichromate cells in series to light up a 2½ c.-p. 8 volt lamp. I do not see how you can improve upon the battery used by you last summer for the same purpose. If you could make up some papier-mâché cells of flat-square form, and make them sound and acid-proof, you might lessen the weight of the battery and the space occupied by it. Directions for working in papier-mâché were given in the early part of Vol. I. of WORK. The cells may be made acid-proof by soaking them, when quite dry, in melted paraffin wax for at least half an hour, then set aside to cool and harden.—G. E. B.

**Safe Carrying Capacity of Wires for Electric Lighting.**—F. E. S. (*London, S.W.*).—I am trying to meet the requirements of young men like yourself, who have to do wiring for electric lighting installations. An abundance of information on the subject lies scattered about in books, but I do not know of any one hook in which you could find it all put as you would wish to have it. Your difficulty seems to lie in your inability to reconcile the decimal system of measurement with the common practice as known to yourself. I really think you will have to surmount this by learning the decimal system, as this is more correct than the old plan of describing diameters by quarters, eighths, sixteenths, thirty-seconds, sixty-fourths, and so on. In the decimal system, each whole unit is divided into tenths, and multiples of tenths, the most popular division being 100. By this system a ¼ is represented by ·25, ½ by ·50, and ¾ by ·75; the point before each figure denotes that the figure is the fraction of 100. It looks much better on paper than $\frac{25}{100}$, $\frac{50}{100}$, and so on. When the whole unit (he this one inch, one ohm, one volt, one ampère, or any other single unit of measurement) is divided into 1,000 parts, the ¼ is represented by ·250, the ½ by ·500, and so on, three figures being used to the right of the decimal point, to indicate that the fraction is in 1,000ths. The measurements thus expressed are finer and more exact than those given in 100ths. When the unit is divided into 10,000ths there are four figures after the decimal point, as ·2500 to express ¼. A little thought on your part whilst reading this will convince you of the superiority (in point of exactness) of the decimal system. In common systems of measurement we have nothing to express our ideas should the measurement exceed by a hair's-breadth the figures marked on our rules, but by the decimal system we can express a shade larger than ¼, by either 26, or ·251, or ·2501, and thus place on paper an exact record of the measurement. This exactitude is necessary in all electric work hence "the elaborate system of decimals used" in the tables of which you complain. Nearly all wire tables give the nearest number in the Birmingham wire gauge to the decimal measurements therein stated; but this antiquated gauge is the most inexact of any known, and therefore fails to express exact sizes. I give herewith a table of the safe carrying capacity of copper wires and cables employed in electric lighting, but must ask you to give your mind to a study of the decimal system of measurement, as this will be in the future, even more than at present, the universal system understood and used by all electrical operators. In the

first part of this table I give the sizes of copper wires in the Birmingham wire-gauge and also their equivalents in decimal 1,000ths of an inch. I also give the economical carrying capacity of each wire, and its safe carrying capacity as well. The carrying capacity is also put in the cables as half their safe carrying capacity, this being found the most economical calculation in laying wires. The information given in the latter part of this table has been obtained from Messrs. J. E. Hartley & Co., Birmingham.

CARRYING CAPACITY OF COPPER WIRES.

| B.W.G. | Decimal. | Carrying Capacity in Ampères. | Safe Carrying Capacity in Ampères. |
|---|---|---|---|
| No. 8 | ·165 | 20·1 | 40 amps. |
| „ 10 | ·134 | 12·8 | 28 „ |
| „ 12 | ·109 | 8·5 | 18 „ |
| „ 14 | ·083 | 5· | 10 „ |
| „ 16 | ·065 | 3·2 | 6 „ |
| „ 18 | ·048 | 1·8 | 3 „ |
| „ 20 | ·042 | 1·0 | 2 „ |
| „ 22 | ·028 | ·6 | ·5 „ |

CARRYING CAPACITY OF ELECTRIC LIGHT CABLES.

| Strands of Wire. | Size of each Wire B.W.G. | Carrying Capacity. |
|---|---|---|
| 3 strands of | No. 25 | ·9 amps. |
| 3 „ | „ 23 | 1·4 „ |
| 3 „ | „ 22 | 1·9 „ |
| 7 „ | „ 25 | 2·2 „ |
| 7 „ | „ 23 | 3·2 „ |
| 7 „ | „ 22 | 4·4 „ |
| 7 „ | „ 21½ | 5· „ |
| 7 „ | „ 20½ | 6·1 „ |
| 7 „ | „ 20 | 7·2 „ |
| 7 „ | „ 19 | 8·9 „ |
| 7 „ | „ 18 | 12·8 „ |
| 7 „ | „ 17 | 17·4 „ |
| 7 „ | „ 16 | 22·9 „ |
| 7 „ | „ 15 | 28·9 „ |
| 7 „ | „ 14 | 35·6 „ |
| 19 „ | „ 20 | 19·8 „ |
| 19 „ | „ 19 | 24·3 „ |
| 19 „ | „ 18 | 34·9 „ |
| 19 „ | „ 17 | 47·9 „ |
| 19 „ | „ 16 | 62·4 „ |
| 19 „ | „ 15 | 78·9 „ |
| 19 „ | „ 14 | 97·3 „ |
| 19 „ | „ 13 | 128·2 „ |
| 19 „ | „ 12 | 164·7 „ |
| 37 „ | „ 16 | 121·9 „ |
| 37 „ | „ 15 | 154·1 „ |
| 37 „ | „ 14 | 190·9 „ |
| 37 „ | „ 13 | 251·6 „ |
| 61 „ | „ 13 | 416·2 „ |
| 61 „ | „ 12 | 531·9 „ |

Should you meet with any other difficulty, I shall be pleased to help you if you will write again.—G. E. B.

**Zither.**—S. S. (*Stockton*).—You cannot string a zither with piano strings, but must procure a set of melody strings (5), and also a set of accompaniment strings (26). These latter are a mixture, some silver, some copper and others gut. The two sets complete may be had for five or six shillings, according to quality. Send to Chilvers & Co., St. Stephen's, Norwich, if you cannot procure them in your own town. Tutors cost from half-a-crown upwards.—R. T.

**Camera.**—A CONSTANT READER.—If you have a camera for sale you cannot do better than advertise it in WORK.

**Chemical Apparatus.**—PROBYN.—This subject has not yet been treated in WORK in the way you indicate.

**Patent Envelope.**—TEBB STREET.—You cannot do better than consult a wholesale stationer concerning your invention.

**Diamond Chips.**—W. J. C. P. (*No Address*).—I am no authority on drilling china, etc., and I do not quite understand what W. J. C. P. means by "*black* diamond chips." I assume, however, that he means "bort chips," which we use for turning emery wheels, hard steel, and similar work. Bort is a mineral almost, if not quite, as hard as diamond, and is much cheaper. I do not know what firm would be most convenient for W. J. C. P., but Woods & Toussaint, 54, Spencer Street, Clerkenwell, London, are dealers in all kinds of diamond tools, etc., and would, I think, be able to supply him with everything he requires.—DAMON.

**Camera.**—DERF.—In your case, a half-plate Lancaster camera would be a suitable instrument until you became thoroughly conversant with the process. The principal points to look to are: firstly, that the camera is thoroughly sound; secondly, that the focussing sereen and sensitive plate accurately register; thirdly, that the whole is firm and rigid when set up. As a rule these conditions exist in most cameras, or if, by aceident, they do not, a little alteration will put them right. The less intricate the make of the camera, the better it is for beginners. Movements that are especially uscful in a camera are the swingback, and means for raising and lowering the lens. There are scores of cameras in the market that are all that can be desired as working instruments, from 50s. upwards. A good reetilinear lens, suitable for the size of camera, may be obtained from any dealer. To make satisfactory pietures a good lens is *imperative*. If you get a price list from any photographic dealer—Fallowfield's, for example—you will be able to estimate the eost of the outlay to a trifle. The best, or one of the best elementary books is "Burton's Modern Photography." Abney's works on the subject are, for those who know the elementary part, the best published.—D.

**Hints on Boot Finishing.**—S. T. (*No Address*).—I suppose I am to understand by the first part of your letter that you have made a pair of boots and have got all the stuff on, and that you want to know how to finish with a bevel edge, or, anyway, a light edge. Well, this being the case, you eannot make them much lighter than what they are, as the leather should have been fitted to suit your requirements before they were stitched. But, anyway, to finish them off to make them appear as light as possible, trim them round the edge with the knife, then pare, rasp, buff, and sand-paper, as explained in my first paper on "Boot and Shoe Repairing," in No. 112, Vol. III. of WORK. Then, if you have not a welt knife, hold the ordinary knife (with the point flat on the welt) between the thumb and finger, letting the finger form a guard, on the edge of the sole, and trim off the rough edge that the preparing of the edge has thrown on to the welt side, taking off as much as you can without cutting off the heads of the stitches, and then trim as much as you can off the bottom (or sole side). This should be done even all round, so that the edge may be the same substance all round. The welt side can be rubbed down with the bone, and the bottom filed, to make it smooth, being careful not to lift up the channel again. You now paste and ink them in the usual way. With regard to ironing, you must, if you want a good result in either sewn or stitched work, only use the fore-part iron on the sole side. The welt iron I spoke of in my last answer to you is, as stated there, only used for the welt side (from joint to joint), and it is called a jigger-iron. I have given a description of it in the article which appeared on "Boot and Shoe Repairing" (see page 516). It is this iron (or the jigger side of a double iron) that gives the bevel appearance that you saw in the strong-stitched boots you spoke of. I think if you peruse the answer to H. G., in

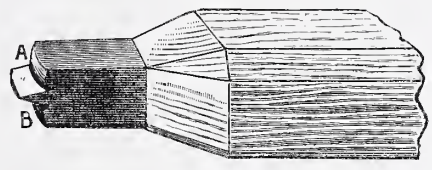



Fig. 1.

Fig. 2.

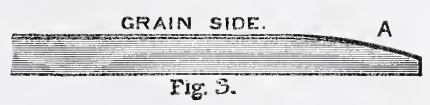



Fig. 3.

**Fig. 1.—Jigger-iron. Fig. 2.—Skiving Leather for Bevel Work. Fig. 3.—Appearance when Stitched, etc.**

No. 97, Vol. II. of WORK, in "Shop," you will find the answer suited to your question. The piece is, as there shown, taken off the grain side. You also ask, should "it be taken off down to about $\frac{1}{16}$ in. at first, and then on the grain side, or flesh side, before sewing into nil, as you do not understand my answer?" You asked in the seventh question of your last (p. 252, No. 120, Vol. III.), if the welt should be thinned down before sewing in? If you refer to the above, you will see I say, "Yes"; but not to $\frac{1}{16}$ in., for you should always buy welts as near the substance of what they are going to be sewn in as you can, for to take a stout welt down to $\frac{1}{16}$ in. would weaken it a deal too much. The welt should have just the thinnest possible layer taken off the grain side, and then taken to the required substance from the flesh side; but this should not need to be much. For bevel, or any light work, always buy light and tight welts. In fitting the sole for bevel work (that is, prior to putting it on the boots), take a piece off all round from the flesh side, to the substance you will require to fit your bevel-iron, allowing for the welt, as shown at A, Fig. 2, or even thinner; and after it is skived off even all round, and put on the boot, it can be hammered at the edge to make it lay flat to the welt, and then when stitched it will look as though it had been taken off the grain side as shown at A, Fig. 3. A bevel-iron is similar to a double-iron, only it has a longer and not quite such a straight guard for the sole side. Your next question, I am sorry to say, I do not quite understand: "How to finish the edge of a pair single sole, pegged waist, thinned down for any iron, and feathered on the welt part." To finish a single sole you need a pump-iron. Fig. 1 is the shape generally used; it is a double pump-iron, A and B being two different substances. This is used, of course, for sewn work. But now I do not know which you mean—the sole or pegged waist thinned down and feathered on the welt part. Pumps have no welts or waist either if they are pegged, and the term feathered is only applied to the inner sole. I am sorry, but an answer would only be at random. If you will now refer to page 845, No. 104, Vol. II. of WORK, you will see that in the answer to POOR SNOB it is stated that the quarter pattern should be cut large enough for the vamp and golosh quarters to overlap to allow for skiving and seam. So you see in cutting the leather you can cut true to the pattern. Some do fold the vamp to cut it equal both sides; but I advise (as the pattern is cut in this way, and is therefore equal) cutting as above, and saving the time of what is called "trenching." You put the pattern on the leather, and a lead weight on the pattern, and you will find it the easiest and best way. To spring a boot, hold the toe in one hand and the heel in the other, putting the waist against the knee, and pulling both toe and heel equally towards you, as you would in breaking a stick, only it must not be done hard. The beating-down is done by holding the upper away from the welt and lightly tapping it down all round on the top of the edge of the inner sole. Its use, as you ask it, is to repair the damage you do in pulling out the last, and to make the feather even and lay flat on the welt. But if ever you have done it, or seen it done, did you not see that it was an improvement to the general appearance of the boot? That is why it is done.—W. G.

**Field Glass.**—H. G. H. (*Saxmundham*) says he has "purchased a pair of field glasses which are very weak," and asks, "can he buy stronger glasses and fix them himself, and where, and at what cost, etc.?" This is one of those letters which, to say the least, is not easy, if not impossible, to answer. Is the glass weak in magnifying or defining power? Two very different things. Glasses of any strength or quality can be procured of any optician; but how can one tell if H. G. H. ean fix them himself? Are the lenses screwed in eells or fixed in bezels? If the former, the work is easy; if the latter, a lathe and some skill are required to do the job. As to where the lenses can be bought, I have found Lancaster, of Birmingham, exceedingly obliging, and he can supply what you need. As to cost, they ean be purchased from 6d. upwards, according to size and quality. If H. G. H.'s object glasses are all right, but the instrument does not magnify high enough, this can be remedied by employing an eye-piece of shorter focus. If the object glasses are common chromatic lenses, then nothing can be done to improve the definition but employing better lenses, which, at least, would cost about 5s. each. If the instrument is one for which a fair price was paid, then really the best plan would be to send it to a practical optieian, such as the one I have named, and ask him to rectify it. If H. G. H. wishes to do the work himself, then Mr. Lancaster will supply the material needed. But from the letter, as a whole, I judge that H. G. H. has no knowledge of the kind of work requiring to be done; if so, he might ruin what after all is, but for some slight defect, a fairly good instrument. I think no one can give more definite advice without an examination of the instrument.—O. B.

**Wardrobe.**—AMATEUR.—An article on making a wardrobe appeared in No. 116 of WORK.

**Cost of Work.**—AMATEUR.—The volumes of WORK bound cost 7s. 6d. each. The twelve parts that are comprised in the volume cost 6s. The fifty-two numbers, of which each volume is composed, cost 4s. 4d.

**Gesso Work.**—H. G. will find it the best plan to purchase the gesso ready prepared from the Society of Artists, Bond Street, W. It saves trouble, and for small pieces of work (such as a frame) the difference in cost is not worth thinking about. It is difficult to give quantities, but the ingredients must be warmed over the fire to form a thickish batter. The gesso is laid on with a brush, and often modelled with the end of the handle. It would be a help to H. G. if he were to see the specimens at the Society of Artists; but, after all, these only show a few of the ways in which gesso can be employed for deeoration. I have never tried using it as H. G. suggests; but it probably might answer his purpose, though it certainly would not be such an artistic deeoration as if a brush were used. Full direetions were given in WORK, September 7, 1889, December 28, 1889, and February 15, 1890.—C.

**Galilean Telescope.**—F. W. L. (*Southborough*).—To make the telescope you describe, you will need an object glass 2½ in. in diameter and 25 in. in focal length (which will cost you from 4s. 6d. to 25s., aecording to whether it is a common single lens, or a properly corrected achromatic lens), and a plano-concave eye-lens of ½ in. focal length (which will cost about 2s.). These lenses can be obtained through any working optician. The foregoing priees are taken from the price list of Messrs. James Lancaster & Son, of Birmingham. But after you have bought your lenses and followed out your plan, the telescope is not likely to be of the slightest practical use to you. The field of view would be altogether too small. A Galilean telescope serves excellently as a field or opera glass, where small magnifying powers only are needed; but it is seldom used nowadays for any other purpose. You had better let the Editor know exactly what you want the teleseope for, and then I will tell you the best way to set to work. To follow out your present plan will be to waste money and to court a serious disappointment.—E. A. F.

**Graining and Decorating.**—EXILE.—To properly advise a "young grainer and decorator what books to study" would be easier done if you had given some particulars of the extent of your present knowledge and skill. As a general instruction, I would advise you to read and study anything and everything bearing upon form and colour, and particularly all that connects the same

with the applied and industrial arts. To particulariso books and prices, I can easily give you a few for you to make regular companions of. Subscribe to the *Journal of Decorative Art*, and write its editor—who is himself a very experienced and rising specialist in all branches of decorative art—for a list of publications. The price of this is 7d. monthly, from 15, St. Ann Street, Manchester, and all booksellers. Send also to Crosby Lockwood & Co., Stationers' Hall Court, E.C., for their list, and of these, Field's "Grammar of Colouring" (3s. 6d.) is one of the most useful. Then save your money, and buy the late Owen Jones' "Grammar of Ornament" for cash, about £1 (published at 5 guineas, and the original edition at 12 guineas). Then on "from strength to strength" to Ogden Rood's "Chromatic Equivalents" (5s.), of Kegan Paul, Trench & Co.; and also Prof. Church's revised "Colour" (3s. 6d.), of Cassell & Co. Then write me again; but in the meantime you may gather a few crumbs from WORK.—DECORATOR.

**Sun-dial.**—A. R. (*Birmingham*) asks "how to find the angle of the gnomon for the latitude of this city (Birmingham) for a horizontal sun-dial." It must be understood that the angle for a gnomon in a given place is the same as the latitude of the place. If you refer to an index of latitude and longitude, you will see that Birmingham is 52½° north, which must be that of the gnomon; in other

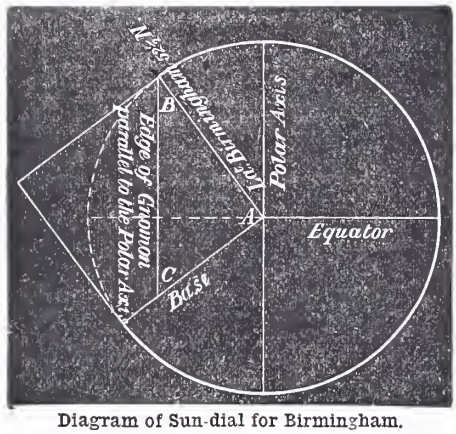



Diagram of Sun-dial for Birmingham.

words, the edge of the gnomon casting the hour shadows must be parallel with the polar axis. There are various ways of finding this, all simple; this is as good as any: draw a circle, or, better still, use a map of the world; draw a line from the centre to 52½°. Place a square piece of paper or metal, with the point, A, at the centre, with the edge, A B, along the line from the centre to 52½°. Now draw a line, B C, parallel with the polar axis, which gives us the angle required. A C is the base, and B C is the edge for the hour shadow. A B and A C must be perfect right angles. A. R. asks for a diagram, which I subjoin, if needed.—O. B.

**Tarred Wall.**—E. J. (*Barnsley*).—Were it woodwork, it might be worth your while to remove the objectionable stuff by dry scraping, or "perishing" it off by heat or solvent: but for a brick wall it is the last thing I would recommend you to do. Your best plan, I think, is to coat it with limewash, and if it is required to stand much rain and weather, stir some hot Russian tallow into it. Several coatings of this would surely make it light and clean enough looking for you, and at one-tenth the cost of cleaning and oil-painting. Give your orders to a local bookseller, or if he doesn't show proper knowledge and enterprise in procuring books, order them at a station bookstall. Smith's representatives will usually get anything with but little trouble.—F. P.

**Cement.**—W. V. C. (*Dublin*).—The ordinary plaster of Paris is the usual article employed in fastening the glass and metal parts of lamps together, and I do not think it could be substituted by anything cheaper or better, as well as for the purpose you mention. Plaster may be mixed with patent knotting with advantage for some purposes, but, if anything, it is more objectionable to handle thus. Plumbers' putty (made with white lead stiffened up with red lead) is also used for fastening plugs, etc., to glazed earthenware, as aqueous fluids would not affect it like plaster.—F. P.

**Washable Wall Papers.**—A STAINER (*Glasgow*).—The information you desire I am unable to give you, and I scarcely think it is likely to find its way into print, unless a reader of WORK employed in making the "sanitary" papers is able and willing to give the process. The well-known firm of paper-stainers, Messrs. Heywood & Higginbotham, were, I believe, the first to make "sanitaries," and I believe it was then, to some extent, a "patent" process. Most of the chief paper-stainers now make them; Lightbown and Aspinall, especially, do a large business with them. I have heard it remarked that some "hot-press" process is used, but personally have no knowledge. Doubtless there is more in it than a "vehicle," probably expensive machinery. Stather's washable goods (Hull) are different to the ordinary sanitary, being printed in materials of an oil-paint nature.—F. P.

**Protected Invention.**—WORKING MAN.—As you have obtained provisional protection for your invention, whatever it may be, for nine months, you can apply to private firms, who may be likely to take it up without the intervention of a patent agent.

### III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Lathe for Umbrella Sticks.**—E. E. (*Walsall*) asks:—"Will any reader inform me through 'Shop' where I could get the best lathe for cutting the spring-holes in umbrella sticks?"

**Lapidary Work.**—SPES MEA writes:—"Would some reader of WORK tell me how I can best proceed to cut some stones that I have picked up during my rambles on the sea-shore, and where I can best obtain the necessary tools, etc., for this purpose?"

**Colouring Bright Steel Surfaces.**—BARIUM writes:—"Will some reader be good enough to inform me how this can be done without greatly heating the articles? The process must be cheap, as I want to colour about 8,000 articles weekly. I want a bluish self colour, similar to that of a watch spring."

**Waterproof Glue.**—LONDON asks where "waterproof glue can be procured."

**Still.**—LONDON asks for "particulars of a still for distilling wood."

**Glass Blowing.**—SPES MEA writes:—"May I take the liberty of asking some of the many readers of WORK to favour me with information respecting the apparatus necessary for blowing glass on a small scale, and the best place to obtain them?"

**Demon Water Motor.**—SPES MEA writes:—"Would any kind readers of WORK who have actually used the above motors, kindly inform me as to the general capability, strength, durability, efficiency, and reliability of these motors for turning grindstones, circular saws, etc., and whether in construction they are really a reliable motive power for the purposes mentioned. I should add that I more particularly refer to the larger-sized motors, namely, the ½ and 1 horse-power."

*** I reply to this at once by referring SPES MEA to a notice of the so-called "Demon" Water Motor, which appeared in WORK, Vol. III., page 122. This is a sufficient answer, and no replies from correspondents, should there be any, will be inserted.—ED.

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Bamboo Work.**—C. R. K. writes, in reply to E. C. W. (see page 416, No. 132), that he "can find everything he requires at Messrs. Heinriehs & Co., Old Street, E.C."

**Wire Crimping.**—THE PHOSPHOR BRONZE COMPANY write:—"We can supply castings in phosphor bronze, but we require a wooden pattern to make same from. Anyone could either supply us with the pattern, or if a wax pattern was sent, we could get a wooden one made and charge simply the cost price of same."

**Boiled or Unboiled Oil.**—H. E. (*Croydon*) writes, in reply to A WEEKLY SUBSCRIBER (see page 459, No. 133):—"It depends entirely upon what colours you intend using for your external painting. If you use a colour of which white lead forms the substratum, it is not usual to use 'boiled' oil. If you are using dark colours they should be mixed with it, as otherwise they lack the body of 'white lead' paints. You will get no paint to look like varnish after two or three years, however you may mix it. If a glossy appearance (permanent) is desired, you must varnish the work, and even this will dull very considerably after two or three years' exposure to the atmosphere."

**Tuck-pointing.**—H. E. (*Croydon*) writes, in reply to SLATER:—"If you wish to tuck-point the front of a red brick house, it is usual to rake out the mortar from the joints, give the bricks a coat of venetian red in turps, and then 'flush up' the joiuts with black mortar (made by mixing vegetable black with the ordinary mortar). The 'tuck-pointing' proper consists of laying fine lines of white mortar neatly and regularly over the centres of the joints. This is done by means of a special trowel and a straight-edge. Stock facings are coated with yellow ochre previous to 'flushing;' but it is not usual to colour *malms*. The term is apparently derived from the German 'tuchen' (to fold or press in), or 'zucken' (to shrink in). I need scarcely say that it is not a novice's job."

### V.—BRIEF ACKNOWLEDGMENTS.

Qnestions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—R. H. (*Bishop Auckland*); EQUATOR; MAOPIE; P. A. (*Newquay*); WATER MOTOR; NIL DESPERANDUM; J. H. (*Bishophill*); E. G. (*Hereford*); R. K. B. (*Woolwich*); BRASSY; E. M. (*Blackheath*); R. R. (*Liverpool*); ENGRAVER; J. A. B. (*Camberwell*); F. H. (*Battersea*); IGNORAMUS; A. D. (*Sunderland*); F. M. (*Portsea*); G. B. (*East Dulwich*); J. H. J. (*Birmingham*); A. B. (*Stoke-on-Trent*); CARR DYKE; E. F. C. (*Dartmouth*); G. C. (*Brighton*); F. G. W. (*Kettering*); J. H. (*Newchurch*); JOINER; G. L. (*Gateshead-on-Tyne*); CLERK; CLOCK; S. G. T. (*Penarth*); VACUUM PAN; F. C. (*Morriston*); A READER; APPRENTICE; AMATEUR; AN ADMIRER; E. D. R. (*Camberwell*); A. R. P. (*West Hampstead*); A READER OF "WORK"; AN AMATEUR; A WOULD-BE PICTURE-FRAMER; CLERICUS; J. F. (*Glasgow*); L. B. (*Wells*); C. P. T. (*London*); R. J. (*Gainsborough*); J. P. (*Darlington*); T. S. (*London, N.*); OLLOARTNEY; J. C. B. (*King's Lynn*); G. H. L. (*Salford*); A. R. (*Scorrier*); G. B. (*Stoke*); T. H. S. (*Newport*); J. H. P. (*Wordsley*); E. R. D. (*Sherborne*); R. G & Co. (*Salop*); SHOPITE; CHRONOORAPH; B. W. R. (*Liverpool*); CONSTANT READER; H. W. (*Stockport*); J. T. B. (*Hebden Bridge*); J. F. (*St. John's*); DRAUGHTSMAN; AJAX; J. H. M. (*Manchester*); T. B. (*Rochdale*); R. A. D. E. P. (*Harrogate*); YOUNG ENGINEER; W. T. T. (*Houghton-le-Spring*); W. W. (*Caverton*); D. O'S. (*Kerry*); J. S. & SON (*Ulverston*); L. T. (*Liverpool*); C. J. (*Chester*); C. H. C. (*Manningham*); C. S. L. (*Kirkcaldy*); T. R. B. (*Newcastle-on-Tyne*); J. R. B. (*Manchester*); R. B. (*Eltham*).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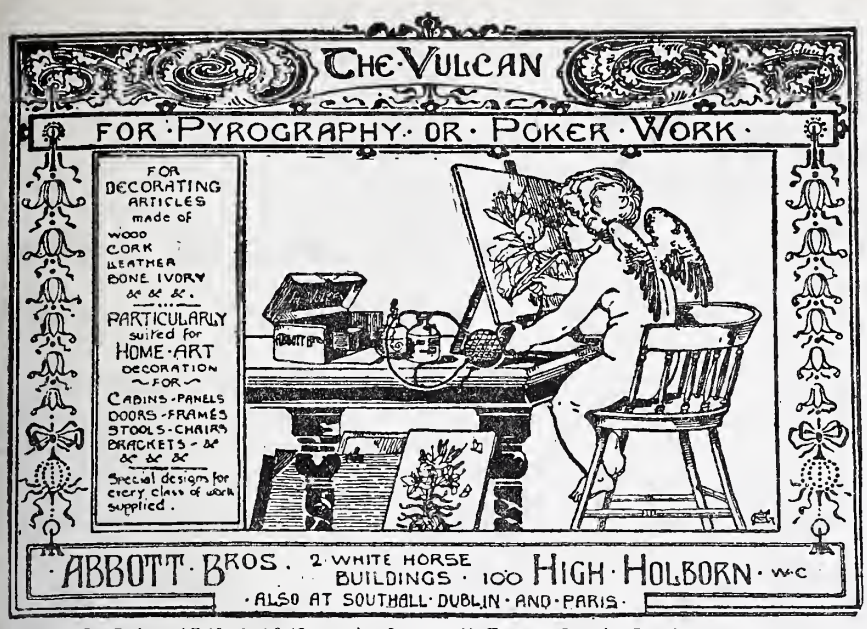


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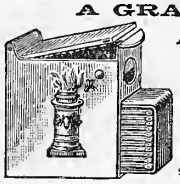

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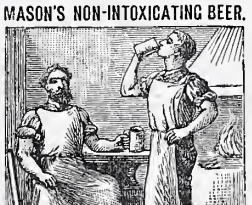

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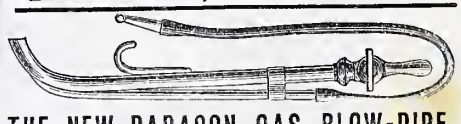

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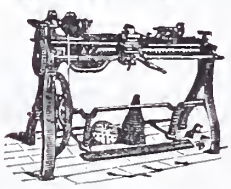

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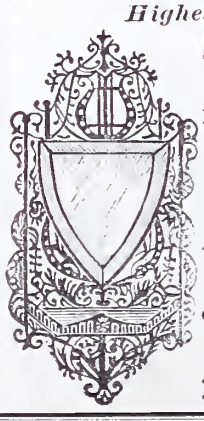

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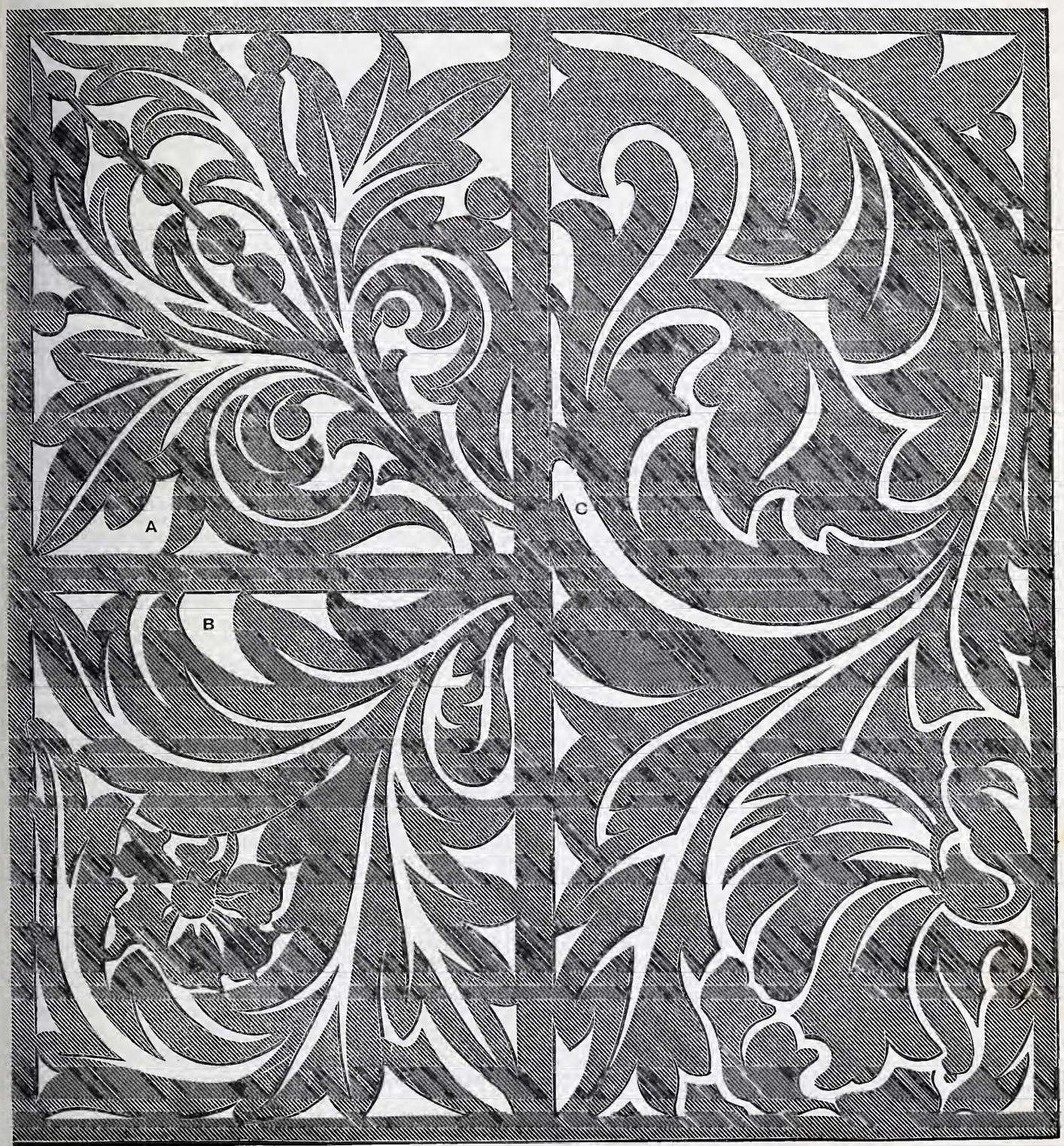



**Design in Fretwork for Panel, Border, Corners, etc.**

## DESIGNS FOR PANELS, ETC., IN FRETWORK.

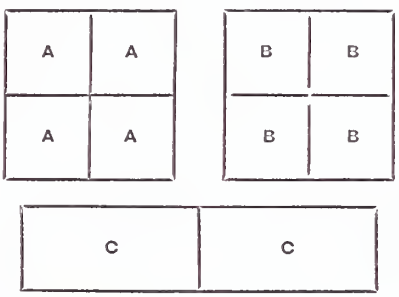
BY J. EADIE REID.

Of all productive amusements, illumined by the cheery glow of a winter's night fire, there is none, perhaps, more "fascinating and profitable" than fretwork. The numerous articles, both useful and beautiful, adorning the walls of our pet rooms and filling their corners are rich in memories of such evenings.

In my sketches in the preceding page, I have striven to supply range for such employment, and trust that while affording scope for technical skill, the sketches will illustrate my theory as to the fitness of the design to the material. This is a point which cannot be insisted upon too emphatically.

Without in any way wishing to depreciate designs published for fretwork—and many are of exceeding beauty—I do think that a great deal of energy is wasted over work more fit for shadow pantomimes rather than decoration.

The drawings given are capable of being repeated, as shown in the following diagrams. The border design might be utilised as a frame or back of pipe-rack, etc.




Fretwork can also be applied to metal work. I have seen a very charming stove cover executed in this way, the design being modelled in repoussé. Finger-plates might be carried out in this method, and the inventive minds of our readers will suggest other outlets.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

### Hardening and Tempering.

The Term Steel—Carbon in Steel—Mr. Seebohm's Classification—Secondary Agents — Definitions — Hardening — Tempering—Annealing — Hammer Hardening — Chisel Tempering—Tempering on a Bar—Grades of Temper—Colours—Effect of Steam—Warping and Cracking — Correcting Crooked Work—Thick Edges—Hardening Agents.

*The Term Steel.*—No confusion need arise in our minds as to the proper application of the term steel. For our purpose we shall only consider the two broad divisions into mild steel that will not harden and temper, and high carbon or crucible steel that will harden and temper. Steel castings, with which we are not concerned, will not harden at all.

*Carbon in Steel.*—The purer the mild steels—that is, the nearer they approach to the condition of malleable iron—the more ductile and the more weldable they are. On the other hand, their capacity for hardening and tempering diminishes. Carbon is the principal hardening element. Yet in no case does the proportion in which it is met with equal that in cast iron. In steel it seldom or never amounts to more than 1·5 per cent. It is as low as ·1 per cent. in the mildest plates.

*Mr. Seebohm's Classification.*—Mr. Henry Seebohm, a Sheffield manufacturer of eminence, read a paper a few years ago at the Chester meeting of the Iron and Steel Institute. In that he very happily likened hardened steel to glass, annealed steel to lead, and tempered steel to whalebone. He gave a list in that paper of the most useful kinds of steel, regarded from the standpoint of temper. I need not apologise if I make use of that list in this article.

Razor temper (1½ per cent. carbon).—This steel is so easily burnt by being over-heated that it can only be placed in the hands of a very skilful workman. When properly heated, it will do twice the work of ordinary tool steel for turning chilled rolls, etc.

Saw-file temper (1⅜ per cent. carbon).—This steel requires careful treatment, and although it will stand more fire than razor steel, should not be heated above a cherry red.

Tool temper (1¼ per cent. carbon).—The most useful temper for turning tools, drills, and planing-machine tools, in the hands of ordinary workmen. It is possible to weld cast steel of this temper, but only with the greatest care and skill.

Spindle temper (1⅛ per cent. carbon).—A very useful temper for circular cutters, very large turning tools, taps, screwing dies, etc. This temper requires considerable care in welding.

Chisel temper (1 per cent. carbon).—An extremely useful temper, combining as it does great toughness in the unhardened state, with the capacity of hardening at a low heat. It is consequently well adapted for tools when the unhardened part is required to stand the blow of a hammer without snapping, but where a hard cutting edge is required, such as cold chisels, hot setts, etc.

Sett temper (⅞ per cent. carbon).—This temper is adapted for tools where the chief punishment is on the unhardened part, such as cold setts, which have to stand the blows of a very heavy hammer.

Die temper (¾ per cent. carbon).—The most suitable temper for tools where the surface only is required to be hard, and where the capacity to withstand great pressure is of importance, such as stamping or pressing dies, boiler cups, etc. Both the two last tempers may be easily welded by a mechanic accustomed to weld cast steel.

*Secondary Agents.*—In addition to carbon, but in a lesser degree, manganese, phosphorus, and silicon are hardening constituents of steel. Within certain limits, the more these hardening constituents are present in steel, and the lower the temperature of the cooling liquid employed, and the greater its power of absorbing heat, the more intense will be the hardness induced in the steel. Mushet steel, used for turning tools, is produced by the addition of wolfram or tungsten, in the form of a metallic alloy, to steel. The resulting alloy is so hard that it does not require to be hardened by the tool maker.

*Definitions.*—My technical friends will pardon me if I explain, in the interests of the "general reader," the meaning of three common terms that will be frequently used in this and in the next article. They are "hardening," "tempering," and "annealing."

*Hardening.*—The process of hardening, as commonly understood by smiths, means the heating of a piece of steel to a high temperature—a full red, or a cherry red—and plunging it at once and completely into a cooling liquid, either water or oil, pure or medicated. This causes the steel to become hardened—as hard as it is possible for it to be made.

*Tempering.*—Tempering means that the steel is re-heated to a temperature very considerably below its previous heat, and when at a certain precise temperature, indicated by a definite shade of colour, it is plunged into a cooling liquid, or in some few cases is allowed to cool gradually in air. This grade of tempering is different in the case of almost every tool or piece of mechanism.

*Annealing.*—If the steel is heated to a high temperature, usually above that required for tempering, but below that for hardening, and allowed to cool slowly in air or in ashes, the steel is then said to be annealed. Steel may be annealed by getting it red hot, and allowing it to cool between hot cinders. Or it may be left in a low fire until the fire has gone out and the cinders have become cold. Or it may be enclosed in a box with charcoal powder, raised to a red heat, and allowed to become cold.

In the first case, therefore, the steel is brought into a condition intensely hard, like glass; in the second, into one softer and less brittle than the first—the whalebone condition—but yet as a rule very hard; in the third, it is in its softest possible condition, akin to that of lead.

*Hammer Hardening.*—Hardening by means of hammer blows is of occasional service when it is desired to increase the elasticity and hardness of a plate or lamina of steel. Its effect is similar to that of cold rolling and of wire drawing, and is removed by annealing. If hammer hardening is prolonged too far, the metal becomes fractured; hence, annealing must be resorted to before this stage is reached. The range of temper obtainable in hammer hardening is not so great as in the ordinary method of heating and quenching in water, and it has a more limited value, being confined chiefly to laminated springs.

*Chisel Tempering.*—The typical method by which much work in the tool line is tempered is this: Say the article is a cold chisel. The scale is removed from the surface, as it must be from all work that has to be hardened. It is then first heated to a cherry red in a clear fire—just the cutting end only—to the length of about a couple of inches, and is then quenched in water. It is taken out and rapidly brightened with a bit of grindstone or emery, in order that the rapidly changing hues may be observed the better. Though the cutting end has been cooled in the water, it is only for an instant, for the heat of the shank at once begins to be communicated to that end, and raises its temperature, until the instant arrives at which it must be quenched for tempering. The smith then plunges the entire chisel into the water, moving it to and fro until quite cold. The colour for tempering in the case of a cold chisel is a deep straw inclining to purple. But, as I cannot too often reiterate, the colour must vary with different grades of steel.

*Tempering on a Bar.*—Another way suitable for many small tools is to heat a bar of iron to redness in the forge fire, and lay the tools upon the bar until they reach the colour required for quenching. If the bar is made red hot at one end only, the tools can be gradually slid along toward that end, and so slowly heated thoroughly through,

until they reach the precise tint for tempering.

*Grades of Temper.*—But all cutting tools of the same type are not tempered alike. Thus, turners' roughing tools or fitters' chisels will be tempered at different shades of colour, according to the material they are specially intended to operate upon. A tool for working hard cast steel will be made harder than one for working grey cast iron. A tool quenched at a straw colour is harder than one quenched at a blue; so that if tools for hard steel are tempered at a straw, those for soft iron and brass are tempered at a tint between straw and, say, purple.

*Colours.* — The main colours through which steel passes from the lowest to the highest temperature are straw, gold or yellow, chocolate, purple, violet, and blue. These, with their intermediate shades, are the indications of the temperatures for quenching for different tools.

*Effect of Steam.*—During quenching the steel should not be allowed to remain still, but be moved about. There is an important reason why steel should be moved about in the water during hardening. Water in contact with red-hot metal assumes the spheroidal state, and prevents perfect contact between the surface of the metal and the cold water. Moving the steel about, therefore, assists in maintaining a more perfect contact by bringing it into colder strata. This also is the reason why, when hardening large masses, such as the faces of anvils, the practice is to pour a stream of water over them. For the same reason, mercury is a better hardening agent than water. Plunging small articles into cold lead or into tallow, or placing them between cold iron, are for the same reason perfect methods of cooling, there being no formation of steam. Further, sharp angles should be carefully avoided in work that has to be hardened. They invite cracks just as similar sharp angles do in castings.

*Warping and Cracking.*—Hardening steel often causes it to become cracked and warped out of truth, though no sharp angles are presented. The reason is this: On dipping the steel into the cooling medium, the outer covering is rapidly cooled off first, and shrinks upon the interior. The shrinkage puts the outside into tension. Presently the interior cools. But it is prevented from free shrinkage by its union to the set exterior, and is thus itself put into tension, so that two things may happen: either there will be a condition of permanent tension, productive of warping or curvature, or the stresses will find relief in fracture. And this is why hardening is so apt to curve or crack the object. And since the effect of water hardening is more pronounced than that of oil or tallow hardening, it is customary to use oil or tallow in preference to water in all delicate works. Moreover, in order to lessen the liability to curvature, long narrow articles are immersed perpendicularly instead of horizontally or diagonally in the fluid, so that its effect may be evenly distributed over the whole of the surface. Again, steel that is taken out of the water before being thoroughly quenched is apt to crack. And steel is apt to crack at the water level if kept at the same height. It should therefore be moved slightly up and down in the water. When dipping articles of unequal thickness on the edges, the thicker edge, as a rule, should be dipped first, to lessen risk of cracking.

*Correcting Crooked Work.*—Thin work that goes crooked during tempering may often be corrected after hardening, and while at the heat for tempering, with a cross-pane hammer, operating on the concave face.

*Thick Edges.*—When tempering cutting tools, the edges should invariably be left thick, to be reduced afterwards by grinding. If tempered thin, the edges will be liable to be burned, and if not burned, the temper of the edge will not be the same as that of the thicker portion. But if tempered thick and then ground down, the temper will be uniform throughout.

*Hardening Agents.*—Almost every smith has his favourite hardening agents. The principal are cold water, medicated in various ways, chiefly with salt, and also lukewarm water, and oil. Mercury has been used and recommended, and since it is a good conductor, and no film of steam can form between it and the work, it should be very efficient. But of course its expense precludes its use for average work, and we may dismiss it at once. For most purposes of the ordinary smith, pure cold water only is used. For light and delicate work, however, oil is preferable. In the next article I shall write at length on the principal fluids and mixtures made use of.

## SOME LESSONS IN WINDOW MAKING.

BY G. LE BRUN.

### Roof-lights and their Construction.

When the worker has mastered the "setting-out," mitring, and putting together of an ordinary dead-light, or fixed sash, he will be the more competent to try his hand at the making of roof-lights, which, although to many they appear more difficult, are in reality easier to make than a sash having cross-bars. For the sake of an example, we will suppose that we have to make the roof-lights for a greenhouse similar to that described in the paper on "The Tenant's Greenhouse," in WORK, Vol. I., page 177. We will thus have a definite object to take the sizes from, and the lesson may prove doubly useful to those who are at work on the house there described.

Turning back, then, to Vol. I., page 177, we find that to cover in the roof four sashes are required. In an erection intended for a permanency, two roof-lights extending the whole length of the building would be the proper mode of construction; but, as in the case before us, portability is an object of importance, the roof-lights are made in four sections (two for each side), so as to allow of ease in handling when taking down or erecting. The number, however, is immaterial—four will do as well as two for our lesson—as the difference after all is only in the respective sizes of the sashes, and does not in the least affect their mode of construction.

We require, then, four roof-lights, each 5 ft. 10 in. high and 6 ft. 2 in. wide, and for these we shall want material as follows:—Eight stiles, 6 ft. 2 in. by $3\frac{1}{2}$ in. by 2 in.; four sole rails, 6 ft. 3 in. by 5 in. by $1\frac{3}{8}$ in.; four top rails, 6 ft. 3 in. by 3 in. by 2 in.; sixteen sash-bars, 5 ft. 11 in. by 2 in. by $1\frac{1}{2}$ in. These are the sizes in the rough, allowance being made in the lengths for stumps on the stiles and tenons. Prepare the wood carefully by planing up straight and square, and pay attention to the running of the grain in the direction in which the planes run when rebating and moulding, as explained in the previous lesson on dead-lights.

Take the stiles first, and lay them on the bench, in pairs, alongside each other, the marked or inside edge being uppermost. Lay a sash cramp across them, and tighten it up sufficiently to prevent the stiles slipping away from each other; put a bit of wood between each jaw of the cramp to prevent marking the material, and keep it up far enough above the edges to allow of your rule passing beneath when measuring, taking care also that the ends of the stiles are flush. Draw a line across the stiles 2 in. from the left-hand end, measure off 5 ft. 10 in., and draw another line across. The distance between these lines is the height of your sashes (A, A, Fig. 1). Now at the left-hand end measure off from your first line 5 in., and at the right-hand end 3 in. These are the widths respectively of the sole and top rails (B, B, Fig. 1). Let the top rail have a rebate of $1\frac{1}{4}$ in., and the sole rail 2 in. (C, C, Fig. 1). The distance between the lines, C, B, is the length of the mortises, and you will notice that at the sole end of the stiles they are continued to the full width of the rail, the part extending from A to C, however, being only $\frac{5}{8}$ in. deep. This is to allow for the insertion of the piece of tenon left on to steady the rail, and also to prevent leakage. This piece, with mode of cutting the tenon of the rails, is shown in Fig. 4.

Turn the stiles upside down, and draw across the lines, C, B, on the back edges, leaving an allowance of $\frac{1}{2}$ in. at each side of the mortises to allow of the insertion of the wedges. In turning the stiles over, get the assistance of another person, each holding the ends tightly, so that they may not slip away from each other endways; if you attempt to turn them yourself by lifting them in the middle, the probability is that you will drop them, or shift all your marks away from each other. Set the mortise gauge for a $\frac{5}{8}$ in. chisel, and run it, as in the previously described sash, $1\frac{1}{8}$ in. from the face. Take the top rails, and lay them on the bench face edge upwards; draw a line $\frac{1}{2}$ in. from the left-hand end, measure off 6 ft. 2 in., draw another line across, and you have the extreme width of your sashes marked. From these lines (A, A, Fig. 2) measure off at each end the width of the stiles ($3\frac{1}{2}$ in.), and square across the marks (B, B, Fig. 2) again; from these last marks measure outwards towards the ends of the rails $\frac{5}{16}$ in., and again square across your marks. These last marks (C, C, Fig. 2) are those you square over the sides for the shoulders of the tenons, and you will notice that, unlike the shoulders of the previously described window rails, both sides are alike, thus forming a square shoulder; the reason of this is that you may have a deeper rebate for the glass, which is an advantage in roof-lights, as it gives a better bed, and tends to prevent leakage. Before, however, you begin to square your shoulders over you must divide the rail into five equal parts, and draw the mortises for the bars. These mortises are $1\frac{1}{2}$ in. long; you had better keep them a little tight, say $1\frac{3}{16}$ in., as loose bars are an eyesore to the good workman. Let the two centre bars be mortised through the rails; the other two merely require letting in about 1 in.

The sole rails, which are next in order, are drawn across the top edges in a similar manner to the top rails, the same mark being taken for the shoulder (C, C, Fig. 2), which on these rails is only on one side—that is, the underneath one. You need not do your measuring over again; it is easier, and also more accurate, to lay a top rail on your sole rails and mark off the various points for shoulders and mortises. You cannot use your mortise-gauge on these rails for the tenons, so you must set a marking

gauge to $\frac{5}{8}$ in., and run it from the back of the wood, which ought to be accurately thicknessed to $1\frac{5}{16}$ in. The mortises are also different, as will be shown presently.

The bars are cut with a square shoulder at the top end, the lower end being cut as in Fig. 3. A $\frac{5}{16}$ mortise into the rail about an inch is sufficient. Of course, you must allow the $\frac{5}{16}$ longer at each end for the mitring into the mouldings of the rails.

When all the stuff is set out, mortised, and tenoned, it is rebated and moulded in the usual way; the rebate, as before mentioned, is of the same depth as the moulding, and this must be seen to carefully, for if both are not of the same depth the joints will not be close on both sides of the work when down through them. Nail the ends of the other two bars in the same way, cut off the stumps of the stiles and tenons, and plane up all round, and your roof-light is finished and ready for putting in place.

I have said nothing about the wood to be used, as that depends on the ease with which it can be got, and the amount of money to be expended. Yellow deal is easily worked; red deal and pitch pine are much preferable, but more expensive, and in remote places are sometimes not easily procurable; but whatever wood is used let it be as free from knots as possible, and I would say avoid using white pine if you can help it.

Two coats of white-lead or other priming paint had better be given the roof-lights ends of the bars, which are generally put into mortises in the top rail, the lower end being rebated into the sole rail, and nailed firmly down. In some instances the rafters themselves are utilised as bars, and rebated on the upper edge for the reception of the glass, the top and bottom ends of the panes being rendered water-tight by an arrangement of lead or zinc. In fact, every locality and every builder have different ways of doing the work, differing, however, only in minor details, the principle being the same throughout; so that the worker who masters the construction of the roof-lights described in this paper will have learned a useful lesson, and once having grasped the general idea of how the work is done, the alteration

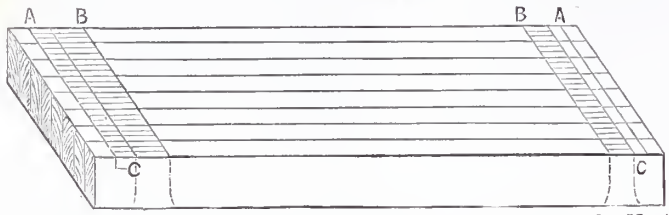



Fig. 1.—Stiles laid on Bench for setting out and showing Markings for Mortises.

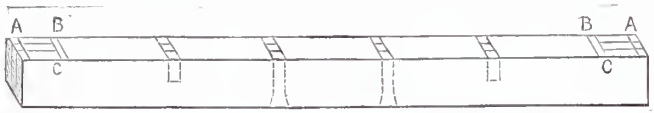



Fig. 2.—Top Rail set out showing Mortises and Tenons.

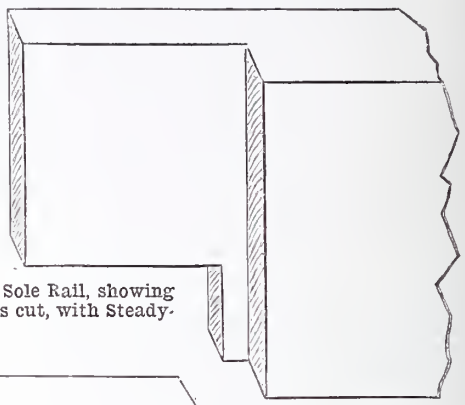


Fig. 6.—End of Sole Rail, showing how Tenon is cut, with Steadying Piece.

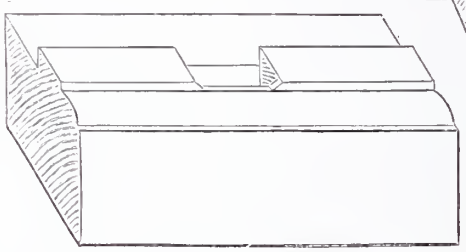


Fig. 5.—Diagram showing Mortise with Mitre to receive Top End of Tenon.

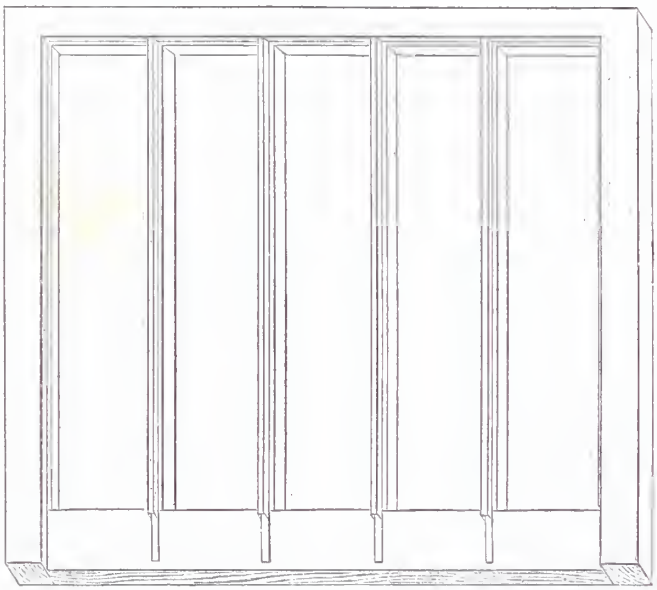


Fig. 7.—Roof-light completed.

Fig. 3.—Section of Sole Rail, showing Mode of mortising and fixing.

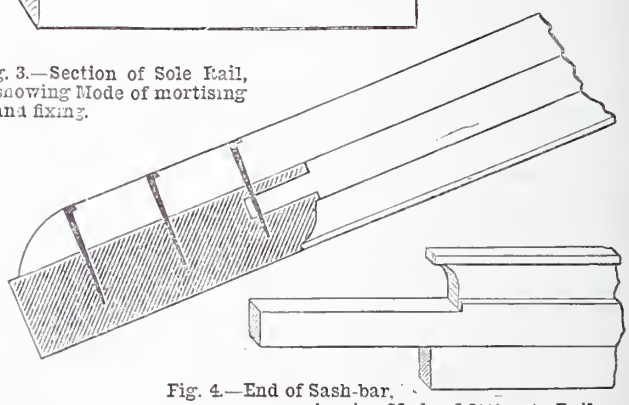


Fig. 4.—End of Sash-bar, showing Mode of fitting to Rail.

finished, and may give rise to twisting of the sash, or breaking of the tenons under the cramping-up pressure.

The mode of mitring the rails and stiles is the same as in the previously described dead-light; the bars, however, are a little differently managed, as will be seen by referring to Figs. 4 and 5, which show the end of a bar cut and mitred, and its corresponding place in the rail. The upper edge of the sash-bar, it will be noticed from Fig. 3, runs over the sole rail, and terminates within $\frac{1}{2}$ in. of its lower edge, where it is rounded off. This rounding should be done after the sash is cramped up. When putting the framing together, wedge up and pin the stiles in the usual way, then reverse the cramp by laying it across the rails in the centre. Wedge up the tenons of the two bars that go through the top rail, also pinning them, and nail the lower ends down firmly to the sole rail by driving three $1\frac{1}{4}$ in. stout brads before they are put in position; they can then be glazed and have a finishing coat of paint. Of course, the priming can be done if necessary when they are up, but it is a much easier operation to do it while they are on the ground and easily got at.

Forcing-frame sashes are made in the same way as roof-lights, but generally on a smaller scale, and no moulding need be worked on them; in fact, it would be lost labour to do so, therefore the under sides of the framing can be left square, allowance being made for that in the shouldering of the tenons.

In making long stretches of roof-lights, such as in nursery greenhouses or on factory roofs, a different mode of structure is adopted; the top and bottom rails running the entire length of the roof are fastened to the rafters, and the stiles and bars fitted into their several places *in situ*. Mortising and tenoning are dispensed with, except the top of minor details to suit any particular requirements is only a matter of thought on his part. In a future paper I will endeavour to deal with some of the intricacies of window making of a more complicated nature, and show how to put together a hung sash with its case.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

THE STUDY: WOODWORK OF THE FIREPLACE—OLD OAK — INCISED CARVING — THE CHIMNEY CORNERS—THE OUTER MANTELSHELF.

*The Study: Woodwork of the Fireplace.*—When the mason had set the grate and (under my direction) fixed the tiles round it, he was, I found, much exercised

in his mind as to the possibility of my ever making my fireplace presentable. His trade traditions as to the way in which things ought to be done had been outraged, but for my own part I saw no special difficulties.

First, round the tiles I fixed a casing of ebonised pine, and on its face a strip of moulding, the inner edge of which projected just so far as would cover any inequalities in the edges of the tiles, for, being an odd lot, they did not, of course, finish in a straight line. This casing projected some

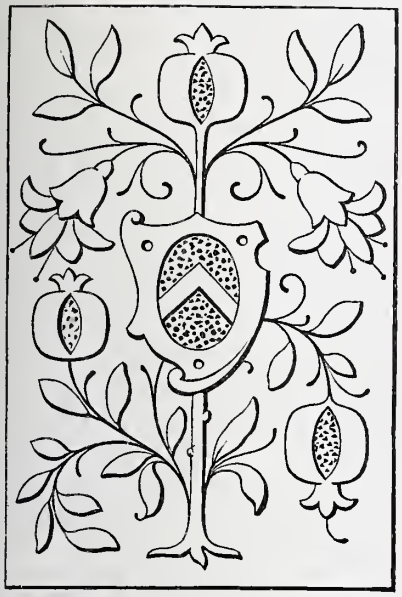


Fig. 5.—Panel: Pomegranate Conventionalised.

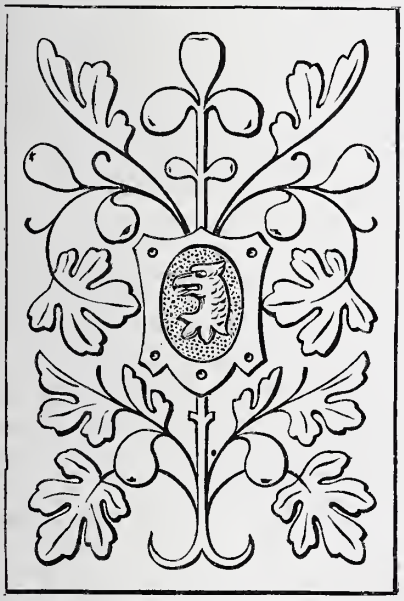


Fig. 6.—Panel: Fig Conventionalised.

3 or 4 in. from the wall, but I did not, as will be seen from Fig. 1 (page 449), rest my mantelpieee immediately upon it. Over it I arranged the groups of brackets shown, and rested the shelf on them. This gave me some handy little nooks, useful for laying things, beneath the shelf. In Figs. 2 and 3 the brackets are enlarged; they, like the mantelpiece itself, and the casing of the chimney-breast on each side, are of ebonised pine. Above the mantel-shelf all is dark oak. Ebonised wood, be it remarked, goes well with the colour of old oak. In this room a great many odds and

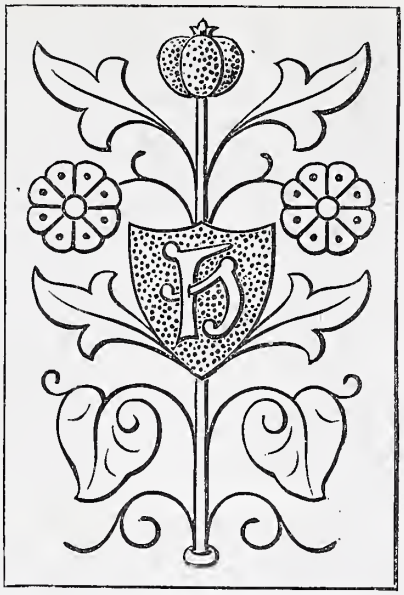


Fig. 4.—Incised Panel for Mantelpiece.

ends of the last-named material are used up, but to have employed new oak to supplement them in every part would have been a costly and difficult matter. I therefore eked them out with the more cheap and easily worked wood, and this wrinkle of my own finding out I can commend to others as worth their consideration. I ebonised with decoction of logwood chips, used hot, and iron dissolved in vinegar, polishing with beeswax and turpentine.

*Old Oak.*—In the decorative work above the mantelpiece, the two demi-figures which occupy the sides are old Jacobean carving—part of the wreckage, probably, of some demolished bedstead—but the panelling between them, though old in itself, is of my own decorating. When I began my work on this house I had by me an accumulation of odds and scraps of old oak-work, some carved, but more without carving. In country places, when old houses are pulled down and churches "restored," it is easy, if anyone will keep his eyes open, and take care to be on good terms with such of his neighbours as are in the building trade, to get such matters for a mere old song. This I commend to the reader as another wrinkle.

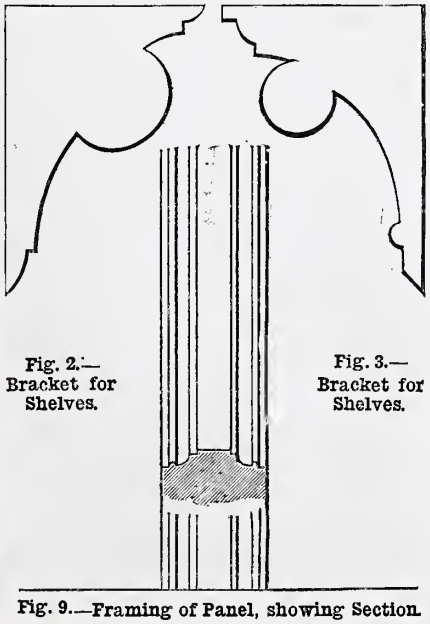


Fig. 2.—Bracket for Shelves.

Fig. 3.—Bracket for Shelves.

Fig. 9.—Framing of Panel, showing Section.

But to return to the overmantel. The decoration on the panels in question consists of little more than incised lines, a kind of work about which I should like to say a few words.

*Incised Carving.*—When setting about the decoration of a whole house, or even of a single room, the amateur wood-carver finds the need of quicker methods than when merely ornamenting some small fancy article, and in the manner before us a number of panels, whether new or old, may be enriched in a comparatively short time. In

Fig. 7.—Panel: Grapes Conventionalised.

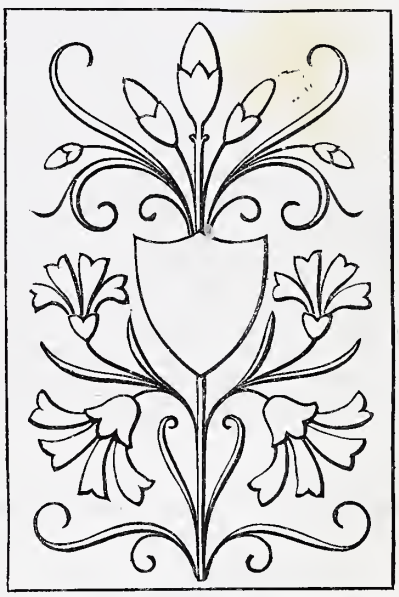


Fig. 8.—Panel: Carnations Conventionalised.

Fig. 4, one of these panels is shown drawn to a larger scale. Except where, as on the shield, the grounding-punch is used to give the effect of relief, almost the entire work is done with the dividing-tool. For this purpose I find that a leaden dummy drives the tool best. A very rough indication of the pattern only is required, as it is easier to get a good flow of line with the tool than with the pencil. One can vary these lines so much in depth and strength as to put a great amount of expression into them.

The design of Fig. 4 is very much a fanciful one, but in Figs. 5, 6, 7, and 8, I have designed other panels which the reader may

like better for carrying out, and in which natural growths are conventionalised; Fig. 5 is the pomegranate, Fig. 6 the fig, Fig. 7 the grape, and Fig. 8 the carnation. In Fig. 7 the grapes will better be defined with a gouge than with the dividing-tool.

*The Chimney Corners.*—The panelling which lines these is old stuff: the diamond pattern with which the panels are worked was a favourite one in early Stuart times. So much of the panelling as appears in Fig. 1 is a portion only of a large piece of wainscoting, which I got from a builder at the pulling down of an old house for 5s. Below this panelling appears a base of plain, ebonised wood, which does not assert itself in the drawing, but in the actual thing throws up and sets off the carving remarkably well.

To the left will be seen a corner-seat, with a carved front. The actual seat is one solid block of stone, which I have thus cased. What is now its front served as the front of a box in the days of James II., but came to me as a fragment with other fragments. The footstool below, I may, for the benefit of fellow-smokers, mention aside, is a disguised spittoon. On the jamb to the front of the seat another adaptation of old wainscot may be seen. In this the gouge-work at the top only is of the date of the panels, the lower carving having been added by myself to match the old work in the corners.

*The Outer Mantel-shelf.*—Over the wide opening to my old-fashioned hearth ran a huge, unsightly beam, which had, in the course of ages, been plastered over with innumerable coats of white and coloured washes. Along its front was nailed a mean, painted shelf, such as one commonly sees in such situations in farmhouse kitchens, the acknowledged receptacle for candlesticks and similar matters. This shelf I removed, and, having scraped and cleaned the beam, I bevelled off its front edge, planed it, and rubbed it over with boiled oil. It was of elm, but, through age and smoke, showed, when dressed, scarcely lighter than my old oak. Against it, but some inches higher than its predecessor, I fixed a new shelf of ebonised pine (as seen in Fig. 1). It is supported by brackets similar to those shown in Figs. 2 and 3, and between them are carved shields, with armorial bearings. For these last, which can be applicable in my own case only, I have in the drawing substituted fanciful devices of sun, moon, and stars. All the woodwork of this shelf, except the shields, was screwed together before fixing up; it was then screwed to the beam and the screws hidden by the shields.

## HINTS ON THE STRINGING OF THE ZITHER.

BY AN OLD TEACHER.

As R. F. has given us a splendidly lucid set of instructions as to how to construct a zither, it is a pity that he has not adhered to the conventional form of the solo instrument, especially as his dimensions appear to be exact for that description. The straight and ungraceful shape he gives is that chosen for the "Élégie," or "song" zither, or for the so-called "concert" zither, while the "Schlacht," "Horn," or "Prim" zither—which is the most serviceable one for general use—is infinitely more graceful, as well as offering greater resistance to the stress of the strings, which, it need scarcely be said, is very great.

Fig. 1 gives the "Élégie" zither, which will be found to coincide with the one given on page 392; while in Fig. 2 I give the alternative shape—that of the "first," or solo zither. Now, there are probably many persons who already possess a zither; it may be without strings, and as there are comparatively few persons capable of stringing such an instrument, my remarks will, perhaps, be of service, especially as I have played the zither in all its forms ever since its first introduction into this country, many years ago, while as a teacher my success has been exceptionally great, for reasons which will be seen anon. Whether for a zither *in esse* or *in posse*—whether it already exists, or still has to be made—I will guarantee that, if my instructions are followed, there will not only be no mistake, but that the tone (always supposing you have got a sound instrument—one not cracked) will be much in advance of any tuned or strung otherwise.

Firstly, I should premise that there are two methods of stringing in vogue, viz., the Stuttgart and the Vienna methods. Fig. 3 represents the finger-board, or rather the open notes of the melody strings (those five

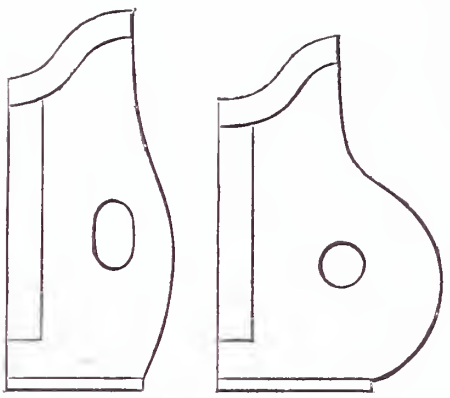


Fig. 1. Fig. 2.

**Fig. 1.—The "Élégie," or Song Zither, used as an Accompaniment. Fig. 2.—The "Horn," "Schlacht," or "Prim" Zither; the Solo Instrument, and the only one useful for Characteristic Zither Music.**

on the finger-board), of a zither strung on the former system, while Fig. 4 gives the Vienna method, which is the one most universal. And let me also add a word of encouragement to such as may possibly be deterred by the difficult look of the zither, with its numerous strings. I am aware that many so-called "instruction books" start off with, "The zither is a most difficult instrument, but," etc. Believe them not, they are fooling thee, as I, perhaps, should if you were going to give me a guinea per lesson, which is no uncommon fee for tuition on this most simple of instruments. I have myself received 5s. per hour for teaching it, but have always impressed the above fact upon my pupils. And the best proof that I am right lies in the fact that in the Tyrol, which is the home of the zither, it is played by "all hands"—men, women, and children. Again, anyone of ordinary intelligence may learn it in a week, although proficiency will only be attained by persistent practice. All there is to be learnt—that is, the methods of fingering with each hand, and the position of one major chord (which is all that there is to learn, as all others are exactly the same relative distance apart, and may be found mechanically)—may be written in the space of one sheet of Work. Therefore, be ye not dismayed, but persevere, and you may play pleasingly and correctly in a month; if you want to do fireworks and other feats you will have to practice long and often, but that is not zither playing proper. The great sympathetic charm of the instrument lies in its capacity for conveying feeling, which must first exist in the soul of the player. For my own part, I do not profess to be a great performer, but I can have a room full of people in tears in no time. That is how the zither should be played. Before going on to describe the best method of stringing, I may say that, should anyone be desirous of trying my simple method of learning, I may be communicated with through the "Shop" pages, although I no longer teach professionally. And here a caution to such as buy their zither. When you get it, it will probably be useless, having, in nine cases out of ten, been strung with silk and gut strings, which are not only worthless as to tone, but which will keep you fully employed in trying to tune your instrument—one of the most hopeless of operations when such strings are used. Take it as an axiom, then, silk and gut strings are, for the zither, worse than useless. On the other hand, I have had instruments in daily use for weeks together without requiring more than a casual or occasional touch—certainly they have never wanted tuning throughout. Procure good metallic strings, which are to be had in sets, in boxes. Beware of the music-seller who promises to "get them," or to "make them up," he is a fraud. Such sets of strings should not cost more than 8s. or 9s., at the outside, although a well-known maker once charged me 17s. for a set. I am aware that they are not to be had except of such as import them direct from Germany, but, having got them, they will last you three years, unless your hands are very moist in their nature, when, of course, the strings gradually rust under the wrapping, and the tone suffers, not the string. I wish it were possible to contrast the tone of the silk and gut with the steel in the pages of Work. What a convincing proof that would be! But string a fiddle with worsted, and you can guess the difference.

The sets mentioned do not, as a rule, include the steel and brass wire for the three first melody strings, but the fourth and fifth—that is G and C—both metal covered with metal, are included. Also, you may find in the set (each separate string having its number and note on a label) more strings than you have accommodation for. This is because a zither may have any number of strings, from twenty-two to thirty-two. Simply start at E flat (having first strung the finger-board), no matter whether numbered one or two. Some sets give G sharp as the first of the accompaniment strings. Don't use it if you find it so—you lose by it. As for any there may be over, simply discard them; they are not required for their legitimate place, but come in useful when you chance to break a string of similar calibre or gauge—an event which need never happen if care is taken to strain each string slowly and carefully, using frequent friction along its length in the process. Never string right up all at once, many strings "go" in this way. Make it a two days' job, and strain well before finally fetching up to pitch. Never go higher than half a tone lower on the piano, unless you wish to accompany another instrument, which zither players are, as a rule, not fond of, except in the case of such instruments as the guitar or mandolin, which can always be made to accord with the more delicate

zither. Having procured your strings, including a reel of each, steel and brass, which are sold specially, and cost about 6d. per reel, cut off about three or four inches of steel wire more than the length of the instrument from tail-piece to pegs. Then, with suitable pliers or your fingers, form a very small loop at one end, the smaller the better. Pass this loop over the pin at the

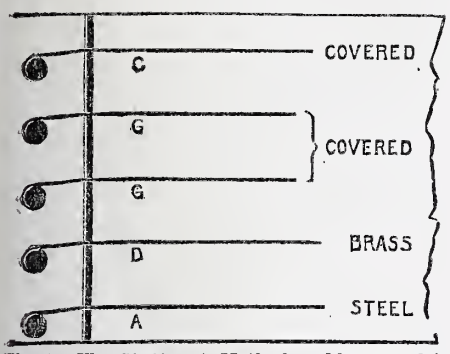



Fig. 3.—The Stuttgart Method, seldom used in England. The Strings bracketed are tuned alike.

tail-piece end and the string up through the groove in the latter. Then run the string through the finger and thumb of the right hand, so as to have it perfectly straight and free from "kinks." Insert not more than 1 in. through the peg-hole, and, with the tuning-key, wind the string evenly on the peg, using the right elbow to keep the looped end from springing out of the groove, or off the pin, and the right hand to guide the string evenly on the peg. When the string just "bites," and there is no fear of its springing out of place, leave it and pass on to the next, taking care in each case to pass the top of the string behind the little pin behind the nut (see Fig. 1, page 392).

When you have got on the three wire strings, you will find all others already provided with proper loops, which only want looping on to the pins and through the groove, but take precautions against twisting and "kinking." Also be very careful in unwrapping each string, as any actual bend in a string would probably result in a break.

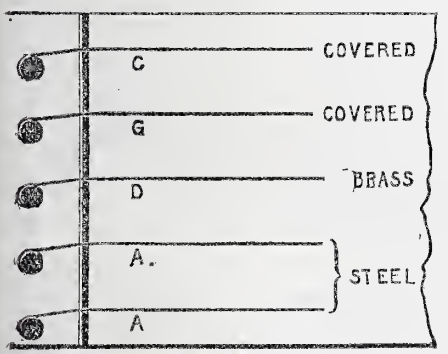



Fig. 4.—The Vienna Method, the one in Ordinary Use. The Strings bracketed are tuned alike.

Having got all the strings on, proceed to raise them carefully, beginning at the first. Fetch that one up to about E (under the stave) by the aid of a pianoforte or tuning-fork. Similarly with the next, which also has, eventually, to come up to A. Fetch the brass wire string up to about B, and so on, straining carefully each string. Now leave to stretch all night, after which proceed to tune the second string to A, then the first to it. Then place the forefinger of the left hand behind the fifth fret (where the first spot is) and tune the brass string to it, but an octave lower. Then stop the D string on the fifth fret, and tune the G to it, and the same with the next, which is C. Then your finger-board is complete, and in tune. Now comes the turn of the accompaniment strings, which comprise the first twelve after those on the finger-board. Tune these according to the following diagram :—

| *Number of String.* | *Name of Note.* | *How to form it, to tune to.* |
|---|---|---|
| 1 | D sharp | On the first fret of the D string. |
| 2 | B flat | ,, third ,, G ,, |
| 3 | F | ,, ,, ,, D ,, |
| 4 | C | ,, fifth ,, G ,, |
| 5 | G | ,, ,, ,, D ,, |
| 6 | D | By the open D string. |
| 7 | A | On the second fret of the G string. |
| 8 | E | ,, ,, ,, D ,, |
| 9 | B | ,, fourth ,, G ,, |
| 10 | F sharp | ,, ,, ,, D ,, |
| 11 | C sharp | ,, sixth ,, G ,, |
| 12 | G sharp | ,, ,, ,, D ,, |

Now all the work is done, as the thirteenth string is tuned an octave lower than the first, the fourteenth than the second, and so on throughout. Some strings in the bass, which begins at the thirteenth, are usually tuned two octaves lower—such are C and D sometimes—but you will easily recognise these by their greater thickness, and the utter impossibility of getting them up another octave. Don't try. Thus far the tuning. As to the proper position of the hands, etc., in playing, I should be very glad to write another article on that, but I am afraid the Editor has had enough zither MS. By the method I have given anyone may easily string up a zither, and do it properly, too, while, by attending to the hints I have given respecting choice of strings, etc., you can ensure having your instrument as nearly perfection as a very perfect instrument like the zither is capable of.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### The Plane.

A few lessons in wood-working being desired by some readers, I will, without further preface, begin.

The use of the plane should be attempted before any other tools are studied. If the beginner buys a new jack-plane, and he can get the tool merchant to sharpen and set it while the buyer waits and watches, let him do so; but if so valuable a lesson cannot be had, try to sharpen it as follows :—

Knock out the iron. This may be done by grasping the plane, turned upside down, with the right hand, while the left holds the wedge and plane-iron. A gentle blow on the bench should leave the iron and wedge in the beginner's left hand. Do not drop them, which you will do if you hold them carelessly. The cutting-iron is now to be separated from the cap-iron by loosening the screw with a screwdriver. The safe way of doing this is to hold the iron on the edge of the bench, the screw just off, but close to, the bench edge. To sharpen the plane, rub firmly but gently on a clean oil-stone on which is a little oil. (For a lesson on Sharpening, see WORK, Vol. I., page 310.) Be careful to put the plane together as the maker intended; beginners do not always do so.

It is important to learn to set the plane by the eye, so that without trying the plane and going through that unsatisfactory process of tapping and withdrawing the iron, you become able to place the iron so that it will take off a shaving proportionate to the hardness of the wood and the strength of the operator. I should advise the beginner not to attempt to use a plane the iron of which projects more than the thickness of the paper on which this is printed. He can afterwards remove stouter shavings, but some considerable experience in teaching prompts me to lay stress on this matter.

Another little point on which a warning is necessary: in placing the cap-iron and the cutting-iron together, do not let their edges pass each other, or the newly sharpened edge will suffer. Sometimes in screwing together this will happen; if so, it is usually because the head of the screw touches one side of the iron before the other. As the screw is generally accurately turned, the fault may be in the boring of the brass nut which is fixed to the cap-iron, or it may be in the cutter-slot being thicker at one edge than the other, or some roughness in the slot, or the whole cutter or cap-iron may be bent or winding. Whatever the cause, find it out, cure it, or change the iron, for there is nothing more trying to a beginner than having with care sharpened the plane-iron, and find, to his annoyance, that in the screwing together of the two irons the cap-iron passes the sharpened edge and spoils it.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Some more Fancy Knots.

Single Pitcher Knot—Pitcher Handled—Double Pitcher Knot—Slinging a Can—Shamrock Knot—Dalliance Knot—Davenport Brothers' Knot—Bell-ringer's Knot.

Fig. 98 is the "Single Pitcher" knot, known also as "Tom Fool's" knot. The easiest way to make it is to form two half hitches, as shown in Fig. 99, one lying half-way over the other. With the finger and thumb of the left hand draw the part A down through the bight, and with the same fingers of the right hand bring the strand, B, upwards through the bight, under which it lies. Pull the loops thus formed out to a sufficient length and knot the ends together. When used to supply the place of a broken pitcher handle, the centre knot should be hauled taut, and the pitcher being placed on it, the loops are brought up to form handles. To keep them in their places a lashing is put round the neck of the pitcher, as shown in Fig. 100. This knot is also very useful in slinging a shot when required as a weight, or for any other purpose. In this case the centre knot is not hauled taut but left open, forming a large loop on which the shot lies. If the ends are spliced instead of knotted a three-loop knot is made. It is also used as a trick knot to puzzle landsmen, and from this arose its name of "Tom Fool's" knot. To make it in this way, turn the left hand with the palm upwards and lay one end of the cord across it, holding it against the side of the hand with the thumb. Turn the right hand over so that the backs of the fingers are downwards and the ends of the fingers pointing towards you; take up the other end of the cord on these fingers, but do not close the hand; bring the right hand, without altering its position, over the left, until the part hanging down over the first finger of the right hand hangs outside the left hand. With the third and little

fingers of the left hand seize the cord which hangs down over the little finger of the right hand, and at the same time with the right thumb and the other fingers of the same hand take hold of the cord which is on the left hand. If the hands are now separated the knot will form.

This is a good puzzle, as from one hand lying over the other as the knot is made, it is impossible to see that one end is grasped between the third and little finger of the left hand, even when the knot is made slowly and with every apparent intention of showing how it is done.

Fig. 101 is the "Double Pitcher" knot.—This also goes by the names of "Jury" knot and "True Lovers'" knot. It is used as the single pitcher knot to sling a broken pitcher, but in this case we have four loops to carry it by instead of two. In rigging a jury-mast the end of it is put through the centre of the knot before it is hauled taut; the stays to support and steady the mast are then made fast to the bights of the knot. It is called, I believe, a true lovers' knot because there is no end to it. Form two half hitches in a piece of cord, as in Fig. 102, then make another hitch, which draw behind the other hitches with the inner edge overlapping the inner edge of the first hitch, as shown in Fig. 102. Pass the forefinger and thumb of the left hand over strand A under B and take hold of C. Put the same fingers of the right hand under D over E and take hold of F. Take G between the teeth and draw the three loops out. It is better to make G the length required at first, as the other loops being immediately connected with the ends can be more readily adjusted as to size than the upper loop. When the loops are made the right size the loose ends are spliced together with a short splice, thus forming the fourth loop. The knot is now completed.

Fig. 103 is a ready way of slinging a can which comes in useful for a variety of purposes, such as turning a meat can into a paint pot, dipping for water, etc. etc. Pass the end of the cord under the bottom of the can and bring the two parts over it, and make with them an overhand knot; open the knot, as shown in Fig. 104, and draw the two parts down until they come round the upper edge of the can; haul taut, and knot them together again over the can, as shown in Fig. 103. This is a very useful dodge.

Fig. 105 shows an ornamental knot that was discovered by a correspondent of the *Queen* newspaper hanging below a Japanese lamp. It has been named the "Shamrock" knot. Of course the ends could be spliced, thus forming a four-looped knot if required. Whether it is ever used in Japan otherwise than for ornamental purposes I cannot say, though it is evident that it is available for the same uses as Fig. 101. It is not, however, as good a knot as the other, being more troublesome to make and not so strong, in consequence of the short nip of the strands in the centre of the knot. Fig. 106 shows the way of making it. An overhand knot is first formed with the ends at A; the end B is then laid across the upper loop, brought round and under the right loop and up through the bight C. The strand D, after passing at the back of the upper loop, is carried over the left loop and down through the bight E. The loops are now adjusted for size and the knot hauled taut. Fig. 107 gives another way of making this knot. Two overhand knots intersecting one another are made on the ends, as shown in the figure; the part A is then drawn up through the bight C, and the part B down through the bight D. These form the side loops, and the top loop being pulled out, the knot is completed. By an extension of these methods knots may be made with any number of loops, but the difficulty increases greatly as the loops increase, so much so, that many loops cannot be made without wire is used instead of cord. As this would lead us beyond the scope of these articles, I shall leave the matter to my readers to follow out by themselves, if they deem it worth their while.

*Dalliance Knot.*—This is a trick knot, and rather a difficult one to learn when you merely see it rapidly made. The object is to make two double knots, quite independent of one another, at once on a double cord. Double the cord so that the ends lie together; bring the bight over the standing parts, as shown in Fig. 108, and cross the strand A over the strand B; they will now appear as in Fig. 109. Press the part C down between the two strands on which it lies, and bring it up through the opening D, draw it out, and two overhand knots will be formed on the double cord. While the part C is being drawn out through D, the whole of the loop E must be brought up through the bight F; this forms the upper knot. The lower knot is made by loop F, C forming bight at top of double cord. The finished knot is practically the same as Fig. 16 (page 137).

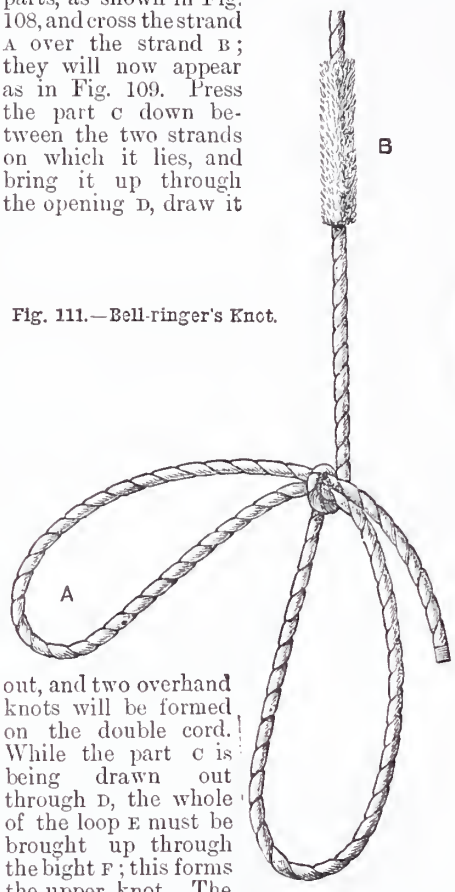


Fig. 111.—Bell-ringer's Knot.

Some of my readers will doubtless remember the performances of the so-called Davenport Brothers some years ago. These consisted of various tricks performed with ropes. In the principal one the performers were shut up in a cabinet, and when the doors were thrown open they were found seated on two chairs tightly bound hand and foot. Any amount of examination of the ropes and knots was allowed. The moment after the doors were closed they rang bells, played on the tambourine, and threw things out of a small window in the top of the cabinet. On the doors being opened again directly they were found firmly tied to their chairs as before. They claimed to effect this by spiritual agency, whereas their only assistant was an ingeniously contrived knot, which is shown in Fig. 110.

To perform the trick, two ropes about 12 ft. long each are required; they should not be too stout—the kind used for cording boxes is as good as any. First the knot A joining the two ropes must be made. This is an openhand knot, shown in Fig. 8 (page 65), the ends being passed twice through the bight to increase the size of the knot. Two running knots are now made close up to this knot as shown at B, B. The knotted end of the ropes is laid on the seat of a chair with the ropes passing down the back of the seat and under the chair. The performer seats himself on the chair, and, drawing the loose ends of the ropes up in front from under it, he passes them round and round his legs and the legs of the chair in as complicated a manner as he can devise. He now draws the knotted end from under him, and, putting his arms over the back of the chair, passes his left hand *down* through one loop and his right hand *up* through the other. He now turns his right hand down until the palms of both hands are together and the fingers pointing downwards. This produces a twist in the ropes which takes up the slack and tightens the cord round the wrists. The large knot being between the hands effectually hides this, and the wrists merely appear to be as tightly bound together as they can be. The performer has merely to reverse this last proceeding—that is, to bring the right hand up again, and so undo the twist—and his hand can be withdrawn as readily as it was put into the loop. The trick requires some practice, and the size of the loops must be regulated by the size of the performer's wrists. The knots should also be so placed on the chair at the commencement that the ropes are tight when the hands are in the loops. Of course, they can be tightened by the performer leaning forward, but it looks better and puzzles the audience more if the actor is so bound that he cannot move in any direction. The Davenport Brothers used also to perform the ordinary rope trick, which consists of the performer being bound by any of the audience; he is then covered up, and when, in a few moments, he is uncovered again, he is found to have freed himself from the cords with which he was tied. This is done by expanding the chest and making the muscles as rigid as possible whilst the tying is going on. When the muscles are relaxed there is not much trouble in slipping off the rope, particularly if it is a new one. The Davenport Brothers were checkmated in this trick by some Liverpool gentlemen securing their hands with a Tom Fool's knot, and also on another occasion by tying their thumbs together behind their backs with whipcord. There is no better way of securing a man than putting his hands into the loops of a Tom Fool's knot and knotting the ends securely behiud his back. It is much safer than using the ordinary handcuffs.

Fig. 111 is the "Bell-ringer's" knot.—I give the name by which it is commonly known, although it is a hitch and not a knot. Church bells have a large wheel on the axle on which they are hung, round which the bell-rope passes; this is done to obtain sufficient leverage to raise the bell mouth upwards when it is rung. This requires a long rope, a good portion of which lies on the belfry floor when the bell is down. When the ringing is over this slack is always hitched up out of the way in the manner I have shown. A loop, A, is made near the end of the rope; this is laid against the standing part, and a hitch taken over it at about the height of a man's head. The hitch should be kept quite close to the standing part, and it will hold the loop quite securely; at

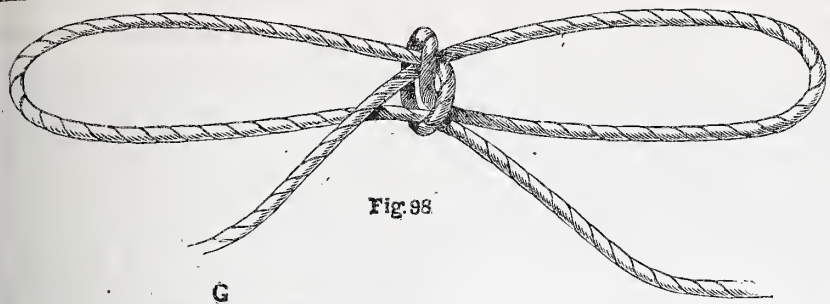


Fig. 98.




Fig. 99.

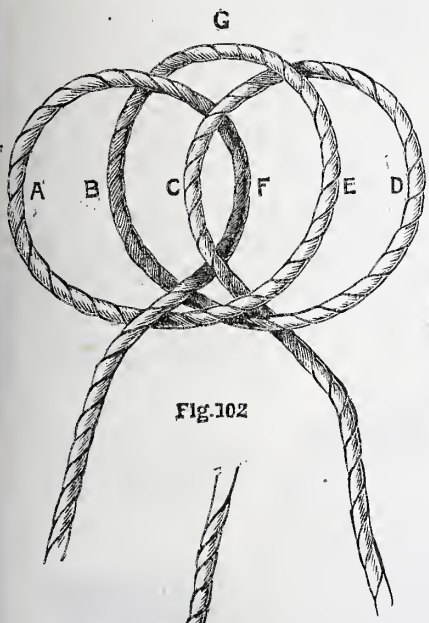



Fig. 102.

Fig. 100.

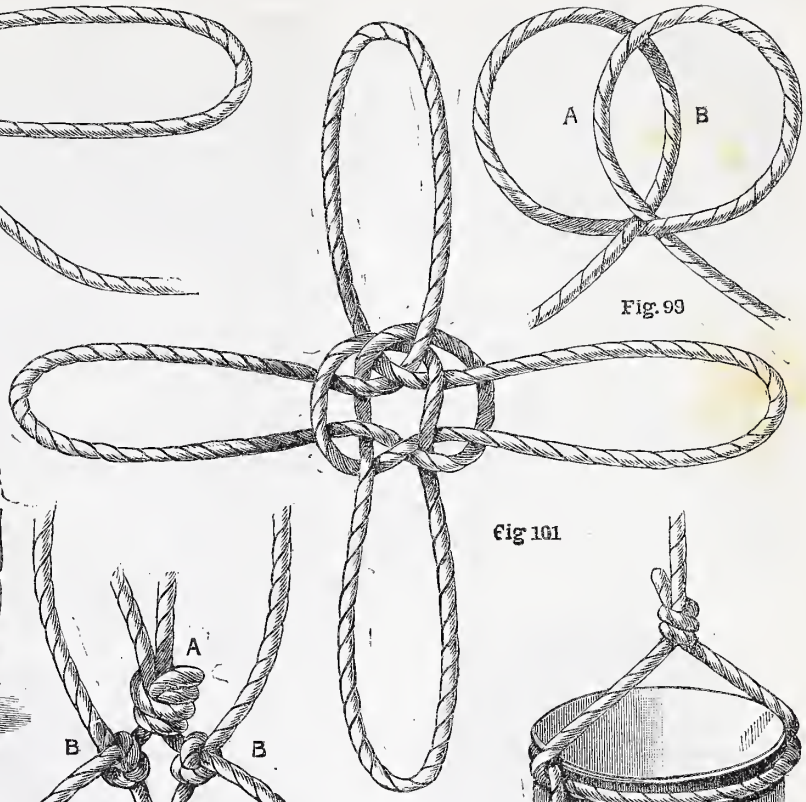


Fig. 101.

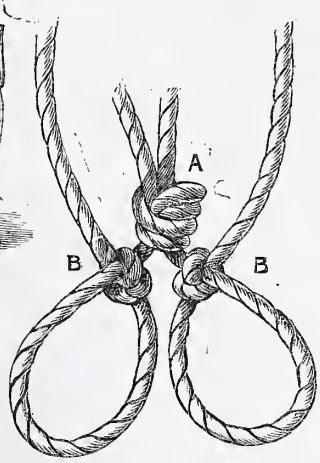



Fig. 110.

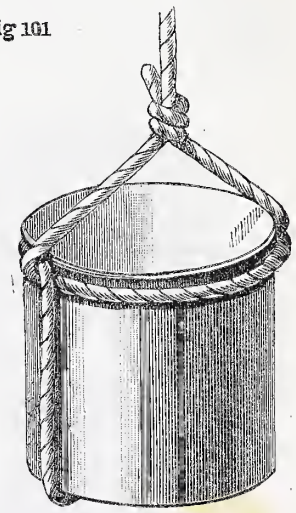


Fig. 103.

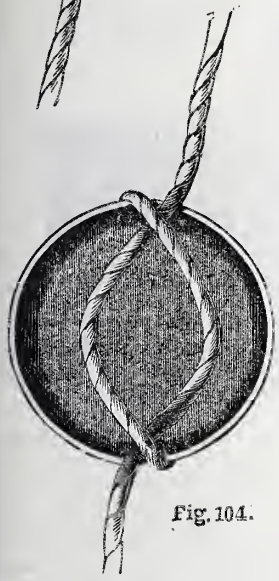


Fig. 104.

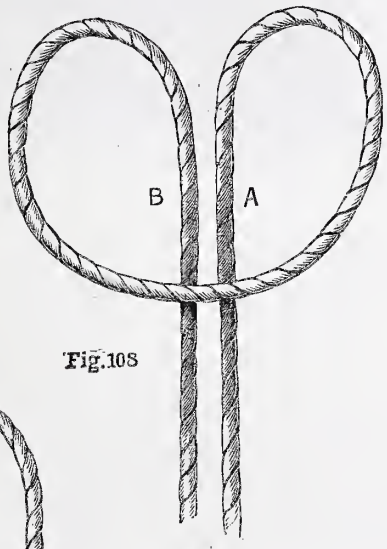



Fig. 108.

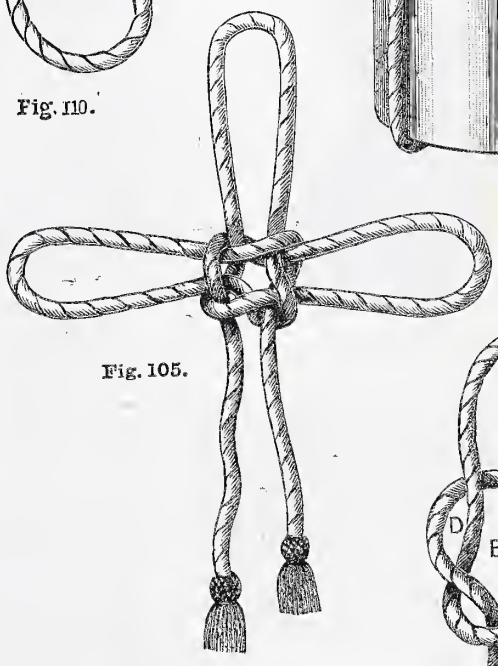


Fig. 105.

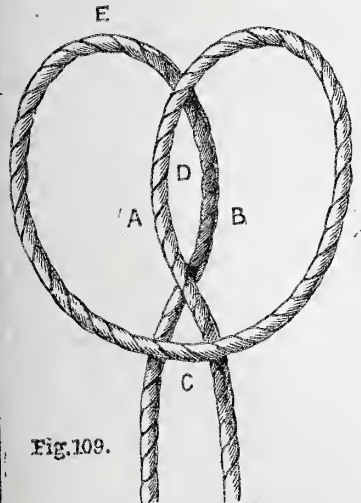



Fig. 109.

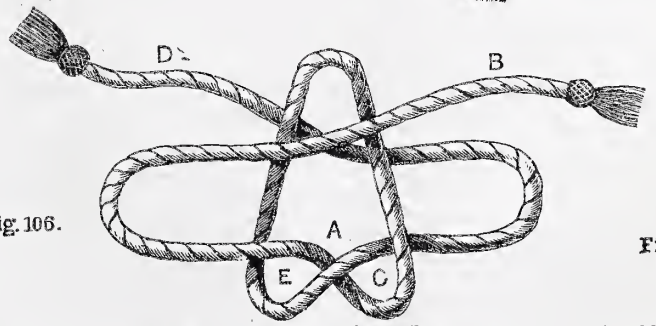



Fig. 106.

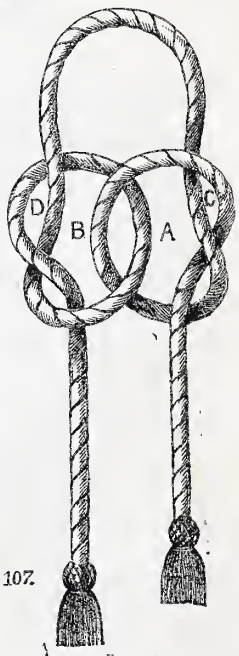



Fig. 107.

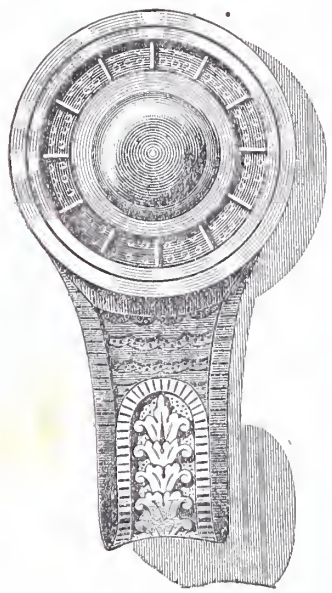
Fig. 98.—Single Pitcher Knot. Fig. 99.—Single Pitcher Knot commenced. Fig. 100.—Pitcher Handled. Fig. 101.—Double Pitcher Knot. Fig. 102.—Double Pitcher Knot commenced. Fig. 103.—Slinging a Can. Fig. 104.—Ditto commenced. Fig. 105.—Shamrock Knot. Figs. 106, 107.—Shamrock Knot commenced. Fig. 108.—Dalliance Knot. Fig. 109.—Dalliance Knot commenced. Fig. 110.—Davenport Brothers' Knot.

the same time a slight pull at the end releases the whole thing at once. When I was an amateur bell-ringer anyone leaving their bell-rope trailing about was subject to a fine. The part B where the rope is grasped when the bell is checked as it comes over is called the sally or tufting. It is made by opening the strands and inserting short pieces of worsted, which are afterwards trimmed until they are all of one length.

## A PICTURE SUSPENDER.

BY JAMES SCOTT.

It is as well, when hanging must take place, that it should be accomplished with adjuncts not too revolting; therefore, when a picture is about to be hung, the use of the most befitting attachments should be undertaken. A disreputable-looking nail protruding from a wall whereon is suspended a tolerably well-executed picture is a common



A Picture Suspender.

sight to behold in many households. Sometimes the nail may have a brass head, which fact in itself is sufficient to speak for the opinion which is generally held of a bare nail. Someone, however, has flown higher still in his estimation of what is necessary to support a picture. The outcome of his cogitations is represented in the illustration. The article is made of brass. The circular face consists of a removable embossed cap, which fits closely outside a rim which is raised around the upper circular portion of the hook. A hole is pierced in the upper circular portion of the hook to receive a nail which is to pass through it into the wall. Over the hook travels the supporting cord. Thus it will be seen that the nail, although unsightly, is yet indispensable. So it always is—the weakest to the wall. But it must not be forgotten that in this case the nail is weakest in aspect only.

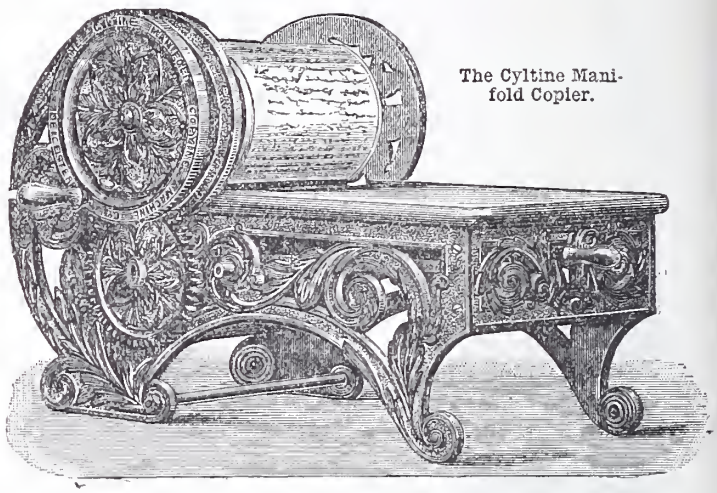
It may be pointed out that this picture suspender is merely an adaptation of the hook that is used for hanging pictures on a brass bar generally fixed a few inches below the cornice to the purpose of hanging a single picture. Its use is entirely a matter of taste and preference.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

85.—THE CYLTINE MANIFOLD COPIER.

In the accompanying illustration will be found an excellent representation of a new lithographic copying machine for office use, well adapted for the reproduction of circulars, plans, notices, blank forms, shorthand, music, bills of fare, menus, quantities, instructions of special character, and, in short, for doing anything and everything in the shape of office manifold copying. It has been brought out by the Cyltine Manifold Copying Machine Company. As I have not seen a specimen machine, I can say nothing definite with respect to its working, but to judge from the specimens of work done by its aid which have been submitted to me, it appears to be a useful and effective appliance for office work, and one which all readers of WORK requiring such a machine would do well to inspect before making a final selection from the copying appliances already in the market.



The Cyltine Manifold Copier.

The Company claim for their copier the following advantages in addition to cheapness of reproduction after first cost: Originals are written with an ordinary pen with a free-flowing special ink, and can be copied without delay. Unlike the ordinary apparatus, made of wood principally, which may be moved from place to place, and, from its mobility, is liable to injury resulting from falls or other accidents, the Cyltine Manifold Copier is a permanent institution like the screw press for letter copying. It is the cleanest working copier, and the result, in jet black or any other colour, is equal to lithography. It will print to register on ruled paper. There is no hand rolling: turning the handle of the machine does the work. Sheets are fed into the machine from the mahogany board on the front, and are automatically printed and delivered straight as they go in, not curled or creased.

In order to use the machine to advantage, it is necessary that the operator should be "neat-handed"—that is to say, neither clumsy nor awkward in handling the machine and the paper on which the impression is received. All machines are sent out as they should be worked, with one exception—that is to say, the gelatine is dry, and it must, of necessity, be damped before the machine is in working order. To do this, the plated clips must be put on the gelatine before soaking, in the centre, and the dogs in the centre of the clips. Then water must be placed in the tray, and the gelatine scooped under the water, which has the effect of excluding all bubbles of air. The gelatine should be soaked in and under the water for twenty minutes, and when taken out should be wiped on both sides with a damp chamois leather. No other detergent will do. As soon as the surplus moisture has been removed, the gelatine has to be applied to the cylinder and secured by passing a screw through the dogs, the screw being tightened with a key supplied for this purpose. When the wrinkles in the gelatine have been smoothed out with the damp leather, and it is tight on the cylinder, the machine is ready for use.

The preparation of the copy is simple enough: as already explained, it must be written with the ink supplied by the Company for this purpose, and should be written on fairly thick paper with a smooth surface. When the ink is dry, the paper should be damped on the back and laid in a book for a minute to prevent it from creasing when it comes into contact with the damp gelatine. When applied to the gelatine, it must be fed up to the gripper stops, and when nipped, the paper must be folded over the gelatine and smoothed down with the right hand, so that the surfaces of both gelatine and paper may be brought into contact in every part. They should be kept in touch from half a minute to two minutes, according to the number of copies required. When the "copy" is taken off, the cylinder must be washed with wetted leather, which must then be squeezed out and again applied, to dry off.

The work of printing may now be started, but as when the gelatine was put on the machine and the copy placed on the gelatine, the ink rollers were disconnected by taking the springs off and drawing the brass roller back into the recesses, which had the effect of causing the compo roller to drop out of touch with the cylindor. Ink must now be applied from the tube that contains it here and there to the pad, and rolled up evenly with the loose brass roller. The pressure of the cylinder is regulated by the screw under the screw-board, but too much pressure should be avoided, and the nut locked after altering the screw. An easy, steady rotation does the best printing, and care should be taken to work the machine regularly and without exerting too much force, as this is likely to injure the stop against which the latch is brought. When the latch is at the stop is the time to feed the paper into the gripper. This done, press the latch to start, and make a clean circle back to the stop, then feed in another sheet, and so proceed until the requisite number of copies have been worked off.

The handle shown in front of the machine is used for throwing the cylinders out of touch when working up the ink on to the negative. In the ordinary way, the loose brass roller carries ink sufficient for from thirty to fifty copies; but when the work is large, more frequent inking will be required. When the machine is working, the brass roller at the back, carrying the ink supply, should stand in the recesses, and should only be lifted out and brought into contact with the compo roller when more ink is required. It must be borne in mind that when the cylinders are in touch a revolution should not be made without putting in paper to receive the impression, or the bottom cylinder will be printed. From the description of the manner of working which has been given, and the illustration of the machine, some idea may be gathered of its utility for the various purposes mentioned in detail above.

THE EDITOR.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—Questions Answered by Editor and Staff.

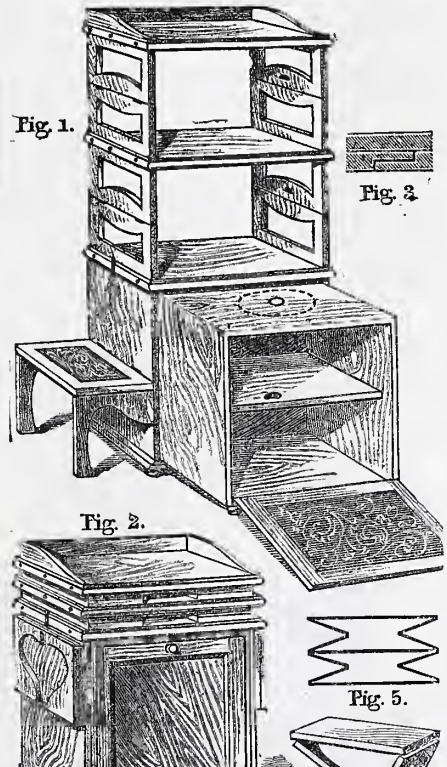
**Paint (for Art Ironwork).**—T. H. (*London, S.E.*), Amateur, and Others.—I believe the black known and sold in the trade as "Berlin black" would be the article you require for coating art metal work. Mander Bros., Wolverhampton, and most other manufacturers, make this: but only a few put it up in small quantities. Recipes for making flat blacks are given in Vol. I., and a little gloss could be given to them by adding a little more of the varnish or binding vehicle.—F. P.

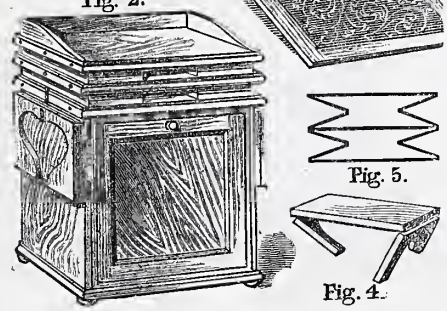
**Water Gold-size.**—S. H. (*Elmore*).—On p. 603, No. 38, Vol. I., you will find a useful *résumé* of the "water-gilding" process, and which, in justice to inquirers generally, I must refer you to. I should think, however, that you would more easily succeed in re-gilding the frame in question by stopping the cracks with either "white-lead putty" or distemper "filling-up," according to the nature and appearance of frame and cracks, then paint with sharp colour and size, and gild in *oil gold-size*. This, if done well, would have a good burnish, and last longer than water gilding, as the latter cannot be so easily washed or cleaned up. The oil-gilding method has been repeatedly explained briefly, but sufficiently for you, in Vol. I., which I hope, like all scnsible readers, you have bound up and ready at hand to refer to. J. Hill, of Pentonville, will supply gold-size, oil or water.—F. P.

**Blackthorn Varnish.**—M. C. (*Crossgar*).—Although unable to bring the experience of a specialist in "blackthorns" to bear upon your inquiry, I conclude it ought to be a good "*hard*-drying" varnish for coating them with. *Patent knotting*, or knotting composition—which is a quick-drying varnish—is used to a considerable extent for cheap umbrella handles and sticks, and it answers the purpose very well, drying hard in about half an hour. It can be made by taking the subjoined ingredients, placing them in a vessel, and dissolving with gentle heat:—1 quart vegetable naphtha, ¼ lb. oxide of lead (red lead), ½ pint japanner's gold-size, and about, but not more than, 1 lb. of orange shellac. Stir and well shake until quite dissolved, then strain through fine muslin. I think this should suit you, and would also do for the "barkless parts" if you spread it carefully with a camel-hair polisher's brush. Sorry I can't advise *re* the "burrs." I fancy if such are subjected to steam, they may become pliable, and can then be bent to shape desired, but have no personal experience to advise on this point. Our worthy Editor will doubtless appreciate the "model sword-thorn"—although I do not think he has so far found it necessary to keep a "fighting editor," and notwithstanding "Shop" contains an occasional "warm corner." Thanks for "good wishes," and, of course, *recommendation*.—F. P. [No, there is no fighting editor kept, as the Editor can do all that is needful in that line in any way for himself.—Ed.]

**Enamel, etc.**—Ibex.—I would have preferred to know the purpose and article the enamel is required for before advising you, but hope this will be useful. Firing glass is a risky method unless it is thoroughly understood and prepared especially with that object in view. For "backing" a piece of plate-glass which has been lettered upon and requires a white ground, I should advise coating it *very barely* once or twice with quick hard-drying paint, made with white lead (preferably, tube flake white), and either bath varnish and turps in parts one to two of the liquids respectively, or Japan gold-size and turps. When fairly solid, this could be finished with a little flake or zinc white (tube pigment) in the best light copal varnish you are able to get, made for interior work if your object is indoors, or using *bath varnish* if it is outdoor work. If you spread a white oil enamel directly on *smooth* glass it would probably, in time, peel off; but by using the "sharp" colour we get a "grip" or "cement" between glass and enamel, and likewise get a better body and solidity than enamel alone will give. Ready-made spirit enamels will not do; they will crack and peel off very quickly. Write Waterlow & Sons, Limited, Finsbury Works, E.C., respecting the "perforator."—F. P.

**Commode.**—C. B. (*Notting Hill*).—When your letter was handed to me, I had a paper in course of preparation dealing with a combined commode and clothes-holder, which I had designed as something fresh. Such an article is rather a delicate subject to appear in the body of Work, where it would, doubtless, possess a certain amount of repugnance; therefore, I will take advantage of your query and endeavour to explain it satisfactorily in "Shop." Space is limited, so I must speak briefly. In Fig. 1 the dotted line suggests a place for a necessary article which shall be nameless. At each side is a bed-step—carpeted. Hooks can be fitted to each of the top boards to hold apparel at night, in preference to its being thrown on to chairs, etc. When closing the article (seen by Fig. 2) the front flap is raised, the box then pushed into the main carcase, the supports of the bedstep folded inwards underneath the latter (Fig. 4), and the whole raised up against the side of the carcase, where they will be secured by means described later on; the two top sideboards are then folded inwards, as shown by skeleton diagram, Fig. 5. From this explanation it should be understood how and where the requisite hinges



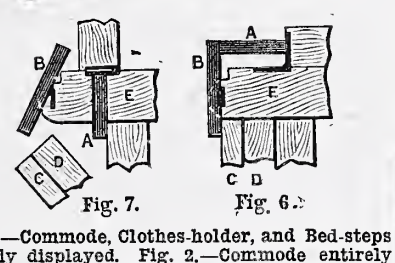




**Fig. 1.—Commode, Clothes-holder, and Bed-steps fully displayed. Fig. 2.—Commode entirely closed. Fig. 3.—Bed-step Supports overlapping each other when folded. Fig. 4.—Diagram showing how Bed-step Supports fold. Fig. 5.—Skeleton Diagram, showing how Top Parts fold. Figs. 6 and 7.—Movement to retain Bed-step in Vertical Position.**

must be fixed. When adjusting the top part the reverse movement will, of course, be necessary. Flush bolts in either one or both pairs of folding boards will keep them firm. When these boards are raised, if my description is carried out, each bed-step will fall into place independently of further handling—the supports tumbling down as in Fig. 4, provided the hinges work easily. If the height of each support exceeds a half-length of the bed-step, both supports must be made to close over each other as in Fig. 3. In Figs. 6 and 7 is shown the movement which will hold the bed-step in position when folded up. The outside long edge of the latter should just touch the underpart of the top board, and a small part of the top board's edge, exactly in the middle, will be cut flat to allow a short wooden bar (B) to be hinged to it. This bar must be wide enough to cover a portion of each support when folded (if their edges meet). Also in exactly the middle of the edge of the bottom folding sideboard will be inserted a short bar (A), sufficiently long enough to just touch the bar, B. In Figs. 6 and 7 C is a support, D a bed-step, and E the carease top board. When the top shelves are adjusted the edge of the bottom folding board naturally touches the top board (Fig. 7), and thus the bar, B, is released, and the bed-step and supports fall down by reason of their own weight. Now it is clear that the bar, A, will not pass through a solid board to assume the position in Fig. 7, therefore it is necessary to cut a small piece out of the top board to allow it to do so, remembering the while that care must be taken to leave enough to hold the hinge for the bar, B. It will be best to draw full-size sketches of this part at starting, for you will find it a "ticklish" job. Concerning the main carcase there will be a bottom board, top board, sides, and backboard. A strip of the bottom board will be united to the front of the bottom board of box. Four feet only will be necessary: two at the back and two in front, the latter cut in halves, so that one pair can remain on the main carcase while the other pair travel with the box. Read previous articles for joinery. Of course, you do not want to be told that you can dispense with the clothes-holder, and save a lot of labour thereby; and also have the top board as a lid, and no movable inner box; and you can also have the bed-steps fixed instead of to fold. For sizes, 16 in. square, 24 in. high (main carcase), and thicknesses ¾ in., ½ in., and some much thinner, will give you a foundation to work upon. You can have castors, but I do not advise their use.—J. S.

**Oil Varnish.**—C. A. (*Hackney, E.*).—The subject of making oil varnish, from some cause quite foreign and strange to those workers who use quantities of it, appears to possess some fascination for the general community, and for readers of Work particularly. I do not think any person, even were he professionally engaged in its manufacture, could give you a receipt for making "1 pint of the very best oil varnish." I would advise you to turn up Vol. I., and read on p. 659 all that bears upon the subject. Then turn to "Shop," p. 541 (same vol.), and read answer to a similar query. The receipt from Spon's "Workshop" vols. is about the most *unworkshop*—if I may so term it—direction that could be published on the subject, and fully bears out the observations of the great varnish firm, quoted on p. 659. Best oil varnishes are, almost without exception, made from *copal* gum—whether the house-painter's "*carriage*," so-called, at 16s., or the coach-painter's genuine carriage varnish, at 30s. to 40s. per gallon. You would therefore require some *copal*. The manufacturers buy gums in large quantities, and sort the light and dark according to their requirements. The light is the scarcest, and hence the dearest. "The *best* varnish" is only a comparative term, and all good varnishes are made for various conditions: some for outdoor work—elasticity; others for whiteness and "hand-polishing;" others, again, for quick and hard-drying qualities; and as all these conditions are effected and governed by the proportions and treatment of the ingredients, you have some notion of the difficultics in the way of making a pint of the best—for what purpose you don't say. Copal is a gum that is very difficult to properly dissolve in oil and turpentine, and to effect the dissolution it is very necessary to have special facilities of heating and special vessels for the purpose; so that even if you were given proportions for any varnish, the chances are still ten to one against your succeeding. "Bloom" is a fault that the best of varnish manufacturers have never thoroughly succeeded in mastering, and therefore how could a novice, with an odd pint, expect to succeed in this respect? whilst with small quantities the purchaser is always at a disadvantage. If any reader can oblige the working "British public" with such a receipt for a pint of best oil varnish that will stand proper tests, he will be their benefactor, without doubt; but as one who has the buying and using of hundreds of gallons a year, I should want to test it myself before accepting it. I will try to contribute a *useful* receipt later on.—Decorator.

**Furniture Firms.**—W. E. R. (*Penryn*). — So much depends on the class and kind of furniture that you want, that it is impossible to answer your question satisfactorily. Surely, if you are in the furniture trade you do not require to ask the names of wholesale firms. Of course, any wholesale firm will supply furniture "to the trade at trade prices." You had better refer to the advertisement pages of one or other of the periodicals devoted to the trade, and you might as well read the answer to Spot ("Furniture Frames") on p. 260 of Work, No. 68, Vol. II.—D. D.

**Chest of Drawers.**—F. W. (*London, W.*).—Your question is such a vague one that it is almost impossible to answer it satisfactorily. As you have only a limited quantity of wood, why not make the chest of drawers of dimensions to suit yourself, and not run beyond the wood you have? Assuming that a chest 3 ft. 6 in. wide is what you consider a middling size, make it 3 ft. 6 in. high, and 1 ft. 8 in. from back to front, or thereabouts, and you will not be far wrong.—D. D.

**Oak Chest Fittings.**—Joiner.—For suitable brass work for your bureau, apply to Grew and Bridge, Summer Row, Birmingham. As they are wholesale people, it is only as a matter of favour that they will supply you, as they probably will if you mention this Magazine. Of course, you can hardly expect them to charge you the lowest wholesale price for such a small quantity as you are likely to require. You might also try Melhuish, of Fetter Lane, E.C. It will be cheaper and better for

you to buy the brass work than to attempt to make it, as you are not accustomed to the work. Without knowing the design of your oak table, it is quite impossible to supply you with design of chair to match. A moment's consideration on your part would have shown you this. Send a drawing of table, and we will see what can be done to help you.—D. D.

**Xylonite or Ivorine.**—H. C. (*Birmingham*).—The maker's name and address of this substance have already been given several times in "Shop" as follows:—British Xylonite Company, High Street, Homerton, London, E.—D. D.

**Finishing Bookcase.**—POLYSMATTER.—There is no "best way" to finish within the limits you name. It is entirely a matter of personal taste whether you finish in natural colour, or ebonised, or walnut, or mahogany. I have never seen fluted glass used for the purpose you name. I do not think it would at all tend to improve the appearance of your bookcase. I decidedly prefer slides to support the writing-flap in a piece of furniture such as sketch shows yours to be. Flaps would be awkward. Their only recommendation is that you might find them rather more easy to make and fit. If you are a fairly skilful worker, though, this consideration ought to have no weight with you. You must please yourself about the use of gilt mouldings if you ebonise the job. You and many others may think them very handsome and nice, while I and many others are equally certain to consider them quite the reverse.—D. D.

**Polishing Counter.**—W. J. G. (*Caversham*).—If you used the beeswax and turpentine in a proper way, you ought to have got a fair amount of polish. I do not, however, consider polishing was at all suitable for such a counter as you name, because the polish is so easily destroyed by moisture. It is not necessary to fill in the grain when the work is to be wax polished, as the wax also acts as filler. If you had told us the kind of wood, and other particulars, we might have been able to tell the cause of failure. Inquiries cannot be answered privately through the post. Glad you find WORK of so much benefit to you in your trade.—D. D.

**Tool Chest.**—A NEW READER.—Tool chests are so varied in size and fittings, that it is quite impossible to devise one for you if you cannot do so yourself. You know your tools, I do not; so here, at once, you have an advantage over me. As you are a professional mechanic, surely you have ample opportunities of seeing other tool chests. Were you an amateur, I would give you hints, but to offer them to you would be superfluous, for you, no doubt, have your own ideas. As for the tools themselves, I hardly know what to say, but my opinion is that you had better ask your shopmates which is the best place in your neighbourhood to buy tools at. Of course, if all your mates are "puir feckless bodies" too, you can't depend on them; but if, as I take it, there is a canny Scot or two among them, you may as well put yourself under their guidance. Naturally, small ironmongers, as well as large, want a profit, and good tools are not to be bought at low prices. There is certainly a lot of rubbish in the market nowadays, and the way to increase its quantity is by grinding down the retailers' prices. Pay a good price to a respectable tradesman—I suppose there are some in Thirsk—and you will get good tools.—D. D.

**Ivory Carving Tools.**—T. J. B. (*Shrewsbury*).—You ought to be able to get these through any good tool dealer in your own neighbourhood. If not, Melhuish, in Fetter Lane, E.C., is able to supply them.—D. D.

**Covers—Insects in Wood.**—H. G. B. (*London, N.E.*).—Yes, covers for binding Vol. I. of WORK have been prepared, and are obtainable for 1s. 3d. each. Get them through your bookseller or newsagent. Your second question is more difficult to answer, for you don't say what sort of insects are in your desk. Are they in the wood, or do they simply make your desk and papers a dwelling-place? If they are in the wood, it is not easy to get rid of them—almost impossible, in fact. The only thing you can do is to wash benzoline into the holes. Other kinds of insects can generally be got rid of by cleanliness and care, as you are no doubt aware. Growl away, if it does you any good. You are not the only one who is given that way. I daresay you will have noticed this, as you are a subscriber from the first.—D. D.

**Varnish.**—E. L. H. (*Liverpool*).—I am afraid the varnish you used must have been of an inferior quality or wrongly used. If you go to Minton's, or any of the other large paint and varnish manufacturers in Liverpool, you will find there is no difficulty whatever in getting a good clear varnish which will dry hard.—D. D.

**Hand Camera.**—X. Y. Z.—We will bear your suggestion in mind. The preparation of working drawings to be of value to our readers is a matter of time and skill, which the gentleman alluded to might not find it convenient to supply. This class of instrument, to be really useful, is little more or less than an ordinary small camera in a cover, to attract little attention as possible during use, the plates being contained in ordinary dark slides, the addition of a finder and means of effecting the exposure being arranged on the outside of the case; the lens also being set to bring everything into focus beyond a certain distance. The variation of form and detail, but embodying the above conditions, is simply illimitable. Of course, high finish of a camera for such a purpose is much less needed than for one for ordinary use. If credence was to be placed on the advertisements, we see every maker has the best, provided with a sufficient number of double dark slides. Drawings and description for making have already been given in the first volume of WORK. A lens and instantaneous shuttle and very little knowledge in carpentry would suffice to make a workable instrument. The more unlike any other the better for detective purposes.—D.

**Spanner.**—E. W. S. (*Eastbourne*).—The spanner is correctly described and fairly drawn in your sketch. It is, I find, stamped "Bauer's Patent," with the No., which is so worn on the spanner I saw that it is unsafe to quote it. I am almost certain I have seen it for sale at a machinist's shop in Church Street, Shoreditch; but I have no doubt that it can be procured by order of any tool-dealer, preferably those serving gas and hot-water fitters. My inquiries have satisfied me that it is a good and useful article.—B. A. B.

**Cycles.**—PURCHASER OF CYCLE.—The machine from which the design Fig. 3 in June 21st issue was made was of Humber & Co.'s make.—P. B. H.

**Fret-working.**—ELGEE.—I do not think that you are infringing any copyright in making the things you describe; but even if the idea has been originated by you, I am afraid you would not find it pay you to register the design. There is nothing sufficiently meritorious about it—in fact, the design is in many respects decidedly weak and meaningless. Try and improve, and when you have produced anything really good, offer the design to one or other of the large fret-pattern publishing firms, such as the one you name.—D. D.

**Dry Walls.**—A. B. (*Renton*) asks if there is a composition to prevent damp from rising. There is not, so far as I know. I think that the house must have been erected without a damp course—that is, a course of pitch and tar well boiled and laid upon the first course of bricks, just above the

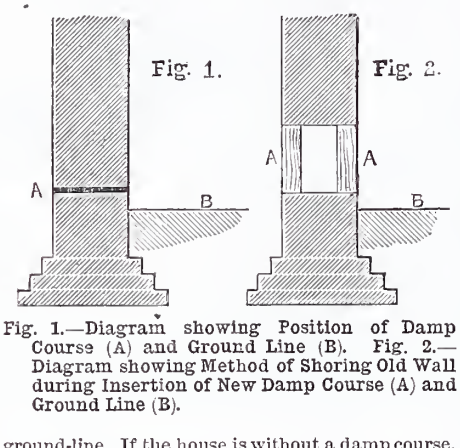



**Fig. 1.—Diagram showing Position of Damp Course (A) and Ground Line (B). Fig. 2.—Diagram showing Method of Shoring Old Wall during Insertion of New Damp Course (A) and Ground Line (B).**

ground-line. If the house is without a damp course, the best method I can recommend you is to knock the plaster off the wall inside, say for a height from 4 ft. to 5 ft., and face the same with the best Portland cement. If the house you mention has a gable end, the best way to make a good job of it will be to cement it from the apex to the ground with good cement; if this be too expensive, cover the gable end entirely with pitch and tar; and lastly, if this does not remedy, the only way will be to remove two or three courses of bricks and insert a damp course. Now the best material for you to use is roofing felt, laid on boiled tar, as per sketch.—W. B.—[After coating the wall with Portland cement, I should face with Keene's cement, especially if the wall is to be papered. I have treated a battened wall in my own house in this manner with the most satisfactory results.—ED.]

**Gum or Resin.**—G. R. R. (*West Calder*).—As you do not say for what purpose the varnish is required I am unable to help you so fully as I should like. It may, however, be said that the manufacture of varnish is not suitable work for amateurs. You will do better by putting yourself in communication with a varnish manufacturer, and telling him just what you want. If you get a colourless varnish, you can easily make it any colour you may want by using a suitable pigment or dye. I should say you will get the colour you wish for with picric acid.—D. D.

**Model Boat Building.**—POGLL.—A paper on the kind of craft you refer to has been ordered from a competent hand.

**Putty.**—Q. R. S. (*Grays*).—Mix a quantity of whiting into a stiff paste with linseed oil, rubbing and heating it well before using. For particular purposes, as for fanlights, iron-framed greenhouses, and other places where the lap or hold is very narrow, a little white lead may be added to advantage. Coloured putty has a mixture of red ochre, lamp-black, or other colour, with the whiting. Soft putty: 10 lbs. of whiting and 1 lb. of white lead, mixed with the necessary quantity of boiled linseed oil, adding to it ½ gill of the best salad oil; the last prevents the white lead from hardening.—Y.

**Writing-desk.**—SECOND HAND.—The initials o the plate of your writing-desk cannot be well erase without removing the plate, unless you are pr pared either to sacrifice appearance or to rub dow the surrounding woodwork to the same level. think you will probably be able to remove th plate without injuring the surrounding wood you heat it. The heat will probably melt, or, a any rate, soften the cement with which the plate i fastened down. If you injure the wood, you wi have no difficulty in concealing defects by the us of stopping. Probably, a new plate would cost s little that it might not be worth while preservin the old one.—D. D.

**Waterproofing Canvas.**—E. H. (*Hampstead*).—To render tents waterproof, they may be coate with boiled linseed oil and terebin, 1 gill of th latter to 2 quarts of oil, two coats being sufficien —Y.

**Saw Sharpening.**—Q. R. S. (*Grays*).—Use triangular file, and sharpen *every other* tooth on on side first, then proceed in the same way on the othe side; after that, use a saw *set*, with which ever other tooth on one side first, and then the othe side, are slightly bent, so as to make the teeth *clea* their way through the wood being cut. In som instances, if the teeth are uneven on the points th file is run along them before commencing to sharpe the teeth, so that they may all be of equal length —L. Y.

**Ship and Naval Craft.**—There are no books o periodicals published that would help you. Yo cannot do better than write for all information a to the classes at the School of Naval Architecture South Kensington Museum, London, S.W.—Y.

**Fire-grate.**—ONE IN A FIX.—A good dea must depend on circumstances, which I am, o course, unacquainted with, as you do not tell m anything about them. I think, however, as you object seems to be to increase draught, that th best way will be to bring in the fresh air below th fire.—D. D.

**Folding Screen.**—INVALID.—To make a screer draught-proof at the folds, use a rule-joint hinge As these are somewhat costly, you may prefer t effect your purpose by simply tacking a piece o cloth, or something similar, over the joint, leaving sufficient fulness to allow the screen to be folded.—D. D.

**Luminous Paint.**—R. E. D. (*Gateshead*).—In answering, to the best of my knowledge, your question—which is of more than individual interest —I may mention that a short notice of this article is given in No. 42 of WORK (Vol. I., page 662). I draw your attention to this, and the name of agent therein given, as I think you will probably find your best and cheapest course to be the direct purchase of the paint. The following particulars of Balmain's luminous paint may not have come to your notice. The basis of Balmain's paint is calcium sulphide, prepared by subjecting calcium sulphate (plaster of Paris), mixed with one-third its weight of charcoal, to a strong heat. Both substances should be previously finely powdered and well mixed together, and a conveniently sized fire-clay crucible is necessary for the heating. To make it into paint, take fifty parts of the prepared calcium sulphide (CaS) and four parts of bichromate of potash, and grind thoroughly together, and then convert into liquid paint form by adding good "outside copal" oil varnish. Another receipt I append: Take thick oyster-shells; clean, and burn them until red-hot. Break them up when cold, and sort out the black-looking and darkest portions. Pound up the remaining shells to a fine powder form, and then place alternate layers of this and flour of sulphur to within an inch or so of the top of crucible, the layers being some half-inch in thickness. Fill to the top of crucible with well-kneaded clay, and let it become hard by gentle heat. Then place the crucible on a fire, and endeavour to get the whole to a dull blood-red; and then try to keep it so, by careful attention, for not less than one hour, and longer, if the clay well seals it up. Set aside to cool gradually, and then reduce its contents to a fine powder. This should result in a bright blue luminous paint. Mix with gelatine and water solution, or gum Senegal solution, if required for indoors, and for outdoors the above *best* varnish; for boiled oil and turpentine will answer in good drying weather, used in about equal parts. If this is required for your gate or railings, have the iron-work well scraped and free from rust, and well coated with a common *oxide* paint before using the luminous compound. White-lead paint would not answer so well; the luminosity stands best on oxide. I hope this may be of some use to you, and point out in what respect your experiments have been wanting.—F. P.

**Whitewashing, etc.**—INQUIRER.—I am surprised that, having taken WORK monthly from the first, you have learned so little of the above subject. No. 50 (Vol. I.) contains a long article on distemper and its practical applications, whitewashing being the lowest or commonest phase of the subject. I will, however, try to assist you, in face of your long and carefully written inquiry. Now, the good, solid-looking jobs cannot be done with common lime; but you must get its *carbonate*, viz., common whiting, for the basis of your mixture. Although lime, freshly slaked, may answer for a time, it will peel off, as you know, after accumulated coats, no matter whether it be called lime, or sold, with a fanciful name, as a "patent distemper." To get a good job of distemper, *all* old lime must be thoroughly scraped off; and when you do this on a few jobs, you will

ish you had never put lime on. If you only take f the loose places—no matter how well you make spread the preper distemper—these patches will nrely be noticeable, being either a different colour, else showing the shade from a different plane or vel of surface. I give you instructions for both new id old jobs. *For new plaster*, if the price will and it, after stopping all cracks, etc., coat with a irly strong mixture of warm size, with a very little hiting in it, just to tint it; then soak the whiting water, putting the former into the latter; pour ff all surface water; well stir with the hand and m, and add the *warm* size: never use it hot unless ecially instructed. If you cannot get and keep atent jellied size, try Cannon's concentrated powder. he *best* glue will answer, however, if prepared us: put to soak in cold water overnight; then, ext day, break up with the hand, and treat it just fficiently to mix the glue and water thoroughly. dding "hotglue" will spoil any distemper; common lue or common "size powders," so-called, will also ake any mixture turn out "stainy." For tinted hitewash ("distemper"), add the stainer or pigent, whether lime blue, Venetian red, or ochre nd umber, to the slaked whiting, and well mix ith the same *before* adding the size. Mix the pigent with a little water first; don't put it into the hiting in a dry form. When made, let it cool efore using; it will then be set, and will want a ood brush, not a thin "rag of a thing," to spread it. *or old work*, if you can't scrape all the dirt and me off, take the loose off, and coat with the size oating, as above. You may then spread the jellied hitewash with comfort, and with less fear of stains. Before re-coating proper distemper work, the old istemper ought always to be washed off; this is nuch easier to do than scraping lime off. Ceilings nay be done once or twice without washing off; ut the results are only "cheap," and often "nasty." Soft soap is quite unnecessary. With pains and atience, combined with practice, you are bound to ucceed.—DECORATOR.

**Lantern Slide Painting.**—E. D. B. (*London, N.*).—Ordinary oil colours, such as are sold in tubes or the use of artists, do for lantern slide painting. Only those that are transparent, such as Antwerp blue, viridian, rose madder, raw sienna, carmine, and yellow lake, must be used, as all you require to do is to stain the surface of the glass. An excess of pigment, or the use of opaque colours, would prevent the light shining through the colours, and giving a reflection on the screen. Mix the colours with amber varnish, and apply with camel-hair brushes, putting the colours on evenly and thinly. The use of the finger to blend and soften the tints s to be recommended; and skilful lantern slide painters do a great deal by dabbing the tints with the broad part of their finger. A soft kid glove also is used on the finger. You had better practise on a piece of glass the laying of skies and flat tints, until you can do it fairly well. Clouds are taken out of a tint of blue with the finger. Photographs on glass, or positives, are largely used now, and colour admirably.—F. M.

**Marble Black.**—S. P. (*Middlesboro'*).—Although the size and shape of the articles would have been useful for me to know, I think you can easily obtain what you require. As, I conclude, you are not afraid of soiling your fingers, I would suggest mixing lamp-black with cold water, and using the black fluid instead of plain water for the plaster castings. Of course, this would only result in a *grey;* but it is a better ground than white to finish upon. You may then give the castings, being quite dry, a couple of coats of French polish or patent knotting. This will stop the suction of the plaster. Three coats may be necessary to do this, and it must be spread quickly and carefully, in order not to roughen the surface or damage the sharpness of the casting. When the suction is thus stopped, you will probably find the black enamel a ready and effective finish. The ordinary "tin enamels" of the quick-drying sort are rather prone to crack, however, so you may desire some other more reliable finish. French polishing with the rubber would be best, if the article was of a nature to be so rubbed; but a small, intricate casting would have to be done with a camel-hair brush. If it were desired, black could be added to the polish, or you could coat the casting with *ebony* water-stain before knotting and polishing. The most permanent finish on *broad* work would be coating with "ivory black" flat paint, next three or four coats of "polishing copal" varnish, and then polished to the real marble gloss with a piece of felt, sweet oil and rotten-stone, or putty-powder. I hope this will be useful.—T. P.

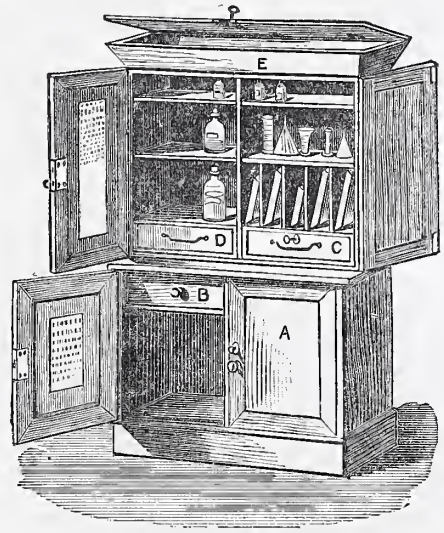
**Fret Machine.**—F. C. (*Belfast*).—I can see very plainly where you are wrong, and I will do my best to help you; but at the same time I do not like the tone of your letter. In the first place, you say you have made a machine according to my instructions exactly. I say you have not, and that is where you are wrong. For a spring I use indiarubber, that being my instructions given. I find it more suitable, because you can increase or decrease the strain upon the saw at pleasure by putting more on or taking some off. If you follow out the instructions given, the machine will work. The one I use is precisely the same as given, and answers my purpose. You must increase your spring power. Fret saws will stand a very great strain. You say that myself and friends extolled the above machine to the skies. Yes, and will still continue to do so, for we know its value.—J. D. W.

**Zither.**—H. L. (*Carlisle*).—You ought to be able to obtain what you require at almost any good musical instrument shop; but if you still wish for my assistance in the matter, I should be very happy to give it and help you to get what you want. The cost of an instrument suitable for your requirements would be about two guineas, and tutors may be had from 2s. 6d. upwards. The Editor has my address, which I have no doubt he will let you have if you send a stamped addressed envelope.—R. F.

**Dulcimer Wood.**—C. B. A. (*Streatham*).—A complete set of wood for an F dulcimer, as described in "The Dulcimer: How to Build One," Vol. I. of WORK, would be about 7s., or, including bridges, sound-hole rings, feet, and stand, about 10s. 6d. The thicknesses given are for rough stuff, except where otherwise stated. It would be a decided improvement if you used all yellow pine for back braces, etc., on account of its greater sonorosity, the only drawback being its greater cost. The joint in the back runs from side to side, but if you used pine you could get it wide enough to dispense with this joint, which would be a further advantage. Send to Chilvers & Co., St. Stephen's, Norwich, for their price list of fittings, etc.—R. F.

**Dulcimer.**—CAWD-HUD.—If you refer to WORK, Nos. 31, 38, and 41, you will find full information concerning dulcimers.

**Photographic Cabinet.**—E. W. N. (*Cheltenham*).—The following is a design for a useful cabinet or chest, the dimensions must of course be suited for the size of the bottles, dishes, etc., it is to contain: the advantage of the cabinet over the box form is that it is not necessary to remove one article to get at another. The top is made with a




**Photographer's Cabinet—A, Camera Cupboard; B, Cloths and Brush; C, Poisons; D, Scales; E, Paper.**

lid, and forms a useful receptacle for sensitised and other papers: the extreme height need not be more than 5½ ft. In a drawer labelled "poisons" may be kept the more dangerous or valuable chemicals, such as cyanide or gold chloride. One side of the lower part is devoted to cameras and dark slides; on each door is affixed a list of the contents of each special cupboard, which can be added to or altered according to circumstances. The whole forms a compact receptacle for everything required by an ordinary amateur, who takes a pride in his belongings; and as to the size, it may be made to suit the size of the apparatus used, and has the advantage of showing the contents at a glance. In fitting a cupboard of this kind, bottles of different capacities and uniform in shape should be obtained, with a few spare bottles.—D.

**Films from Negatives.**—TED.—The best method to remove the films from their present support is to place the broken negative in a dish, face upwards, containing weak hydrofluoric acid. In a short time the film will easily separate from the glass, and must be carefully removed to another dish, considerably larger than the film, of clean water: another piece of thoroughly clean glass being introduced beneath the film, which can then be adjusted on to the glass, and the two gradually lifted out of the water edgeways together. This must be done slowly and carefully: the water will then run out from between the surfaces, and all that remains to do is to place them on a rack to dry. See that the film is placed on the glass right side outwards, or the negative will print reversed, which would be unsuitable for anything besides carbon printing or transparency making. Blisters occur on papers with a highly glazed surface when they are newly albuminised. Too much difference in temperatures of the fixing and washing baths, and too strong solutions of hyposulphite of soda, will cause them. Prints on paper disposed to this fault should be taken out of the printing frames and immersed for a few minutes in good methylated spirit *before* being moistened with water, or any other solution it may be intended to use. After this spirit-bath the other processes may go on as usual.—D.

**Varnish.**—E. W. N. (*Cheltenham*).—A very good varnish may be made by diluting the best white hard spirit varnish obtainable at the oil and colour shops with good methylated spirit to a proper thinness, or 6 oz. of orange shellac and ½ oz. of sandarach (roughly powdered) mixed with as much silver sand placed in a half gallon bottle and filled up to the shoulder with best methylated spirit. Let this stand in a warm room for a week, shaking it well up daily; then let it stand to settle, and pour off the clear portion and filter through blotting-paper. This makes a very hard serviceable varnish, not tacky or liable to scratch.—D.

**Staining Fishing-rods.**—ANGLER.—A useful brown stain for these is given in the issue of Sept. 26th, No. 132, p. 439, under heading of "Means, Modes, and Methods." Another plan is to mix vandyke brown into a paste with liquid ammonia, and thin down with water till the required shade is obtained. As you appear to have no experience in French polishing, the next best thing to do is to apply the French polish with a camel-hair brush—a polish made by dissolving 3 oz. of best orange shellac in half a pint of methylated spirit will suit. If, however, a brighter finish is required, make and use a varnish as advised in "Shop"—"Varnish for Walking Sticks" (No. 131, p. 429, Sept. 19th issue).—LIFEBOAT.

**Boat Propeller.**—T. B. W. (*Bradford*).—Respecting the model of your pleasure-boat, there seems very little merit in the idea you have suggested for propelling the same. In the first place, the method you have adopted for fastening your apparatus to the boat's keel would obviously impede the boat's progress through the water, which would be a serious objection in the case of either a lifeboat or pleasure-boat, speed being more or less essential with both. Then again, one of the pleasures of boating consists in two or more "oars" being jointly engaged. Your arrangement admits of one person only, besides which, the length of your propellers is such that only one set could be fitted to any boat, as they would catch each other. Generally your idea is most impracticable, and you would be only wasting time to attempt to carry it out, to say nothing on the score of expense.—C.

**Printing Patterns for Crewel Work.**—J. H. (*Stockport*).—The patterns on paper for transferring to the material by use of a hot iron are printed in white wax with which a suitable pigment has been ground up. I am not aware that in printing patterns direct on the material, any particular process is resorted to.—S. W.

**Circular Frames.**—T. H. T. (*Blyth*).—Apply to any wholsale dealer in picture frames or mouldings. Perhaps you might meet with a turner in your own neighbourhood who could make them.—D. D.

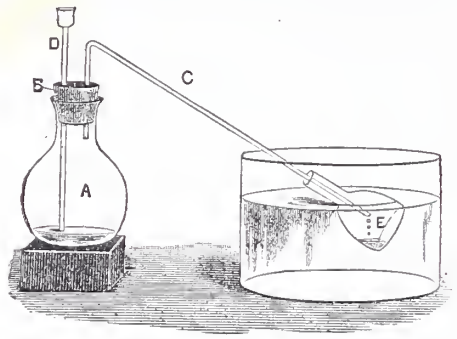
**Carpentering.**—J. T. G. (*Norwich*).—As you have only just begun taking WORK, your best plan will be to get all the previously published parts and read the numerous articles on cabinet making, joinery, and carpentering which have appeared. There is no one article nor series of articles which gives all the rudiments of woodwork, as a moment's consideration must show you; this would be impossible. A very large proportion of WORK is taken up with articles on working in wood, and there is scarcely a number from which you could not learn much. By the way, it is hardly so much information on what is generally regarded as carpentering or joinery as on cabinet making that you want.—D. D.

**Turning Designs.**—T. D. (*Liverpool*).—I do not know of any good turning designs being published. There were some mentioned in our "Guide to Good Things" (WORK, Vol. II., p. 90) which I should think would be much better than the wretched design you enclosed. The address for those I recommend is: F. G. Walker, 21, St. Helen's Street, Ipswich, and the price is 1s. 7d. Any effort to design your own patterns is of benefit, and to buy a turned article, and copy or modify it, is better than buying a drawing.—B. A. B.

**Specifications.**—DOUBTFUL.—A provisional specification is required by the law to contain the title of the invention, and to point out the nature of the invention, fairly, no doubt, but in its rough state, until the inventor can perfect its details, which has to be done in the complete specification, and everything made perfectly clear, so that at the expiration of the exclusive right the public may be able to use or practise it with the same facility the inventor has done. Under the new Act of 1883, the provisional specification is only published with the complete, and if the complete is never filed, the provisional is never published. From our correspondent's remark that he has recently *filed* a provisional, we should judge that he is doing the work himself, in which he has evidently had no experience, or he would know that a provisional specification is *lodged*, and that a complete one is *filed*. If our correspondent has a plan, machine, or system, that is *novel* and *useful*, he will scarcely, in our opinion, succeed in creating a legal property of it by his own unaided exertions, and if it is likely to prove of value, he will find it a very ill-judged course for him to pursue. If he will refer to No. 44 of WORK, Vol. I., p. 694, he will there find information on the subject of patents, of which most

inventors and the public in general are entirely ignorant, but which, if carefully studied, should be of great use to him. Without our seeing the provisional, and knowing what the sweeping alterations he mentions are, we are not in the position to give him any useful advice under the circumstances named. The particulars referred to as being found in No. 44, Vol. I., are too long to reproduce here, and if our correspondent has the first volume he can readily refer to it.—C. E.

**Bromine.**—PROBYN.—Free bromine can easily be obtained from ammonium bromide or cadmium bromide by mixing them with the black oxide of manganese, and distilling with sulphuric acid. 2½ parts by weight of ammonium, or cadmium bromide, are well mixed with 1 part of manganese dioxide and the mixture placed in a flask (A), which should be provided with a well-fitting cork, or caoutchouc stopper (B), through which the end of a bent tube (C) projects a little way, and through which there also passes a funnel-head tube (D), which reaches nearly to the bottom of the flask. 2½ parts of sulphuric acid are now poured down the




**Apparatus for making Bromine—A, Flask; B, Cork or Caoutchouc Stopper; C, Delivery Tube; D, Acid Safety Tube; E, Condensing Flask.**

funnel tube into the flask, which is then very gently warmed. Free bromine is liberated, passes down the delivery tube (C), and should be collected as a dark reddish-brown liquid in a flask or bottle (E), surrounded by the coldest water procurable. See that the cork in the flask fits well, for bromine has a very strong odour, and its vapour is suffocating and very irritating, and also see that the tube (D) dips below the acid in the flask.—F. B. C.

**Table Alteration.**—W. C. (*Hurst, Berks*).—Not knowing exactly what your round table is like, or what the pedestal is, I cannot advise you else than to leave it as it is, or make a dining-table with semi-circular ends, supplying a rectangular piece which I should fix to the pedestal, supporting the semi-circular ends on slides, and a leg, or two legs, to each. The extension possible would not be great, say about equal to a circumscribed square to the circle of present table, or perhaps a little more. Considerable ingenuity would be required to make a successful job, but I see no other use for an old loo table if altered.—B. A. B.

**Damaged Waterproof.**—W. G. C. (*Sierra Leone*).—Under the circumstances stated there is no remedy but cutting out the entire part that is damaged, and all that part to which the liquid has reached where at present no damage is apparent. Then get a piece of the same kind of waterproof, and let it be 1 in. larger all round than the space included in that of the removed portion. Having trimmed the opening neatly to a round, square, or other suitable form, stretch the sheet evenly on the floor with the proofed surface under, and with some rubber solution paint the edge of the opening all round with a width of 1 in. Over this lay the part to be inserted, and when it is placed in its proper position press it down over the joining with a heavy flat iron, and iron it down all round so as to get all the air out and bring the parts into close contact. If properly done, it will, when dry, be found a good job, and the sheet as good as ever, except that the double thickness at the edges of the patch will show what has been done. There is no means known by which the surface can be renewed or restored to its pristine state.—C. E.

**Hydraulic Propulsion.**—C. Y. H. (*Smethwick*).—When our correspondent has brought his "idea" into a *practical* form, either in a *model* or in a set of *drawings*, showing its practicability, he will *then* have something tangible to deal with; otherwise, the "idea" is of no benefit to anyone, and cannot in that state be treated or dealt with. The steering by means of the propelling power is not by any means new. We travelled on the Thames nearly forty years ago in a boat propelled by a jet of water, and by inclining the jet to the right or left the boat was made to answer the helm. Years before this a screw propeller was arranged so as to be turned right or left, and thus steer the boat or vessel, and we think it was patented, but the complication and wear and tear seem to have acted prejudicially to its introduction, and we believe it was never developed further than being fitted in a small launch. Our correspondent will only be wasting his time in trying to get anyone to join the "idea." When he has provided the means of demonstrating the correctness of his "idea," and brought what is at present imaginary into the condition of being an actuality, he will then have some basis to work on which he has not at present, and cannot have whilst he cannot show that the "idea" is practicable.—C. E.

**Iron Safety Bicycle Frame.**—W. W. (*Manchester*).—A safety frame built of iron pipes is generally much heavier than that with steel tubes. Iron pipe is only put into the cheapest machines, which are so roughly finished that the tubes show lines all along and a furrow where the tube has been joined in making. By moving the hand round the tube a lumpiness will be felt which is entirely absent in weldless steel tube.—A. S. P.

**Rocking Cradle.**—FATHER.—I cannot undertake to teach you how to rock a child's cradle in WORK, or devise any method "whereby a cradle would rock itself when started for from ten to fifteen minutes." You will find a reply in "Shop," in No. 50, relative to a wooden swing cradle; another in No. 161, on a child's cot that does not rock, and another on a child's rocking boat in No. 102. There is also a fourth in No. 122 on a swing bassinette.

**Incubator.**—G. R.—I am glad to say that the promised paper on the Atmospheric Incubator has reached my hands, and will appear as soon as possible—that is to say, in December, which is the earliest possible time that arrangements already made for the appearance of articles in hand will permit.

**Monogram.**—W. K. G.—I am sorry to disappoint you, but the demands on "Shop" space are far too great to allow me to give any more monograms for the present, at all events.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Bending Metals.**—J. C. (*Scarboro'*) writes:—"Would any readers give me information as to the best method of bending steel or brass beading (⅛ in.) for fenders, ashpans, etc.?"

**French Medal Glue.**—ESOR writes:—"Can any of your readers inform me as to the best method of preparing French medal glue for use on wood, and for keeping a quantity always ready for use where about 28 lbs. are consumed per day? Does glue, by being kept boiling hour after hour, lose any of its intrinsic qualities?"

**Re-transfer Ink.**—LITHO writes:—"Would any reader of WORK tell me the way to make re-transfer ink from plate to stone?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Wicker Stains.**—F. H. (*London, S.W.*) writes, in reply to A. B. (*Westminster, S.W.*) (see page 462, No. 133):—"You should wash the wicker chair quickly with strong soda water, and then rinse it off with plenty of clean water, under a tap if possible, then stand it in the sun to dry. When quite dry stain the worn parts with burnt umber, or if red, with burnt sienna (ground in water) and a little stale porter. When this is dry, varnish the whole of the chair with brown hard varnish, and it will look as good as new. The varnishing must be done quickly; do not go over it twice, or attempt to smooth it, as it were, but when once on, let it remain until quite dry."

**Black Varnish.**—M. (*Bishop Auckland*) writes, in reply to CARADOC (see page 446, No. 132):—"One of the cheapest varnishes for iron is tar varnish. It is made by boiling gas tar and asphalte, and well stirring till melted; then take it from the fire, and mix with mineral naphtha. The boiling and mixing must be very carefully done, as it is very liable to take fire. A piece of wet sacking is generally kept in readiness for such an emergency, when it is put over the mouth of the pan. As the price is low, I should advise purchasing it ready made, rather than run any risk."

**Pumps.**—M. (*Bishop Auckland*) writes, in reply to J. H. (*No Address*) (see page 398, No. 129):—"You will find sections and descriptions of engines, pumps, etc., in 'The Model Engineer's Handybook,' by P. N. Hasluck."

**Bath Heat.**—M. (*Bishop Auckland*) writes, in reply to ROUND O (see page 414, No. 130):—"If you write to Mr. T. Fletcher, of Warrington, he will supply you with a gas-heater to heat the water as it runs into the bath."

**Indiarubber Mat.**—M. (*Bishop Auckland*) writes, in reply to ROUND O (see page 414, No. 130):—"You might try the cement used for fixing the tires on bicycle wheels."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—H. E. P. (*Plaistow*); R. L. T. (*Plumstead*); D. G. C. (*Bradford*); A. W. B. (*Bristol*); J. G. (*Hull*); H. S. (*Ponder's End*); H. B. S. (*Liverpool*); J. M. M. (*Bristol*); J. E. B. (*Chesterton*); H. T. M. (*Acton*); G. P. (*Elgin*); J. P. A. (*Walthamstow*); WOODWORKER; WATER ASPIRATOR; J. R. (*New Brompton*); SEA GULL; E. R. D. (*Sherborne*); H. A. H. (*Ryde*); C. E. T. (*Liverpool*); AIR PUMP; E. E. S. (*Newton Abbot*); G. M. L. (*Selborne*); A. E. T. (*Bury*); R. W. C. (*Douglas*); CARVER; G. P. (*Elgin*); C. A. P. (*Finsbury*); R. G. H. (*Birmingham*); J. A. (*Gristhorpe*); J. P. (*Hastings*); T. B. B. (*Manchester*); FOUNTAIN; W. H. P. (*Tottenham, N.*); E. G. F. (*Bermondsey*); J. (*Durham*); F. S. (*Kidderminster*); R. H. (*Blackpool*); J. T. (*Whiston*); A. N. (*Horwich*); J. O. R. (*Whitcombe Magna*); W. L. (*Dalston*); G. B. (*Paisley*); G. A. (*Hornsey*); H. D. (*London, S.W.*); H. H. M. (*St. Leonard's-on-Sea*); T. R. (*Walthamstow*); LABOUR; M. B. (*Chelmsford*); KERNEL; R. N. (*Grays*); A PUZZLED ONE; L. M. (*Oldham*); T. M. (*Liverpool*); E. C. O. (*Tottenham*); J. J. M. (*Liverpool*); E. H. (*Kingsland*); F. S. (*Reading*); C. M. W. (*Dulwich*); J. M. P. (*Nottingham*); G. F. C. (*Southampton*); COMMUTATOR; WHEELER; T. H. C. (*Stroud*); A. H. (*Woolwich*); A. W. (*Stoke-on-Trent*); H. H. (*Burton-on-Trent*); DRAUGHTSMAN; A. H. K. (*Pendleton*).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**The Talmer does the Best.**—Illustrated pamphlet of this perfect Hand Camera 2 stamps.—TALBOT AND EAMER, Blackburn.

**Photographic Apparatus,** list 2 stamps. Dark Slides, best quality, fitted to any camera: ¼ plate, 5s.; ½ plate, 9s. 3d. All sizes made.—TALBOT AND EAMER, Blackburn. [18 R

**Fretwork Designs.**—Books of 12, 7d. and 1s. 1d.; 40 smaller designs, 7d.; sample sheet of 6, 2½d. Fretwood from 4d per foot.—TAYLOR'S Fretworkeries, Blackpool. [19 R

**Fretwork Tools and Materials** at CLARKE'S Tool Stores, Fore Street, Exeter. New Illustrated Catalogue post free. [20 R

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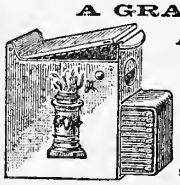

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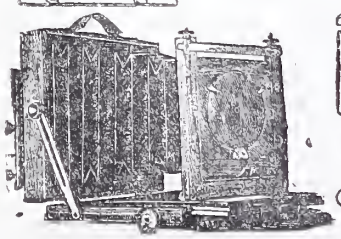

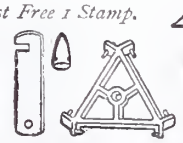

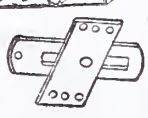

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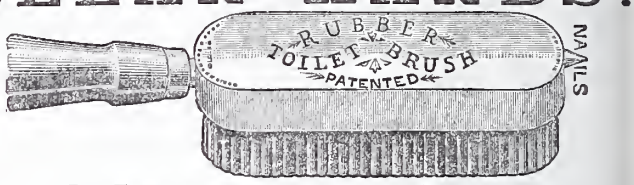


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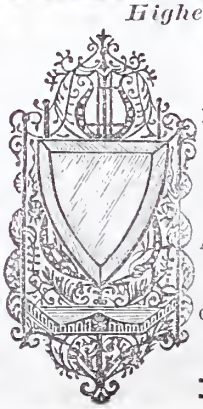

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# WORK

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VOL. III.—No. 140.] SATURDAY, NOVEMBER 21, 1891. [PRICE ONE PENNY.

## STAGE CARPENTRY.

BY WILLIAM CORBOULD.

PROFILE — BOARDS FOR PROFILE — COVERING BOARDS WITH CANVAS — PREPARATION OF GLUE—GLUING AND PRESSING BOARDS—SET PIECES—MAKING WINGS AND SET PIECES—PUTTING PROFILE ON WING.

IN this series of papers I shall deal with the making of profiles, set pieces, practical doors and windows, vampires, etc., borders, rollers wings, etc.

*Profile.*—I shall commence first with the making of profile, and I may here say that to do this properly you will require no little attention to the instructions here laid down, because if badly done it will entail a deal of after trouble; on the other hand, if well done you can cut it and work it to anything.

Some of my readers, no doubt, will not know what profile is, and what it is used for. Profile is a thin board with canvas well glued down to it on both sides. When this is dry and hard you can cut it with a knife or profile saw into any form: such as the edges of wings in which you wish to represent foliage, rocks, etc., when a straight-edge would be out of place; but if a piece of profile is put on to the straight-edge of the wing, you can put it to the painting. This, however, will be carefully explained hereafter.

*Boards for Profile.*—The boards required for this purpose are usually about 10-cut — that is, a 1 in. deal would cut down boards about 1 in. thick, and either 9 in. or 11 in. wide. The canvas required for the purpose must be pretty open—that is, rather coarse in the web. Many use paper-hangers' canvas, but canvas not quite so coarse may be used, or even common unbleached calico will do. Let your glue be the best you can get—that is to say, get Scotch glue, and always use it. Now for the preparation.

*Covering Boards with Canvas.*—We will suppose that we have three boards to do—they may be 9 in. or 11 in. wide. You must cut your canvas a little less than the width of your boards, so as to allow of stretching when rubbing down; the canvas must not come beyond the edge of the board when finished, because it must be part and parcel of the board itself when cutting it up as may be required.

*Preparation of Glue.*—The best way to prepare the glue is to have a small pail and break up the glue into it; place this in a large pail, put water into both, place them on the fire, and let them boil until all the glue is dissolved. The glue should be of the same consistency as castor-oil.

*Gluing and Pressing Boards.*—Lay the board on a bench or table, and take a large brush and well cover the board with glue about 4 ft. at a time; lay the canvas on, well stretching it, rubbing from the centre towards the edges; go on gluing and placing the canvas on the same way until you have covered the board. Now take a piece of canvas or rag, soak it in the water, and squeeze it out, but do not leave the rag too dry; commence at the end, and rub until you bring the glue through the canvas—that is, until it assumes the appearance of soap. When you have finished, turn the board over, and go through the same process on this side as on the other. When you have finished, you must get a number of pieces of wood, about 1 ft. long and 1½ in. thick. Lay these pieces on the floor in a dry place, and where you will not want to disturb them for four or five days at least. Place the pieces about 18 in. apart, lay the board that you have just finished flat on these pieces, and having done this, go on with another board. When finished, place some more pieces of wood on the board you first laid down, placing the second board on the slips previously laid on the top of the first one. Go on doing this until all the boards are finished. On the top of

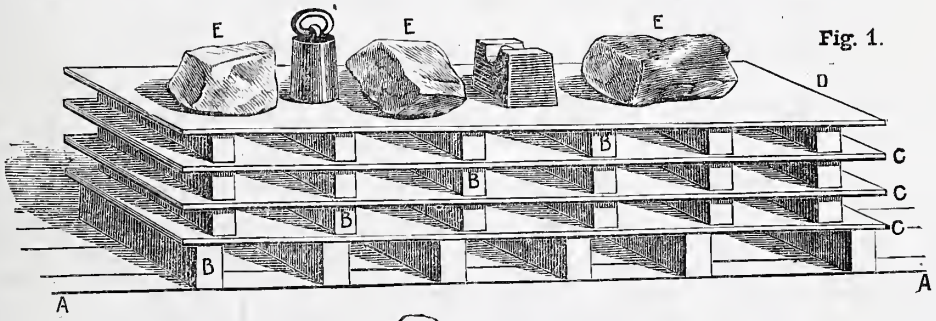


Fig. 1.

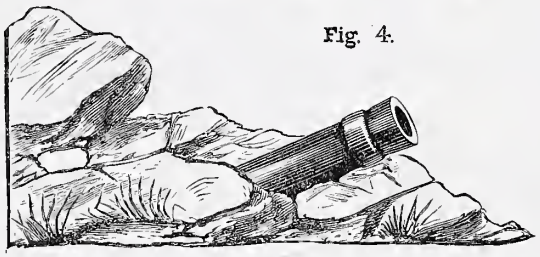

Fig. 4.

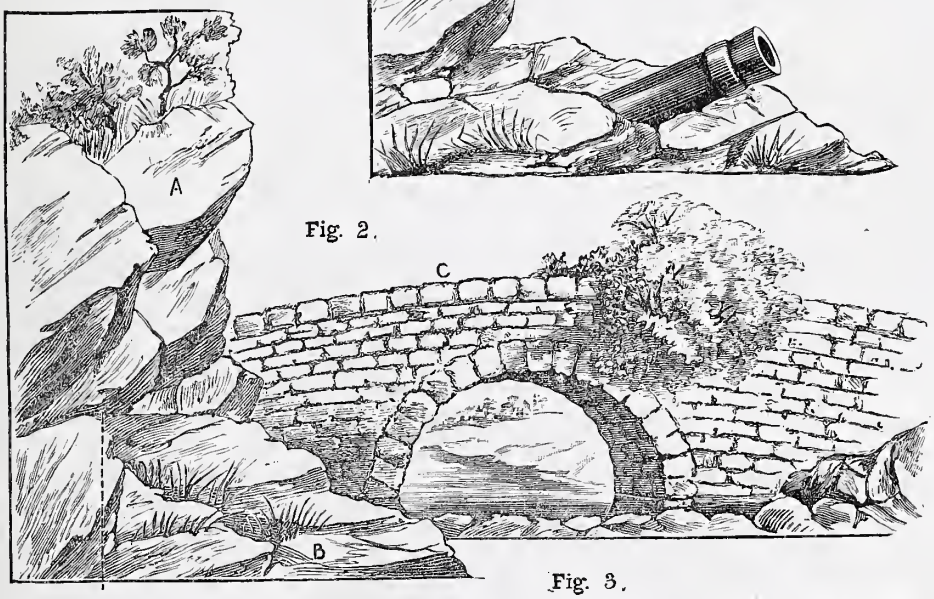


Fig. 2.

Fig. 3.

Fig. 1.—Boards glued and covered with Canvas, piled to allow them to dry. Fig. 2.—Wing (A) and Two Set Pieces (B, C) in Combination. Figs. 3, 4.—Set Pieces.

the last board place some slips of wood as before, and on the slips lay either one board or some pieces of board, as you may happen to have about the workshop. On these pieces of board place some heavy weights—anything will do, whether iron weights or stones. In four or five days the whole will be dry and fit for use. You will see by this method that the air can freely circulate through the whole pile, as shown in Fig. 1. In this, A A is the floor; B, B, the blocks of wood placed between the boards; C, C, C, the three profile boards; and D is the board placed on the top of the profile boards, whereon are the weights, E. As I said before, anything will do if heavy.

*Set Pieces.*—Set pieces, such as rocks, banks, or foliage pieces, are sometimes set partly on the stage from one of the wings, and at other times right across the stage, as shown in Figs. 2, 3, and 4. In Fig. 2 the wing is seen at A, the set piece at B, and the bridge, C, is also a set piece, placed a little back from the wing, leaving an opening between for entrance or exit. The bridge piece, being set also a little in front of the scene, gives the stage a very picturesque appearance; but more of this hereafter, when we come to borders.

*Making Wings and Set Pieces.*—We now come to the making of these wings and set pieces; 3 in. battens are generally used for the framework, or floor boards, which run about 6 in. wide when ripped down through the middle, answer the same purpose well enough. Let us take a wing first. Supposing it to be 12 ft. high and 3 ft. wide: you would cut two 12 ft. lengths and three 3 ft. lengths; the proper way to put them together would be by mortise and tenon, as in Fig. 5; on the other hand, if it should be that the "scenic artist" or stage carpenter is an amateur, and does not happen to have the proper tools, he may put the framework together by halving, as shown in Fig. 6. By using good glue and wire nails, say 1¼ in. long, so that they will turn and clench, the wings will be quite as strong as if they were mortised and tenoned.

*Putting Profile on Wing.*—The following is another way:—Butt the parts together, cut a piece of profile neatly, and glue and nail this on as shown in Fig. 7, in which A is the piece of profile with the edges bevelled off; B is the corner when finished. Fig 8 shows how the profile is put on. We will suppose O P to be the side of a wing; it will be seen that a rabbet is cut at A so that the edge of the profile board may be laid in it when ready. Well glue the rabbet before laying in the profile, and then fasten it all along with small flat-headed nails; of course, the wing or set piece is made first, and in covering them with canvas, never allow the canvas to come too close to the edge of the frame, and keep the tacks quite 1 in. from the edge of the canvas, because after tacking down you must hold up the canvas with one hand while you use the glue-brush with the other. Then take a damp rag and rub it well down; when dry, it will be ready for painting, as in Fig. 13. You must at all times allow sufficient canvas to cover over the edge of the profile after it is nailed on. Do not forget this.

Figs. 9, 10, 11, and 12 are the back views of wings and set pieces, Figs. 2, 3, and 4 showing the way they are put together. Fig. 12 would be hinged together in the centre by hinges known as back-flaps, so that the portions of the painted side shut up face to face. The centre partition must be covered with a strip of canvas to hide it, making the painting appear as one.

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BY CHARLES KELSEY.

INTRODUCTION—DEFINITION OF A DESIGN—SCULPTURE NOT INCLUDED — HISTORY OF THE DESIGNS COPYRIGHT—WHERE DESIGNS ARE REGISTERED—ACT AND RULES, PRICE, AND WHERE OBTAINED—WHO CAN REGISTER—DEFINITION OF "PROPRIETOR"—DESIGNS MUST BE NEW OR ORIGINAL—DEFINITION OF "NEW OR ORIGINAL"—WHAT IS "PUBLICATION"—SUBDIVISION INTO CLASSES—LIST OF CLASSES AND REMARKS THEREON.

*Introduction.*—In past numbers of WORK, several papers dealing with Patent matters have appeared, which have been of great value in explaining the method of procedure necessary to obtain the grant of a Patent, and also in putting before the readers the general principles of the law relating to Patents. But hitherto the section of the law which deals with the protection by Registration of Designs, Patterns, Shapes, and Ornaments — that is, the Designs Section of the Patents, Designs, and Trade Marks Act of 1883—has not been prominently brought before its readers; and I propose, in the following pages, to deal with this subject in a similar manner to that in which Patents have been treated.

A slight reference to this Registration appeared at the latter end of C. C. C.'s paper on Patent matters in Vol. I., page 545; but the subject is of so much value that it deserves treatment in an independent paper.

The information will be found useful and valuable, more especially by those—manufacturers, designers, and artisans—who design or produce novel articles of manufacture, new shapes for articles of utility, or who ornament or decorate such articles in some new manner, or who design the patterns for such purposes. The law applies to all materials, and therefore the information will be useful to workers and designers engaged in all the varied manufacturing industries which are carried on at the present time.

Also, it will be useful to those amateurs who design or produce for pleasure some article, shape, pattern, or design, which, if manufactured and placed on the market through the ordinary channels of trade, would be likely to "hit the public taste," and secure a sale.

The inventor of simple articles may here also find welcome information as to this alternative method of securing protection to that involved in "taking out a Patent," which is open in some cases by proceeding under this section of the Act; for the protection acquired by Registration is fully as effectual—if the subjects are such as may be rightly included in its scope—while the cost is much less, the procedure in making the application much more simple, and the granting of protection much quicker; thus enabling the inventor to put his goods on the market without delay, which is frequently of great importance to catch some particular market. Frequently these points—the initial cost and the inability to make the application unassisted or to employ a Patent agent—form insurmountable obstacles to the worker who is desirous of obtaining a Patent; but if the subject be such a one that it can be registered as a design, these obstacles will be evaded, for, after perusing the present paper, any person with ordinary intelligence will find no difficulty in making an application unassisted, and the fees are so trifling as to be within the means of almost everyone.

It will be my aim at the same time to give much necessary information as to the rights so acquired, and the general principles of the law.

It is but natural that designers and inventors should be anxious to secure, as a reward for their ingenuity and industry, a fair share of any profits earned by the sale of their inventions and designs; but they frequently fail in doing so from ignorance of the steps to be taken to secure their rights, and my object in writing this paper is to do my best to supply this deficiency.

*Definition of a Design.*—In dealing with this subject, evidently the first step must be to ascertain what is or can be rightly included under this section of the Act; and the step is an important one, because it is worse than useless to attempt to gain protection by provisions which are not applicable to the subject in hand. The term "Design" is a very wide one, and different definitions of it will be found in different dictionaries; but as the term is defined in the Act itself, in Sec. 60, we must turn to that source for our information. The definition is rather a long one, but its importance must be my apology for quoting it *in extenso*. Sec. 60 runs as follows:—"'Design' means any design applicable to any article of manufacture, or to any substance, artificial or natural, or partly artificial and partly natural, whether the design is applicable for the pattern, or for the shape or configuration, or for the ornament thereof, or for any two or more of such purposes, and by whatever means it is applicable, whether by printing, painting, embroidering, weaving, sewing, modelling, casting, embossing, engraving, staining, or any other means whatever, manual, mechanical, or chemical, separate or combined, not being a design for a sculpture or other thing within the protection of the Sculpture Copyright Act of the year 1814 (54 George III., Cap. 56)."

First, it will be noted that the field covered is very wide. We may take it for granted that designs in any material will be included, no matter how executed.

It should be noted, also, that the words "for the pattern, or for the shape or configuration, or for the ornament thereof," are the essential words of the section, on which everything turns; and anything which is included under these terms may be rightly registered under this section.

Under the terms "for the pattern" and "for the ornament" are included all designs or patterns used for the decoration or ornamentation of surfaces or articles, and thus the works of pattern designers for all materials, such as calico printing, paper staining, house decorating, lace weaving, leather embossing, etc. etc., are included; as also are the works of the decorative artists and workers who are engaged in ornamenting articles of beauty or utility—such as china decorators, wood carvers, marquetry workers, metal chasers and engravers, jewellers, bookbinders, etc. etc.

Under the terms "for the shape or configuration" are included the external or internal shapes or forms of all the various articles of manufacture—such as the shapes of the potter, wood-worker, glass-blower, metal-worker, stone-carver, ornamental modeller, etc. etc.

It will be noted that "sculpture" is specially excluded from this section, as its protection is dealt with by the Act before referred to. As, doubtless, amongst the

readers of Work are sculptors, modellers, and plaster-cast makers, I propose dealing with it in a supplementary paper, for a brief *résumé* of this Act would be welcomed by them.

It is the terms "for the shape or configuration" which render this section useful for the protection of many minor inventions. If the essential novelty in an invention consists in making the article, or portion of the article, of some novel shape or configuration—perhaps to enable it to better perform its purpose, or, it may be, to ensure greater facility in its manufacture, or for some other such reason—it will be possible to secure protection for it by Registration as effectually as by patenting it. But if the invention does not conform to these terms, it is useless to register it under this section, for if a certificate was granted by the Office, a plea that it was not such a one as should have been registered would, if upheld by the Courts, invalidate the Registration.

The history of this part of the Act throws a good deal of light upon what may and what may not be protected under the Designs Copyright, and so I give a brief *résumé* of it.

*History of the Designs Copyright.*—The first attempt of the legislature to grant a Copyright in Designs was the Act 27 of George III., Cap. 38, which came into operation on June 1st, 1787. This was intended to protect the patterns printed upon linens, calicoes, cottons, and muslins. It gave a protection for two months only from the date of publication. The designs were not registered, but the proprietor's name had to be printed upon each piece. The Act was enacted for one year only. In the following year a continuing Act was passed. By subsequent Acts the period of copyright was extended, and designs printed upon other textile fabrics were included.

The next great step was in 1842, when a further Act was passed, 5-6 Vic. Cap. 100, known as the "Ornamental Designs Act," which instituted the present practice of registering a design to secure copyright, and the protection was extended to patterns and ornaments applied to the articles produced in other trades. The shapes or configurations of articles of manufacture were also covered, the object being to protect, in like manner, the shapes produced by the potter, metal-worker, and other manufacturers.

In 1843 was passed the "Useful Designs Act," 6-7 Vic. Cap. 65, the object of which was to protect articles of utility which were not designs for the ornamentation of articles, or ornamental shapes of articles, such as were included in the "Ornamental" Act previously alluded to. The protection granted, to quote from the Act, applied "to any new or original Design for any article of Manufacture having reference to some Purpose of Utility, so far as such Design shall be for the Shape or Configuration of such Article, and that whether it be for the whole of such Shape or Configuration, or only for a part thereof."

This Act was, in fact, used for the protection of the many minor articles which were being invented, which were not considered by their owners sufficiently important or sufficiently valuable to be made the subjects for application for the grant of a "Patent." At that time the Patent fees were much higher, and the procedure very complicated.

These laws remained in force up to 1883, when the present Act was passed, which extended the term of Copyright to a uniform period for all designs, lessened the fees, and brought both useful and ornamental designs under one head.

Under the old arrangement it was very difficult to draw the line between a useful shape and an ornamental shape, so the distinction was abolished. Now any article of manufacture in which the shape or configuration of the whole or of some part is the essential

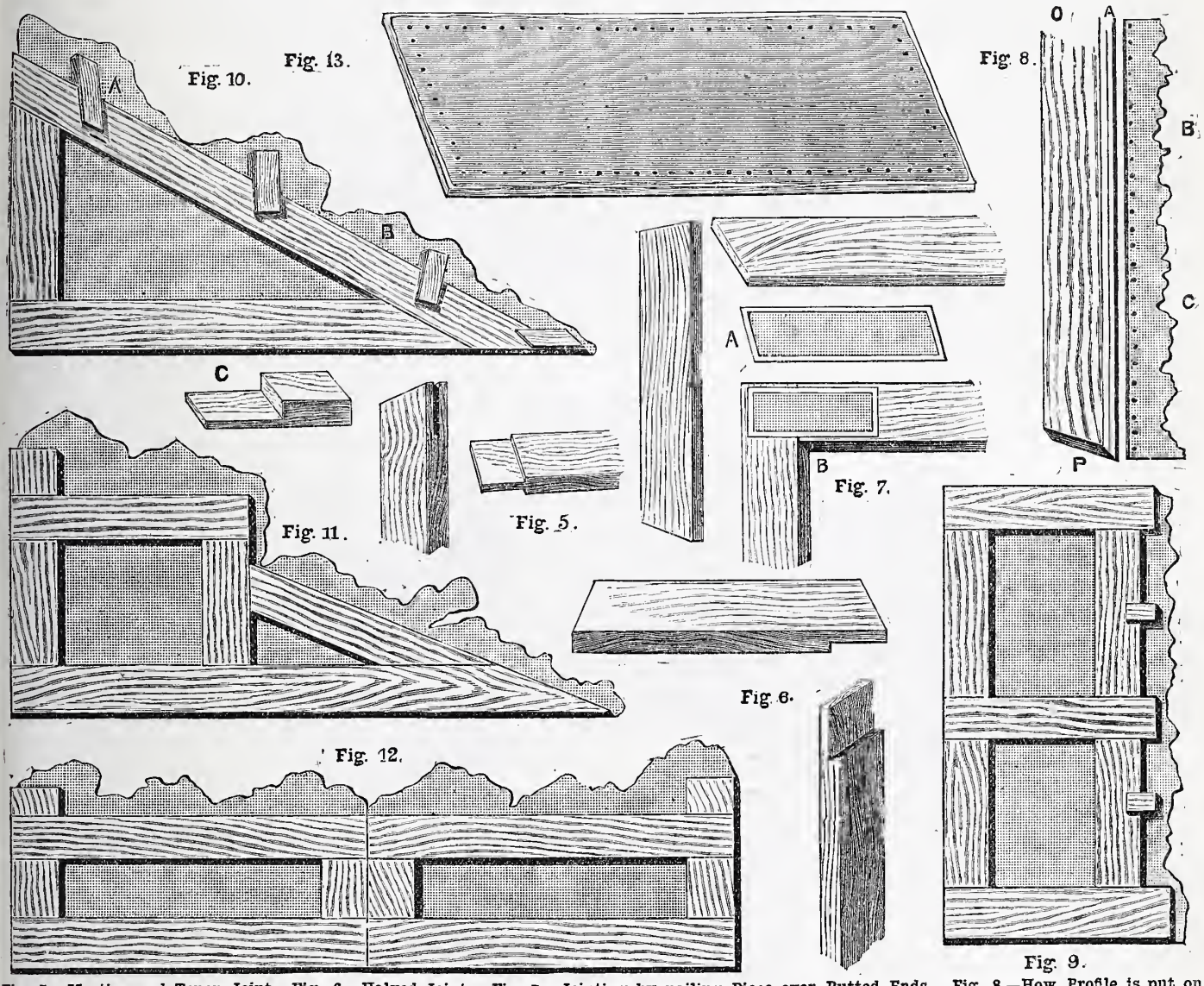



**Fig. 5.—Mortise and Tenon Joint. Fig. 6.—Halved Joint. Fig. 7.—Jointing by nailing Piece over Butted Ends. Fig. 8.—How Profile is put on. Figs. 9, 10, 11, 12.—Back Views of Wing and Set Pieces in Figs. 2, 3, 4. Fig. 13.—Covering Profiles with Canvas.**

novelty may be registered, whether it is for some purpose of utility or for ornament merely, in addition to designs, patterns, and ornaments formerly included under the "Ornamental Designs Act." It is this inclusion of the old "Useful Designs Act" in the present Act which renders it applicable for the protection of many minor inventions for articles of utility, and if they conform to the conditions stated, such articles may be thus fully protected.

*Where Designs are Registered.*—As will have been gathered from my foregoing remarks, this forms part of the business carried on at the Patent Office, situated at 25, Southampton Buildings, Chancery Lane, London, W.C., which is under the direction of the Comptroller-General and his staff, who act under the powers conferred upon them by the Act of 1883 and the rules made in connection therewith, the terms of which control and regulate all their actions.

*Acts and Rules, Price, and where Obtained.*—Copies of this Act, commonly called the "Patents, Designs, and Trade Marks Act, 1883" (price 1s. 7½d., by post 1s. 9d.), may be procured at the Sale branch of the Patent Office, 38, Cursitor Street, Chancery Lane, London, E.C., or will be forwarded to any address if Postal or Post-Office Orders are sent addressed to the Comptroller.

Copies of the Designs Rules, 1890, are 6d., by post 6½d. Copies of the amending Act of 1888 are 1½d., by post 2d.

Copies of "Instructions to Persons who wish to Register Designs," which contain much valuable information, are given gratis at the Office, or will be forwarded by post if applied for.

*Who can Register.*—The person entitled to copyright is the proprietor of the design, and the Act gives a definition of "proprietor" in Sec. 61. It runs: "The author of any new or original Design shall be considered the proprietor thereof, unless he executed the work on behalf of another person for a good or valuable consideration, in which case such person shall be considered the proprietor; and every person acquiring, for a good or valuable consideration, a new and original Design, or the right to apply the same to any such article or substance as aforesaid, either exclusively of any other person or otherwise, and also every person on whom the property in such Design or such right to the application thereof shall devolve, shall be considered the proprietor of the Design in the respect in which the same may have been so acquired, and to that extent, but not otherwise."

In this respect the Designs section differs from the Patent. The grant of a Patent to a person who has seen some invention abroad and first brings the knowledge to this country is valid, but the definition of proprietor seems to preclude such a proceeding in the case of a design. Here the applicant must be either the author, *i.e.*, the original inventor, or designer, or a person who has acquired the right from such original inventor for a "good or valuable consideration," such as works executed while the designer or inventor was in his service, or by purchasing the design from the original designer. In the case of purchasing a design, it will be well to have a formal document to that effect, to prevent difficulties arising on that point in the future. In one decided case it was held that the grant of a sole agency in this country was not such "good or valuable consideration" as the law meant; and so it would seem that the design must be acquired by cash or its equivalent. Persons who have stolen or copied a design without giving the original designer or inventor some consideration for it, will not be protected, even if a certificate be granted to them.

*Designs must be New or Original.*—All designs applied for should be "new or original," and such as have not been, prior to the date of application, "published" within the United Kingdom. These are important points to be borne in mind, for neglect of them will invalidate the registration. They are the most usual pleas raised as a defence to an action for infringement of copyright, and have given rise to many interesting decisions from the judges who have tried these actions. As these decisions govern the construction, or the meaning of the words used in the Act, they are useful in deciding what the Act deems "new or original," and what is meant by "publication." In one case it was held that the reproduction of an article which had been published in a different material—such as making a design in metal which was well known in china—did not constitute a "new or original" design; and in another case it was held that the copying of a photograph of a well-known person upon china was also not a new design; but it has been held that a new combination of old parts was perfectly valid. The law is, evidently, only for the protection of the design or invention which has been *bonâ-fide* invented or designed by the applicant or by some person working for him, and which they have registered before publishing.

It has also been held that designs must be "substantially new or original" to claim protection. Some slight variation is not sufficient: there must be, in each case, a substantial novelty.

*What is Publication.*—On the question of publication, it will invalidate the Registration if the design has been exhibited, before Registration, for the purpose of seeing if orders could be obtained for the article, although, in the same case, it was held that consulting an expert as to the workability of the design was not such "publication" as would be fatal to the after-acquired rights.

It should be understood that, even if a certificate of Registration has been acquired, if these points of publication and novelty have not been attended to, the Registration will be invalid.

*Subdivision into Classes.*—The Act and Rules subdivide designs, for the purposes of Registration, into fourteen classes, taking as the distinguishing feature the material in which the design is to be produced.

Registration only applies to the class or classes of goods for which application is made. Thus a design may be registered as a paper-hanging, and may be produced by another person as a cretonne or furniture print; so that it is necessary, if the applicant wishes to apply his design to more than one class of goods, that he should make separate applications for each class required. Only by taking this precaution can he prevent his design being used by other workers in different materials. In cases of doubt, where the applicant cannot decide for himself the proper class in which his application should be made, the Comptroller is empowered to decide for him by Sec. 47-5, and this is much the best course to adopt under such conditions, for this reason: placing in the wrong class by the applicant would most probably invalidate the Registration, but if placed in the class which the Comptroller directed, such a plea could not be raised, as he is specially empowered to decide such a point.

*List of the Classes, with Remarks thereon.*

The classes are:—

*Class I.*—"Articles composed wholly or chiefly of metal not included in Class II."

This includes, in addition to designs executed in all the ordinary metals, works in the precious metals, other than jewellery.

*Class II.*—"Jewellery."

This term, "jewellery," is treated by the Office as meaning personal ornaments. This class is not restricted to articles in metal, but includes designs produced in the other substances used in jewellery, such as precious stones, jet, coral, horn, etc.

*Class III.*—"Articles composed wholly or chiefly of wood, bone, ivory, papier-mâché, or other solid substances not included in other classes."

This is a general class for designs for works executed in solid substances other than those included in the special classes. It includes, in addition to the materials mentioned, designs for works in stone, and such substances as indiarubber, gutta-percha, vulcanite, etc.

*Class IV.*—"Articles composed wholly or chiefly of glass, earthenware, or porcelain, bricks, tiles, or cement."

Primarily for designs in fictile materials which are solidified by baking or burning, like pottery, bricks, and tiles, and also for glass. The term "cement" includes designs in artificial stone—possibly articles made in plaster of Paris—and such-like articles which are formed in a plastic state, and solidify afterwards without the aid of heat.

*Class V.*—"Articles composed wholly or chiefly of paper (except hangings)."

Includes, besides paper, designs on or articles made with cardboard and the like substances, and it becomes sometimes difficult to draw the line between these and the papier-mâché included in Class III. This class also includes designs for Christmas cards, greeting cards, etc., but such goods are much more frequently entered for Copyright at Stationers' Hall, and on this point it is difficult to say which is the more correct proceeding; but when they are of some novel shape in addition to the ornamentation of their surface, Registration as designs would appear to be the safest course. Frequently manufacturers register them at both Offices, and possibly they would be entitled to some protection under the law regulating Artistic Copyright.

*Class VI.*—"Articles composed wholly or chiefly of leather, including bookbinding of all materials."

This class includes designs for all leather-covered goods, such as writing and despatch and dressing-cases and the like, which are so covered. Also designs for bookbinding in all the materials which are used for this work.

*Class VII.*—"Paper-hangings."

The class includes designs for all the varieties of paper-hangings.

*Class VIII.*—"Carpets and rugs in all materials, floorcloths, and oilcloths."

This includes designs for practically all floor coverings with, perhaps, the exception of indiarubber matting, which is put with the other indiarubber goods in Class III. Also all varieties of oilcloths.

*Class IX.*—"Lace, hosiery."

Includes all kinds of lace goods, and such hosiery goods as stockings, socks, and the like, and knitted piece goods.

*Class X.*—"Millinery and wearing apparel, including boots and shoes."

May be said to be restricted to designs for complete articles of wearing apparel. Designs for portions of articles of wearing

apparel sold separately—not as complete, made-up articles—are placed in the class indicated by the material of which they are composed.

*Class XI.*—"Ornamental needlework on muslin or other textile fabrics."

Includes all designs for hand and machine-wrought embroidery or ornamental needlework.

*Class XII.*—"Goods not included in other classes."

This, as appears, is the class for designs for miscellaneous goods which are not included in any of the other classes. Designs for textile narrow goods—such as fringes, frillings, braids, gimps, ribbons, tapes, and the like—are included in this class.

*Class XIII.*—"Printed or woven designs on textile piece goods."

This is a very large class, including designs for all textile piece goods—that is, goods sold by the yard—including all the varieties of dress goods and furniture textiles. Includes, in addition to printed and woven designs, patterns executed by stamping or embossing and cutting, like varieties of velvets and velveteens.

*Class XIV.*—"Printed or woven designs on handkerchiefs and shawls."

In addition to the articles indicated, includes textile squares generally—such as bed-quilts, table-linens, towels, and such-like goods as are sold complete in themselves, singly or by the dozen.

It should be noted that in the wording of the first six classes—with the exception of Class II.—the words "wholly or chiefly" occur. This means that articles composed of more than one material should be applied for in the class of the predominating material. Previous to 1890 the words were "wholly or partly," and this necessitated registration in each of the classes over which the materials of the design ran, so that the amendment made is all in favour of the applicant.

It should also be borne in mind that it is the design or patterns applied to some material, or the forms or shapes executed in some material, that is protected—not the material itself.

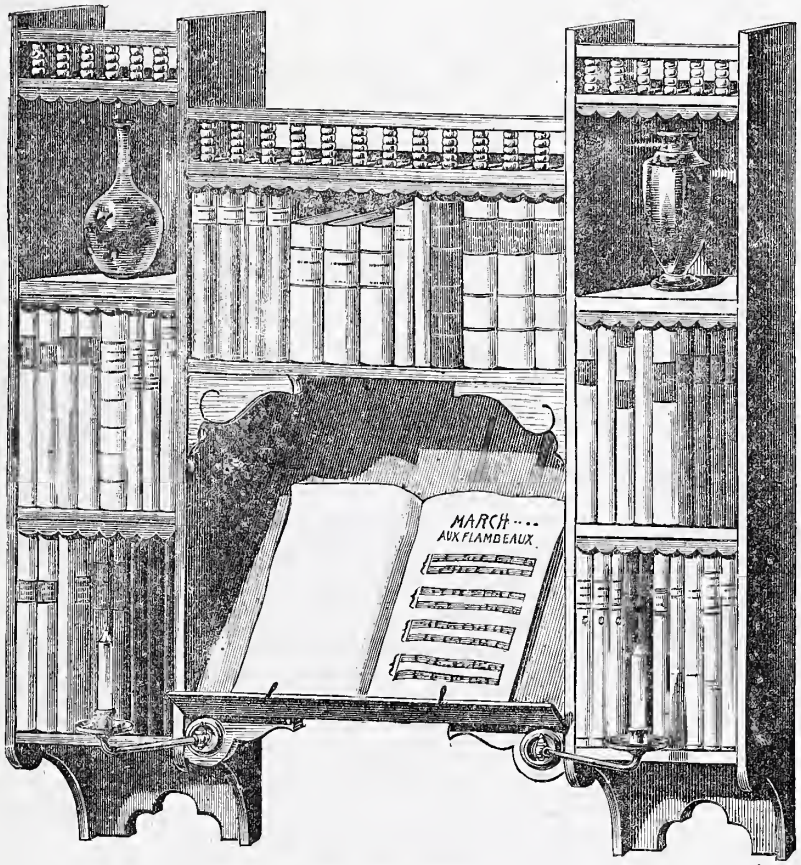
Having now fairly launched the reader into the subject, I shall, in the subsequent papers, deal with making the application, and the procedure the Office takes thereon; and then deal with what constitutes an infringement, and various other minor matters relating to the subject. I shall deal with every branch as completely and succinctly as space will allow, and I shall make no apology for doing so on account of the interest which is evinced in everything relating to patents and patent laws and usages as soon as the subject is broached in the pages of this Magazine. That it is one that is of the highest importance to every workman cannot be denied, and on this ground alone it deserves consideration in WORK.

## FITMENT TO HANG ABOVE A SMALL HARMONIUM.

BY PALGRAVE MORRISON.

"AND underneath her window He used to go and strum, In mode at which you would have wept, His dull harmonium." So sang Mr. Gilbert in an early "Bab Ballad," and the painful truth of his words will be echoed by all those who live next door to a plodding amateur who has begun to blow the reed-chest. Mr. Spurgeon was once asked if a man could play the trombone in a brass band and yet remain a Christian, to which he is reported to have replied: "That no doubt he might, yet, if he practised at home, his next door neighbour could not."

But in spite of well-deserved sarcasm freely launched at the people who make the most distressing noises with the aid of the harmonium, it is capable of excellent music; and if only I dared to give a column of advice—from one who knows—I fancy it might be more useful to the amateur than the music-desk and shelves it is my object to describe.




Fitment to hang above a Small Harmonium.

If one who has suffered the miserable incompetence of a so-called music-desk to carry out its professed intention could say here plainly what he really thought of that irritating imposture, either the Editor would cut it out, or the Magazine itself would be disgraced by profanity. For the arrangements made by the manufacturers of small harmoniums to keep the music at the proper angle and allow its pages to be turned over are, as a rule, merely absent—for the small harmonium never suggests that anyone might occasionally be tired of playing from memory, and wish to have his music in front of him.

Then, again, like a piano, the instrument, as a rule, has no convenient receptacle for printed music. To obviate these two omissions, and afford, beside conventional, artificial light, is the not very subtle problem attempted herein.

As a piece of joinery, it is enough to rouse the disdain of the ultra-professional workers who cannot tolerate simplicity; for it is but a set of shelves after all, and to seriously consider the readiest way to make such a thing is beyond hypothesis. The decorations are confined to a few small spindles—*à la* the anachronistic "Early English Queen Anne"—but these may be replaced by fretwork, or still better, by carving, if desired.

The practical point is that a good, useful music-desk is offered; that space for two candle brackets to be affixed is also given. The shelves will be useful for books if the amateur's musical library is limited. With regard to size, the desk should, I know, be 24 in. wide, and the whole structure not less than 3 ft. 4 in., the average width of the instrument. Supposing it to be built of 1 in. stuff, that would allow the side recesses to be only 6 in. each, whereas they are shown twice as wide. But I prefer the whole to overlap the instrument; if personal reasons decide otherwise, there is no reason why there should be any side shelves on the music-desk level. All the details are purposely left vague to suit the taste of any who wish to adapt an idea, for, after all, the idea is the main thing. If it be an idea, however badly treated, the clever worker soon discovers the way to better it; and so far as I know, obvious though such a thing be, no one has illustrated such a combination of desk and shelving as that suggested in this fitment. The article does not take long to make, and forms a useful present for a friend and a taking piece of furniture for bazaars, which will form a counter attraction to the too numerous cushions and antimacassars which usually form the staple article for sale at these entertainments.

## ASHPAN MAKING.

BY R. ALEXANDER.

THIS short paper is to be taken as a reply to a query on the subject by J. W. (*York*).

The first thing to learn in making these articles is to know how to go and measure for them. I speak from experience, and no doubt many brother workmen can confirm the statement that not one person in twenty bringing an order for an ashpan to an ironmonger has a sufficiently intelligible order or sketch to enable the workman to make it without going to the range or grate and taking his own particulars. To do this, make a sketch of the bottom of the pan like Fig. 1; next measure the width of the fire-hole that it is to fit in; and here it is that an error often creeps in. Bricklayers or

range-setters are only human after all, and frequently the back part of the fire-hole is narrower than the front, so that an ashpan made the right size, apparently, when tried in jams half-way, necessitating either an alteration of the pan or a cutting of the brickwork underneath. To avoid this, cut a small piece of stick to the size of the front, and with that test the back of the fire-hole both at the bottom and top. Whatever the size is, write that at the back of your sketch as shown in example—7½ in. The next dimension to take is the "depth." Do not confound this term with the height, of which I will speak presently; the depth, A A, is the distance from front to back. Always mark on the diagram ¼ in. less than your measure, as a little space at the back does not matter, but it looks very bad to see an ashpan stand out from the grate. We will say for an example of depth 6½ in., and mark it on the plan as shown. The shoulder of the ashpan is generally about an inch each side. Draw a line from shoulder to shoulder and then mark the distance the front has to be from that; it varies from 4 in. to 7 in.,

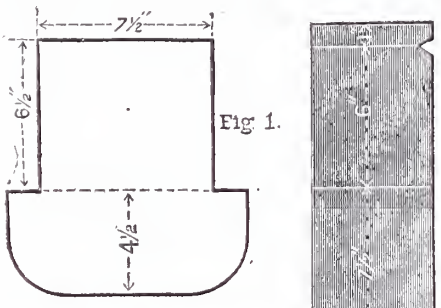


Fig. 1.

Fig. 3.

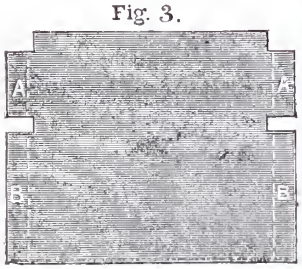


Fig. 2.

**Fig. 1.—Plan of Ashpan for Kitchen Range. Fig. 2.—Flat Pattern of Back Part. Fig. 3.—Flat Pattern of Front.**

according to the size of the ashpan. In our example I have marked it 4½ in. Two more dimensions now need to be marked down—that is, the height of the back part and the height of the front. These, of course, vary with circumstances. I have marked: back 7 in., front 10 in., which is about an ordinary average. Some people cut a paper pattern, but this is unnecessary if the directions I have given are followed, though in the case of a register grate ashpan it is generally necessary. I can only give very brief directions for working up, and must presume, as you are an improver, that you know something of the trade and names of tools and technical terms. Use 24 gauge charcoal iron or soft steel for small size, and 22 ditto for larger ones. First cut out the piece for the back, marking it out like Fig. 2, which is supposed to be for the size given above. Fold the top and wire, leaving the wire out 3 in. at each end; bend square on the hatchet stake down the lines, then bend on the lines; you will find that you must mark them on the other side. Next bend the wire that you leave out straight up. Having got this part of the ashpan true and square, bend a strip of tin or zinc to get the length to cut the front. Cut the piece, and cut a notch each end at the part that is to be the top; at the height of the wire of the back part cut a piece out of the front as shown in Fig. 3; wire the top, and bend round to shape. The parts marked A are bent round and closed over the wire left out of the back, and the parts B are riveted to the 1 in. parts thrown off the back (see A, B, Fig. 1). Next throw off the edge for the bottom, shape up again, and mark out the bottom with a slate pencil, allowing nearly ¼ in. all round; turn up, pane down, and knock up in the usual way. Punch a hole in the centre of front, and rivet in a bright range knob with two or three thick washers inside. If any further information is required, I shall be pleased to give it to any who may ask for it.

## SADDLES FOR RIDING ON HORSEBACK.

### WITH RECENT IMPROVEMENTS IN STIRRUP HANGING.

BY JOHN CHARLES KING.

Several patents are taken out in England in each ensuing year for saddle improvements: for cross and side saddles, some of them to obviate or nullify the very parts which had at some previous time been patented as improvements. And some without the patents are correct as far as they go.

The hunting season is here, and its sure fatalities and lamings of riders follow with increased intensity every year. Seven deaths and six hundred falls, with injuries, were last year's hunting season's record.

A Queen's huntsman boasted ten falls in one run. Thirty riders tilted out of the saddle in view at one fence. All this is discreditable for a nation of horsemen, and should be rectified.

The fault, in the judgment of some experienced riders, is that the stirrup is hung so forward that it does not serve to support the body of the rider at his centre of gravity, but about six inches in front of it, where the feet fail to support the body, unless the body is leant forward over the stirrup fixings. This action of the rider decentralises him, and causes him to tilt forward over the forelegs of the horse, and to use his reins and hands on the horse's withers to effect a balance at the landing from a leap. This weight thrown on to the forelegs of a horse causes him to knuckle-over, or pitch on his knees, unless he pitches the rider over his head and breaks his neck, and thereby saves his own. For it is noticed that if the horse unseats his rider he saves himself often, but if the rider hangs on to the horse, both come down together, sometimes the man undermost.

As all correct riding is by knee-grip, it is obvious that the supplementary aid of stirrups should not interfere with this grip, which in all riders would be the same—at the middle of the horse's body from hip to shoulder, and at the middle line from back to belly. This part of a horse moves but little up or down or radially in turning, hence the graceful pose of the barebacked rider.

The legs need support, and the slighter the better, but it must not interfere with knee-grip, and need not.

The horsemen of the pampas of South America have a hole in the skin strapped on their horses, or a strap pendant from the girth for the leg support, with a hole in it for the toe. If a stirrup is used by them, it is still in the same position, though the stirrup is a block of wood with a hole in it mostly. These men are rarely ever unseated from the wildest horses in flight over rough ground.

So far, all horsemen agree that the stirrup hanging should be more central on the saddle. Why is it not? requires a view of a tree to convey an answer.

Modern trees are made in a way to prevent a central hanging, as will be seen from Fig. 1, of a saddle-tree with its stirrup-bar, which is fixed partly to the pommel point and partly to the belly of the tree, or that part which joins the pommel in front to the cantle behind. This is just three inches too forward at the least, and is the main cause of the mischief that results to both horse and rider.

Why fix it here? begets the question—Why make trees which render any other fixing impossible? Tree-makers know nothing about horses or riders; they make by the gross, and that is all they know or care about. The saddler buys these trees, and assumes they are right, and covers them.

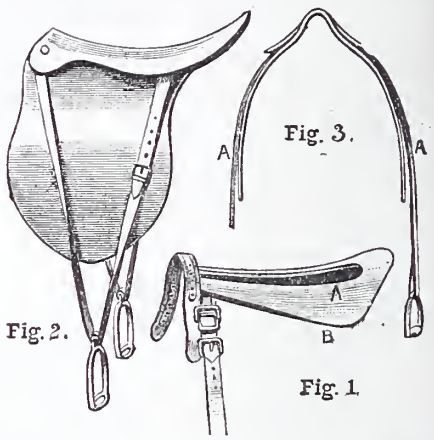



**Fig. 1.—Ordinary Saddle-tree with Forward Stirrup Leather. Fig. 2.—Double Suspension Stirrup Leather Fixing. Fig. 3.—Front View of Saddle, showing where Stirrup Leathers come under the Rider's Knee-grip at A, A.**

The rider buys the saddle, the groom mostly has an interest in approving of it, and the new thing starts on its break-neck career.

"Four men have been killed from that saddle," remarked an old helper in a stable. "Where's the fault?" was asked of him, and answered—"The bars are so forward, that the riders who lean on the stirrup get tipped out before they know it. The old style was to hang stirrup leathers on the bar of the tree three or four inches back, then a man was safer. Military saddles are made so."

However hung, the stirrup leather is right in the way of knee-grip, and forms a shifting wad of leather that prevents fair and easy gripping, as at A, Fig. 3.

The diagram given in Fig. 3 gives a sectional view of a saddle and stirrup from the front. A, A, are the three thicknesses of leather under the knee on each side, being one inch total thickness, to spread the legs wider and mar the perfect grip of the knees, often causing eczema inside the knees with old riders.

The purpose to be gained is of a twofold character in centralising the position of the stirrup and removing the leather from the knee. This has been accomplished in the simplest way possible by a rider who, as

soon as he thought of it, altered his hunting saddle, he being a workman as well as horseman.

The result was a saddle with the stirrup leathers parted so as to hang from two latches, one on the cantle point, the other on the pommel point, as is shown in Fig. 3, so that the grip of the knees comes between the two straps, and the knees are spread an inch less; an essential consideration for safe and comfortable riding, as has been satisfactorily proved by its use by one rider in 10,000 miles' riding in seven years, on young horses, without once having an accident to horses or rider.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### The Plane.

In our first lesson we tried to understand the plane, how to take it apart, sharpen, and put it together. We will now proceed a step, and try to learn to use it.

The learner must not work on a bench that is too high. When the board to be planed is in position, and the worker takes the jack-plane in hand ready to begin, a line drawn through his elbow and wrist should be rather lower than higher at the wrist, though if the fore-arm is level it will do.

Be sure not to attempt to take off thick shavings at the outset, and do not be disappointed—as so many are—if you cannot at once take a shaving off from end to end. If the wood has any hollow in it, it will be impossible to do so, and even if perfectly straight, very improbable that a beginner can do so. Amateurs at the beginning always plane too much off the end near the bench stop, and are too apt to move the arm in the arc of a circle. These errors must be avoided by careful attention. There is no royal road to efficiency in anything.

Try to plane the centre of your material rather than the margin, for if you have a good plane in good order, it is impossible to make the wood much too hollow or concave; whereas, however good the plane, careless use of it can and will make the work convex in every direction.

I know of no better lesson than to try and "face up"—that is, level—two pieces of stuff so that they will, when brought together, be in mutual contact. You will fail several times, but unless you persevere until successful, you need not try to make a piece of furniture or attempt anything difficult.

Just a word on the wood. If you try to plane too small a piece of wood, you will not make such good progress; the little pieces are sure to be made convex in length by a beginner. If experience may give advice, I would say take a piece not less than 2 ft. long—it may be more, in fact. The best results have been obtained by a class of boys under my superintendence by using pieces of wood 4 ft. long, 4½ in. wide, and 3 in. thick. The wood was best spruce, and being too stiff to bend, and affording a good surface, it was cheap material for practice.

When some facility has been obtained, the blade of a 12 in. square or a straight-edge should be employed, to test the accuracy or want of it.

It must not be forgotten that the edge of the plane-iron is necessarily "rounding," or the corners would dig in. The result is that the work tried across presents the appearance of a series of shallow curved grooves. The plane, therefore, must be so sharpened and used as to make these as little noticeable as possible. This is another reason for advocating finely-set planes.

If the 4½ in. by 3 in. stuff has been adopted for a lesson, it will be possible to take another step—that is, to learn what "winding" means, and how to correct it. Procure two pieces of wood equal in size—say, 12 in long, 1½ in. wide, and 1 in. thick. See that they are parallel. These pieces are to be placed across the work, one at each end; then by viewing both, bringing the eye down to glance from one to the other, it will be seen whether the two are in one plane. If they do not appear to lie in one plane, the surface is "winding," and opposite corners must be reduced till satisfactory.

These two lessons must be worked, as, taking so short a time to read, they might be thought unimportant; but upon complete mastery of the plane depends the success of the worker.

## A USEFUL METAL LATHE.

BY SELF-HELPER.

Receipt of Castings—Lining Out—Scribing-block—Drilling the Headstocks—Simple Drilling Press—Reaming out Poppet Cylinder—Grinding out Ditto—Fixed Headstock—Milling Cutter—An Offer—Preparing Cylinder Mandrel—Centre for Ditto—Cylinder Screw—Hand-wheel—Locking Handle—Fixed Headstock—Cones for Mandrel—Lock Nuts—Pulley—Thrust Bracket—Re-lining of Castings—Fitting Bases of Headstocks.

On the arrival of the castings, the first thing to be done is to look them carefully over, and if there are any lumps or rough parts they should be touched up with a chisel and an old file.

It is scarcely within my province in this present paper to describe all the operations of turning, chipping, and filing; but I hope that either myself or another writer in these pages will, in a future number, fully describe these operations, for the benefit of any who do not understand them.

The castings of the headstocks will then require to be "lined out." This is a very important matter in all engineering work, and would require far more space for its full treatment than I am able to devote to it here.

We will take the poppet, as embodying most detail, and proceed to line it out. The centre of the cylinder at the top is found at each end by means of a compass, and centre-punched lightly. It is scarcely necessary for me to describe a centre-punch, but I may mention that it is a piece of steel, as at Fig. 2, having one end coned down to a point, the angle of the point being, when perfect, 55°, and hardened.

The middle point, B (Fig. 1), across the base of the headstock is also found, and marked very slightly at each end. The casting is now laid on its side on some flat surface, and blocked up until the points A and B (Fig. 3) are exactly the same height. It will be found that the corresponding points at the other end will be nearly the same height also, but if the casting is not straight they may not be. In such a case I would have the two points representing the centres of the cylinder—that is, A, and the corresponding one at the other end—brought to the same level; then I would bring the two points, B, and its fellow at the other end, to such a position that one would be higher and the other lower than A. Now I would draw a line right round the casting, on a level with A, as shown. In these operations an engineer would use a metal surface which had been planed and scraped perfectly true to lay the casting on, and to draw the lines and gauge the heights would employ a scribing-block, one form of which is shown in Fig. 4. The pointer can be moved up and down the pillar, and secured at any point by means of a thumb-screw. It can also be drawn in and out and fastened by another thumb-screw. A flat piece of wood, or the top of the dining-table, would do for us instead of the surface-plate, and the heights could be measured by a compass until regulated, and the line drawn round by means of a parallel strip of wood planed down until just wide enough to reach from the surface of the table to A. The lines on the casting will show up much more distinctly if it is rubbed over with chalk before marking, and they can be made permanent by dotting them over at short intervals with the centre-punch and a light hammer. Measuring from A 4 in. along the line, another deep dot may be placed at ×, and a line scribed and dotted at right angles to the line A ×, which we will denote by C D. By standing the square on the table top this can easily be done. The same should be repeated at the other end. A couple of lines, E F and G H, should also be drawn, seven-eighths of an inch at either side of the centre line, and these continued along the base.

Until now the casting should not have been moved when it was once set. It may now be taken up and stood so that the line A × is vertical, and the line C D at one end and its companion at the other will be horizontal. They should be blocked up to the same level, and lines drawn at each side of the casting connecting them, so that there is a line right round the casting near its base. This will be a guide afterwards for us to chip and file down to.

Taking A for centre, a circle ½ in. in radius may be described and dotted at each end, and the lining-out of the poppet is completed. That for the fixed headstock will be done in exactly the same way, except that the lines E F and G H may be omitted. The operation of lining out may appear unnecessary and tedious to the beginner, but it is of the greatest service in supplying lines to which we will work afterwards.

Drilling next demands our attention, and it is here the amateur will find the greatest difficulty, if he has not a lathe or some suitable drilling machine at hand. I will suppose he has only the pillar press and hand-brace, which are to be found in most country smithies. He will require, for the present, two drills, one to bore three-quarters and the other seven-eighths of an inch hole. The chief difficulty is to enter the drill truly. To do this I would describe a number of concentric holes having A (Fig. 1) for the common centre. I would then start the drill, and if it did not work concentrically with the circles, cut a chip out in the direction I wished it to go with a tool like Fig. 5. This can easily be made of a piece of round steel. It is a sort of gauge, and is used like a cold chisel—in fact, the corner of a cold chisel could be made to act as a substitute. When the drill is driven in a little further, it will be found to move towards the part cut out, and by withdrawing it often enough it can be made to become quite central before the shoulders have entered.

The $\frac{7}{8}$ in. drill is to be put through the poppet cylinder, and the tyro will be pretty tired of drilling before it is done. When it is half through, the poppet should be reversed, and the remainder bored from the other end. For the sake of those who have not even a pillar drill to fall back upon, I give in Fig. 6 a plan which I adopted one time to bore a hole about this size with. A pillar was bolted to the leg of the bench, and a long arm pivoted to it with a strong bolt. Another pillar at the other end prevented the arm from swaying about, and also supported a lever by means of which the drill could be released. A weight attached to the end of the arm supplied the necessary pressure. My drill was made of $\frac{5}{8}$ in. square steel, a foot long, and a flat bar of iron, two feet long, with a square hole in the centre and a handle at each end, served to convey motion to it. Of course, the top of the drill was coned to fit a centre in a piece of iron screwed to the lower surface of the arm. A brace could be used in this affair instead of the handles. I do not recommend this in preference to a better machine; I just mention it to show what can be done, and perhaps it will be a useful hint to some readers who might find the drilling an insurmountable difficulty. If the holes from both ends meet pretty fair in the centre of the cylinder, it will be a great matter; but if they are out to any considerable extent, a round file must be used until there is a through hole without any violent projections. This must now be cleared out to size with a reamer. A capital reamer for the purpose can be made of a worn-out flat file, one inch wide. The teeth must be ground off, and the edges backed off to give a cutting edge, as seen at Fig. 7. The point will enter the hole in the poppet for a considerable distance, and act as a guide, and a couple of semi-circular pieces of wood should be employed to steady the tool. It might be held in the vice vertically, and the poppet revolved, if necessary, with a short lever passed through the space between base and cylinder.

The reamer should be worked right through, and the hole will then be found to be very nearly, if not quite, parallel and smooth. If we want to make a really good job of it, we should grind it out. This is effected by casting a cylinder of lead on a bar of iron, and turning it parallel for six inches, and a tight fit for the hole; then it should get slightly bigger—just a shade—and be parallel for three or four more inches.

The front part of the lead *lap*, as it is called, acts as a guide, and the remainder grinds out the hole as it passes in. This will make a far truer and rounder hole than to have the lap fit through at first, and then to press the cylinder which is being ground as equally as possible all round. The grinding is effected by smearing the lead with emery and oil, which is frequently replenished, and revolving it in the lathe. It is a more rapid operation than would appear at first sight. Of course, I need scarcely say that the smallest amount should be taken off by this means—only enough to true and smooth the hole.

I have thus been careful in describing the drilling and clearing out of the hole in the poppet, because it will be found, I think, the hardest part of the work to the beginner; and if he succeeds in producing a perfectly smooth and parallel hole concentric with the casting, he may hope to construct a very good lathe. No pains should be spared in this or in any other part of the work to go as near as possible to absolute perfection.

I now turn to the fixed headstock, which is to have two $\frac{3}{4}$ in. holes bored, one at each end, concentric with the bosses. These holes must be coned out to take the mandrel. The best way to do this is, I think, with a milling tool, which I represent in Fig. 8. It is a tool made from a piece of cast-steel, turned down to a long, conical point, and having teeth cut in its surface similar to those found in the common rose-bit. A spindle passes through a hole in its centre, and a pin prevents the tool from turning on it. The spindle is fitted to a brace or chuck, and, the tool being revolved slowly and pressed against the work, produces a beautiful coned hole, the exact counterpart of itself.

A loose cone at the other end of the spindle keeps the two holes exactly in the same line, which is a matter of the utmost importance.

The dimensions of a suitable milling arrangement would be as follows: Spindle, five-eighths of an inch in diameter and a foot long; mill, largest diameter one inch, length two inches; a quarter of an inch to be parallel, and the remaining inch and three-quarters tapering from an inch to three-quarters of an inch. The loose cone should fit the spindle nicely, and be of the same taper as the cutting cone. Most beginners would find a great difficulty in making a satisfactory milling tool, and so I am tempted to make an offer which is likely to be useful to many of my readers. It is to lend a mill to anyone of the subscribers to Work who is following my instructions in lathe making, for the purpose of coning out a pair of holes, on condition that he pays postage both ways, and deposits with me the value of the tool, as a guarantee for its safe return and careful use. I am induced to make this offer solely through a desire to help beginners, and can in no way gain anything by it.

When the holes are milled out, it would be well to give them a rub of a lap coned down to the proper angle; but I would avoid emery here, as it is almost impossible to get it out of the metal. The grit that is found in the bottom of a grindstone trough, or pounded whetstone, would be just the thing. I ought to have mentioned that the hole, when coned, should taper from an inch at the biggest part, to thirteen-sixteenths at the smallest, thus decreasing three-sixteenths of an inch in an inch and a quarter full.

We have now the handstocks bored and must prepare the mandrels. These are frequently made of good wrought iron, but I prefer steel, either Bessemer or cast. The poppet mandrel is a plain cylinder six and a half inches long, and an inch and a sixteenth in diameter, the extra sixteenth being for turning up. If it comes from the forge rough it should have centres drilled at each end and a cut taken off the entire surface. The ends should be truly squared also. Then it is to be mounted in a chuck and the end supported with a boring collar. In Fig. 9 I show it in the dead centre lathe as being the simplest. A block of wood is screwed against the pulley, a hole having been made in it to clear the centre. Then the lathe is driven, and a hole turned out carefully with a chisel in the centre of the block of wood. The mandrel is driven into this hole, and if it fits tightly it will be amply sufficient to carry it. The free end is supported by the boring collar, which is a plate having a conical hole that the mandrel will enter, but not pass through. This plate is attached to an angle iron, which is bolted to the lathe bed.

While the mandrel is thus driven into the lathe, an $\frac{11}{16}$ in. drill can be pressed against its end with the back centre, and a hole bored to the depth of about three-quarters of an inch; a smaller drill, one nine-sixteenths of an inch in diameter, can then be substituted and the hole continued for about five inches. The mandrel may then be reversed, and a hole a quarter of an inch drilled at the other end for a distance of an inch and an eighth. This hole must then, with a tool, be coned until it is three-eighths of an inch large at the outer end. This tapering would be done best by means of a slide-rest, and some would declare such assistance necessary; but I have often coned out holes by hand.

Having completed the holes, the centre may be prepared to fit the coned hole. It is of the best cast steel, and turned to fit the hole, and afterwards ground into it. The point is then turned while the mandrel is supported as in Fig. 9. The point of the centre should be coned to an angle of 55°, which is something smaller than that made by a triangular file in a piece of thin iron. It is a good test for the coned hole if the centre will run true after having been turned half round from the position in which it was finished; but even if it is a shade out of truth it would be well to be satisfied, as I question whether the hole could be made quite true without very good tools.

Having proceeded so far, the mandrel may be placed between the lathe centres and the outside turned to fit the cylinder, which has been prepared for it. If the centres of the working lathe are too small for the holes which have been made in the mandrel, these latter may be plugged with pieces of iron turned to fit. The centres on which the plugs were themselves turned should be used when turning the mandrel.

It will not be easy to turn this mandrel perfectly round and parallel. Very light cuts should be taken, and then the last touches given with a fine file, and emery cloth stretched on a piece of board. When the point enters the hole in the poppet, on no account should any more be taken off it, for if it is found to fit the end of the hole and not go in further, the hole cannot be parallel. If, however, care has been taken in the lapping operation, this will not be likely to occur. In really well-made lathes, this mandrel fits most beautifully. I know some in which it will not shake when it is out almost to its furthest extent, and we should aim at this degree of perfection in our work.

In Fig. 10 will be seen the cylinder mandrel fitted with its centre pushing screw and nut. The pushing screw is half an inch in diameter and of the length shown, with a collar in the place indicated. It is very often made with a square thread, sometimes left-handed, but this is a matter of fancy more than anything else.

The ordinary Whitworth thread does very well, and it can be cut with a set of dies, and chased to finish and make it true. The nut is turned to fit the $\frac{3}{4}$ in. hole in the end of the mandrel and secured with a couple of little screws as shown. The disc at the back of the collar is drilled, put on a mandrel between the lathe centres, and turned all over; four holes are drilled and countersunk, by means of which to attach it to the poppet. The hand-wheel is also bored and turned, and a little key or feather put in to secure it to the screw, a nut at the back preventing it from coming off. A small slot must be cut in the mandrel, as is seen

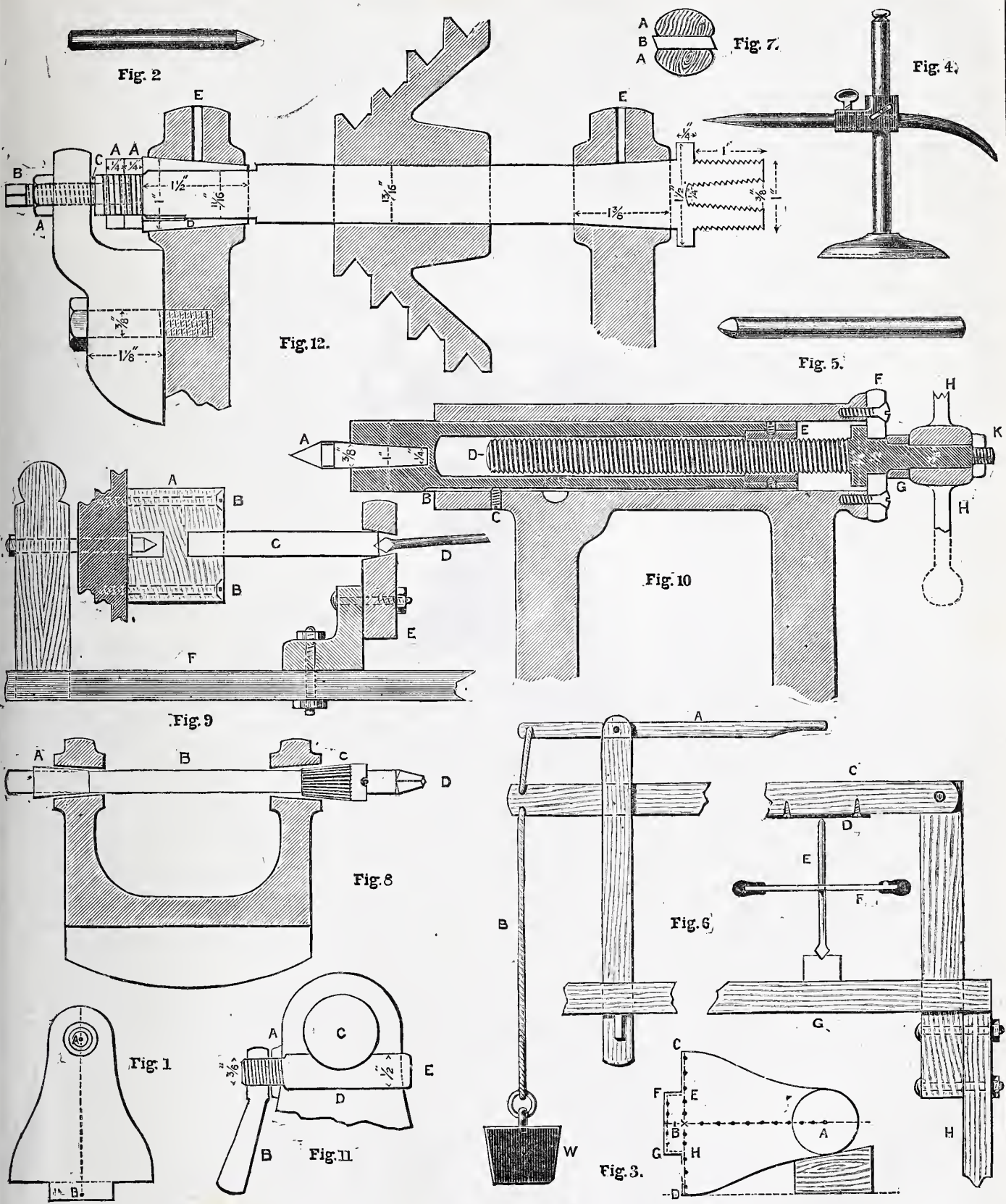



Fig. 1.—End of Poppet—A, Centre of Cylinder; B, Centre of Tenon. Fig. 2.—Centre-punch. Fig. 3.—Poppet laid for Lining out. Fig. 4.—Form of Scribing-block. Fig. 5.—Tool for drawing Drill Point so as to make it enter truly. Fig. 6.—Simple Form of Drilling Press, which can be bolted to any Bench—A, Lever to relieve Drills; B, Cord to Weight, W; C, Lever to press Drill; D, Metal Strap; E, Drill; F, Handle; G, Bench Top; H, Leg of Bench. Fig. 7.—Section of Tool for truing out Poppet Cylinder—A, Wood; B, Steel. Fig. 8.—Section of Fixed Headstock, showing Mill Boring Bar and Loose Collar—A, Loose Cone; B, Bar; C, Drill; D, Square for Brace. Fig. 9.—Mandrel Forging supported for Drilling—A, Wood Block; B, B, Screws; C, Mandrel; D, Drill; E, Boring Collar; F, Lathe Bed. Fig. 10.—Section of Poppet (half size)—A, Centre; B, Slot; C, Screw to fit Slot; D, Screw, ½ in. Pitch; E, Nut; F, Disc; G, Washer; H, Hand-wheel; K, Key. Fig. 11.—Transverse Section of Poppet through Clamping Bolt—A, Washer; B, Handle; C, Mandrel; D, Drill; E, Boring Collar. Fig. 12.—Section through Mandrel (half size)—A, A, A, Lock Nuts; B, Steel Screw; C, Hard Steel Plug; D, Feather; E, Tube for Oiling.

underneath, to engage the point of a screw which is made to project into the cylinder. This slot can be cut out without much difficulty by means of a cold chisel, an eighth of an inch wide, finishing with a small file.

The entire headstock is seen in section in Fig. 10, and Fig. 11 explains the action of the locking handle. A ½ in. hole is bored in the position shown in such a way that it breaks into the cylinder. A piece of steel is then fitted to this hole, and a hollow filed out to the curve of the mandrel; a washer and a handle turned from a piece of half-inch square steel serve to do the locking. It is a very efficient arrangement, and not difficult to make.

Fig. 12 is a sectional view of the fixed headstock, as Fig. 10 is of the poppet. The mandrel should be turned very carefully to the dimensions indicated in the figure. The loose cone at the tail end will require to be very carefully fitted. The hole in it, which is eleven-sixteenths of an inch in diameter, must be very carefully bored and lapped out perfectly round and parallel. It is to fit the mandrel "hand-tight," as some call it—that is, tight enough to be moved by firm pressure of the hand, but neither to shake nor fall off.

Before it has been brought to this state of perfection it should have been roughed down until it was nearly to the finished size; then, when put on its own mandrel and the lock nuts screwed up, it should be carefully finished until it will fit exactly the hole in which it is to run. The fitting of both cones of the mandrel to their bearings will be a tedious piece of work. The holes should be covered thinly with red lead and oil mixed to a thin paint; the mandrel and cone should then be put in place and turned once round by hand. If the cones are marked all over with the red lead they fit perfectly, but if not, the marked parts must be filed or scraped down in the lathe until the desired object is attained. The lock nuts should have a fine thread; gas threads will do very well, but if the work has been done satisfactorily hitherto, it would be worth while to get the mandrel nose and the thread at the back cut in a screw cutting lathe. I have represented the nose as an inch in diameter with Whitworth thread, but it may be made smaller, even as small as three-quarters of an inch. The centre is the same as that for the poppet, and the hole should be coned to the same angle, using the poppet centre to get the correct angle. The pulley is to be bored to fit the mandrel hand-tight, and then turned all over and the V's made. It is secured to the mandrel with a little key, as is also the back loose cone.

The little bracket at the back to take the thrust of the mandrel may be of wrought or cast iron. It is secured with two screws, and another of hard steel, towards the top, bears the end pressure. It works against a little bit of hard steel let into the end of the mandrel.

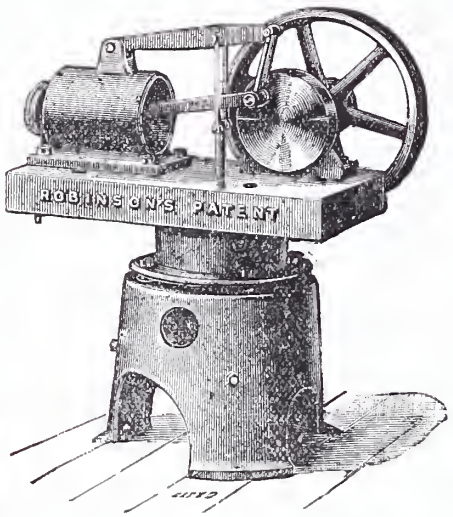
Having the mandrels fitted, the casting should be again lined out most accurately with their centres. If the mandrels occupy the place designed for them in the first lining out, of course the second will correspond with the first: but, if they are a little out, it can be rectified now. The bases of the headstocks are to be planed or chipped and filed to the lines, and the holes for holding down bolts drilled five-eighths of an inch in diameter, and the headstocks are finished. It would improve their appearance a good deal if the end surfaces could be turned smooth and true.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 86.—The Robinson Patent Hot-air Engine.

The Robinson Patent Hot-air Engine, which was invented by Messrs. A. E. & H. Robinson, and is made and supplied by Messrs. Norris and Henty, appears to be one of the most efficient and useful of all engines of this kind that has yet been placed on the market. The inventors and makers claim for it that it is a most useful and




Robinson's Patent Hot-air Engine.

thoroughly good motor for driving small machinery, and is now thoroughly established as a success in the hands of practical users. It is well adapted for amateurs and for professional workmen whose workshops are not on an extensive scale, and do not require an engine of considerable power to drive large machinery. Thirdly, it is absolutely noiseless and without smell. Possessing these essentials, and being in every respect safe and reliable, as a motor it is suitable in any place where small power only is required. Neither eccentrics nor cams enter into its construction, and the only valve to be found in the engine is that which is used to stop it. As there is no boiler, as in a steam engine, the anxiety that will always be felt, more or less, by those who use small engines which, as steam engines, must be provided with boilers, is altogether avoided, as there can be no fear whatever of an explosion. There are many cases in which no other engine could well be used than that which is represented in the accompanying illustration, as it will work for long runs, and therefore for long periods of time, without any attention whatever. There is no exhaust from the cylinder, in which only pure air is used, and this at a moderate temperature, so that very little oil is required. There is no internal combustion or ignition in the cylinder, so that the parts are not subjected to severe shocks, but a steady outward and inward impulse is given to the piston at each revolution of the engine. A minimum of friction and regular working is thus obtained. The cost of working this engine is very low, being only about a farthing per hour where coal or coke is used as fuel. But slight attention to stoking is required, and this can be undertaken by, and entrusted to, a servant or anyone who may happen to be about the place, as no particular skill is required. Gas can be used as fuel, but at a greater cost per hour: and, if gas be adopted, beyond oiling at starting, absolutely no attention is required for hours together. The cost of putting in the engine is very small, there being no special foundation required—in fact, on a reasonably sound floor the simple bolting down to counteract the pull of the belt is all that is necessary. The engine, as above shown, is No. 4 size, and then there are three smaller and two larger. The diameter of the cylinder is 5½ in.; the height, length, and width, taken approximately over all, are 2 ft. 8 in., 2 ft. 3 in., and 2 ft. respectively; its weight is 2½ cwt., and its power is reckoned as being 2-man or ¼-horse. It is fitted with a patent governor, which thoroughly controls the speed. There are no water connections to make with the engine, and there are no complications of mechanism to be found in its construction.

### 87.—"Discovery."

The monthly magazine which is now appearing under this title, and is published by Mr. E. W. Allen, is "devoted to invention, scientific discovery, and the application of science to industrial purposes." There are few readers of WORK, I think, who would not pick up much useful information which could be turned to practical service in the pursuit of any hobby or prosecution of daily employment. Correspondents have frequently asked for a good recipe for luminous paint. The following from "Discovery" seems to be good and cheap: "Take a few oyster shells, and having washed them thoroughly in hot water, put them into a fire for about half an hour. When quite cool pound them fine, rejecting the grey parts. Then put the powder into a crucible in alternate layers with flowers of sulphur; seal up the lid with a paste of sand and beer. When dry, place the crucible on the fire and bake for an hour; when cold, open it, and if any grey powder is still found, remove it. Then mix the remainder into a thin paint with fine varnish. Previous to applying, the article to be painted should have two coats of white lead and turpentine to form a body-ground for the luminous mixture."

### 88.—The Double-pointed Nail.

The Durrans Patent Nail Syndicate, Limited, have drawn my attention to a speciality in the ferm of a secret nail for dowelling and other purposes in wood-working, of which I should have frequently been glad to avail myself when jointing pieces of wood together edge to edge, for which purpose I myself have been in the habit of using the ordinary wooden dowelling peg, or, more frequently, a French nail or wire nail with the head taken off and a rough point made with a file in its place; and it is surprising how a wire pin thus formed will hold pieces of wood together when used at intervals along a joint, for I have found considerable difficulty in forcing two pieces apart when thus connected, so great is the tonacity of the wire. Their utility will be at once perceived, both by the professional workman and the amateur—for the former will see how they may be made available in cabinet work and joinery, and for effecting close and firm joints in laying floor boards and other floors, as in parquetry, in which a close, firm, and invisible joint is desirable; and the amateur will recognise its services in putting together shelving, pieces of wood of narrow width to form the sides of boxes, and other jointing work in the simple wood-working that he is accustomed to indulge in. For small work the nails are cut in four useful sizes—namely, ¾ in., 1 in., 1¼ in., and 1¾ in. The shape will be seen, and the mode of using it understood, from the accompanying illustration. It is made with a projection at A, or hammer-head, by which it can be driven home into one of the pieces to be jointed, the chisel edge at B readily making its way into the material under the successive strokes of the hammer, and the piece to be attached is then placed against the point that projects from the wood into which the lower half has been driven and blocked down. When used in connecting hard wood, holes for the points should first be made with a bradawl. They are, or ought to be, obtainable of all ironmongers.

Double-pointed Nail.

The Editor.

## SHOP:

### CORNER FOR THOSE WHO WANT TO TALK IT.

*In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTER FROM A CORRESPONDENT.

**Incubator.**—H. E. (*South Norwood, S.E.*) writes: "In WORK, p. 461, B. A. B. describes an incubator regulator. I am afraid he is dabbling in matters he doesn't understand, as anyone who has had much to do with mercury will know that under the conditions as drawn, the expansion will be practically nil, and quite useless for the purpose indicated. Pearson's regulator consists of a metal capsule filled with (I believe) the same liquid as used in my regulator described in No. 109, and also in the article you have in hand. The inventors are very jealous of their patent rights, and will take proceedings against anyone making or using infringements. Neither will they supply the capsules except with machines."—[Unless H. E. has tried mercury under the conditions indicated, he is not entitled to say it will be useless. Doubtless some other arrangement would do better, and, it may be, some other material than mercury would be preferable. It is scarcely fair to criticise too closely a reply, unless the question is known. It may be that the querist suggested mercury; it is used in several instruments where temperature increases its bulk, and where this fact is the feature of the invention. If the receptacle were narrowed in the part occupied by the float, it would be better—that is a matter for those interested to experiment upon; if the receptacle were air-tight, no doubt it would be an improvement, but it would be too dangerously near, being a capsule, besides which, to charge a capsule some volatile oil or spirit must be found to boil at about 103°, all which would be getting very near Mr. Hearson's patent. Anyone could find a liquid boiling at the temperature required if they tried. The sketch is only a suggestion, and if it had been a perfect invention it would have been very remarkable indeed. I may as well confess that my reply was written a long time ago, and that I think the arrangement in No. 109 is better, but it is much nearer the infringement. E. is kind enough to warm me about. He criticised MR. WALKER in the same way; I hope to see his incubator soon, and that it will be beyond all criticism.—B. A. B.]

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

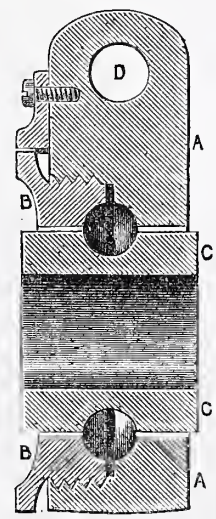
**Silver-plating Opera Glass Fittings.**—J. E. G. (*Carmarthen*).—As you have no practical knowledge of the art of electro-plating, I should advise you to send the opera glasses to a practical electro-plater or to an optician, and get the metal fittings silver-plated. As the body of the instrument is made of ivory, you would entirely spoil the colour of it by immersing it in a plating solution, and you could not silver the fittings without touching the ivory part with the solution. The fittings must be taken off, and this should be done by an optician. You will find instructions on electro-silvering in No. 112, p. 118, Vol. III. of WORK.—G. E. B.

**Electric Lighting.**—E. D. R. (*Camberwell*).—A small installation of two or three lamps in one room of a private house generally proves unsatisfactory to the owner. It is not large enough to warrant the use of a dynamo-electric machine and gas-engine or water motor to generate electricity for the lamps, and it is too large to be fed with current from a battery. A large battery will be necessary to work two or three lamps of sufficient power to light up a large room, and this battery will have to be cleaned and re-charged every day. I have yet to meet with a battery that will prove anything but an intolerable and filthy nuisance to a gentleman using it for supplying current to an installation of electric lamps. If you wish for the luxury of a few electric lamps on one or two evenings, on the occasion of a party, ball, or similar festive gathering, and can afford the luxury, I would advise you to hire the whole apparatus, with a set of accumulators, from such a house as that of Messrs. Cathcart, Peto & Radford. You will find all instructions on electric lighting in Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104 of WORK; the whole contained in Vol. II. I should advise you to read these articles before deciding on having the lamps.—G. E. B.

**Dynamo for Charging Accumulators.**—T. W. (*Bath*).—A set of *large* accumulators may be charged with current from a *small* dynamo, just as you *may* fill a large pond with water through a small pipe. Time will be required in both cases, and one will win if you have enough of it at command. But as a rule, those small machines supplied for the purpose of lighting one or two incandescent lamps may be said to be unsuitable to the work of charging accumulators. The volume of current from them is much too small, and the tension of the current too low to charge anything but a small accumulator, one or two cells at a time. Machines of the Siemens pattern, with only a two-part commutator, are specially unsuitable, because the cells are liable to discharge themselves across the brusher as soon as they get a full charge, even whilst the machine is running. This tendency to discharge may be partially obviated by making the slits on the commutator wider than usual, and altering the lead and bearing of the brushes so as to have them touching one half of the ring only when at rest. The castings advertised include those for the field magnets, armature, and bearings. These are all the castings required. All other parts are wrought iron, brass, and steel.—G. E. B.

**Series Dynamo.**—J. D. (*Halifax*).—As you get current from the machine when the fields are excited by current from a separate battery or machine, but none when the machine is set to excite its own fields, it shows that your arrangements are defective. As it is a series dynamo, you cannot expect any current from it unless you connect the terminals together, or place work of low resistance between them. If the wire connecting the terminals has a high resistance, or tho work has a high resistance, you will not get enough current through it to excite the fields; you may have reversed the polarity of the field magnets by sending current through their coils in the wrong direction. Try running the armature in the wrong direction also, and note the result. You may not, possibly (for I cannot say with certainty without knowing more about the machine than supplied in your letter)—you may not have the wire on the fields and on the armature in right proportion to each other. I do not think that the iron bed-plate would be at fault, or you would not get any results when the machine is separately excited.—G. E. B.

**Bicycle Bearings.**—H. H. (*Finsbury*).—It would be impossible for your correspondent to make ball bearings without the machinery specially made for the purpose, as the making of a ball bearing requires great accuracy. I submit a sketch showing Bown's knucklo-joint ball bearing in section. A is the body, B the screwing-in cap, C the sleeve for fixing to axle, D the knuckle joint for bolting to fork. This bearing is a patent, but the sketch will serve to show "how the side works."—A. S. P.



Sectional View of Bown's Knuckle-joint Ball Bearing.

**Hydraulic Cement.**—E. P. (*East Finchley*).—This material would be of no use as a cement for an aquarium, except for a bottom, after glazing. A recipe for aquarium cement has been repeatedly given in the "Shop" columns of WORK. Here is another:—Take ½ lb. of pitch, ½ lb. of gutta-percha, put them in an iron vessel over the fire (an old saucepan will answer very well), and melt together, adding sufficient turpentine to thin the mixture to a convenient consistency. In glazing with this cement, see that the glass is perfectly clean; the part where the cement will touch should be warmed by holding over a lamp, and when hot, smeared with the hot cement. The job requires doing quickly to ensure success.—C. M. W.

**Boot and Shoe Repairing.**—SNOB.—You want to know, and also think that many others are in the same situation, how to take off the soles when you start repairing. To deal first with riveted soles: I said, in my first article, wet the boots; if you did this they ought not to have, as you say, "literally fell to pieces;" but as that is the case, and after a second trial, too, I must own you really want setting right. I omitted telling you in my first article (as I have so seldom found it necessary, even where work was nearly to pieces, before starting upon it) that for taking the sole off a last can be put in to make a solid foundation to work on; then, after it is wet, the old sole can be prized off with a chisel, commencing at the toe, or the thinnest part: this will enable you to catch hold of it with nippers, and by this means pull off the sole with the nippers in one hand, and at the same time holding the under leather (welt, or runner, as they are often termed) down with the other. Then, should the under part still have a tendency to give way from the uppers, knock the sole back, so that it leaves the rivets sticking out, pull the rivets out with the pincers or nippers, and repeat the process till you have got the sole off without disturbing the boot, and then, before putting the sole on, the under part can be nailed down with a few short rivets to make it solid. Of course, if very long rivets have been used in the making or previous repairing, taking off the sole will, if you are not very, very careful, cause it to fall to pieces; therefore I want you to be careful, so that you will not be disparaged over so small a matter. Perhaps those you worked on had been worn rather bad, and thus made weak. This is one thing I have told you: that as your own repairer, never let them wear low—"a stitch in time," etc.—and the cheaper the boots, the more applicable this adage to boot repairing. For machine-sewn, you can follow the advice given in my next article—"Welting and Soling Hand-sewn Work"—which will also give you what you want to know about hand-sewn. I don't know how you got into such a muddle, but, any way, I will give you another system (for sewn work) which you will, perhaps, more readily grasp. When the lasts are in, and the boots wet, skive off the edge of the sole, not right through, or you may spoil the welt, but still deep enough to cut through the stitches, and cut their heads off. Then, as before, the toe can be raised or prized up from the welt; then the taking off the sole is an easy matter. I am glad you like the articles. I would advise you to look back to some of the questions answered in "Shop."—W. G.

**Book on Brazing.**—W. C. (*Paddington*).—I am not acquainted with a book treating of the different kinds of brazing, or that will give you some idea of how to do some jobs of brazing and soldering. You will find some good "Remarks on Brazing," by Mr. R. Alexander, on pages 664 and 797, Vol. I., of WORK. If you wish to know any more about the art, consult "Shop."—G. E. B.

**Sheet Metal Work.**—TINKER.—TINKER points out a slight error in size in reply to a query by BLACKSMITH (Vol. III., p. 120). It is a printer's error, due, no doubt, to bad caligraphy. Instead of "19¾ × 6¾," it should be 17 × 6¾. The size given would be for a 3 qt.—R. A.

**Garden Workshop.**—CHIPS.—I am rather afraid your ideas are too extensive for a garden workshop. You do not state whether the dead wall against which you propose to place it is as high, or higher, than the back of your shop, or if it in any way interferes with your neighbour's light. Should it interfere at all with the light or view that they may have enjoyed for any length of time, they have every right to stop its erection; and this can be done in a very friendly manner by writing a polite note to the powers that be. As to asking the permission of the district surveyor, as far as my reading and experience of the Act goes, he has no power to give you permission to build such a huge structure (for a back garden) of wood, and would at once condemn it. If you would reduce the size of the proposed shop, make it thoroughly independent, and put it on wheels, and shift it from time to time, to show that it was not a fixture, taking care at the same time not to offend your neighbour, you might get over the difficulty; but this is one of those things which depend so very much on circumstances. Many thanks for your suggestions *re* the Building Acts; but as they principally relate to matters outside the scope of an amateur or individual worker, saying nothing of the different ways in which each surveyor interprets them to suit the different contingencies to which they refer, I always find that it is better to let the surveyor read the Act, which is his business, and the tradesman to conform to his reading, which he generally has to do, no matter how well he may think he knows the extent of the Act.—E. D.

**Fairy Bells.**—F. R. H. (*Rochdale*).—I can assure F. R. H. that it is a real pleasure to help persons of his temper. He asks if I can procure him the material necessary for the construction of the instrument. As any country carpenter can supply the wood, I presume he refers to the strings and pegs. It occurs to me that there will be multitudes of readers of WORK situated practically the same as F. R. H., who lives on a moor, a long way from a town, which is visited but rarely. I cannot help remarking, in passing, that WORK must be indeed a boon to persons so isolated; and, for their benefit, I would say that Mr. Beach, Lime Street, Preston, has informed me that he will be pleased to supply small pegs at 1s. per dozen, and wire (Nos. 10 or 8) at 6d. per ring. Lest a mistake should be made, I would say that the numbers given are those known amongst pianoforte makers, and are not the same as B.W.G. I would further say, if it would help anyone, that, though I am not in business, being a minister, I shall be glad to supply anyone with such material at the price named, and postage, as well as F. R. H. A ring of wire contains sufficient to string several fairy bells.—O. B.—[F. R. H.'s suggestion that all contributors should imitate O. B., and give the probable cost of the articles they describe, is a good one, and might, with advantage to our readers, be adopted by all who answer questions.]

**Telescope Lenses.**—W. R. (*Oswestry*).—Your letter did not reach me. None of the lenses in a 36 in. telescope can in any way be utilised for a photographic camera. You will have to buy a proper lens.—E. A. F.

**Advice to a Draughtsman (Furniture, Education in).**—TAPESTRY.—You are promised a berth in a short time as draughtsman and salesman in the same firm for which you are at present shorthand writer, and you want a little bit of advice and information. Your letter has been handed to me, and if, after you had read this reply, you were to see me, I feel convinced you would be inclined to doubt my sincerity; for I gather from your letter that you are a *young* man, and I am but the same myself. However, if I am not experienced enough in the wicked ways of the world, and enabled to give you *fatherly* advice, I can, at least, give you a few

*brotherly* tips; and when we recollect that Scripture tells us our Saviour "sticketh closer than a brother," it would almost appear that the brother is the ideal of friendship in preference to the father. You must not place too much confidence in book-learning. By this I do not mean that it is advisable to depreciate *alt* such study; but you will find, if you are continually craving for more books which will stock you with information, that you will never be satisfied with your own abilities, and thus, probably, defer personal endeavours until you have perused *alt* the books that come within your reach. As you have purchased, and, no doubt, continue to buy, "Cassell's Technical Educator," and now take in WORK, you should be in a position to do something yourself in the course of a few months, with the addition of a few more publications; granting, of course, that you are a proficient draughtsman, and give your heart to your work. I am afraid you will find that the position of salesman, added to that of draughtsman, will detract somewhat from the latter profession, by reason of the chances always remaining of your being continually interrupted in your drawing; which fact may or may not disturb you, by always lying in the background of anticipation. But, there—I do not know you personally, so must not give way to anticipation myself. To be a good designer, you must strike out a path for yourself, in being original to the greatest extent that you can. There is no need to work always in one groove, and design articles only of one class, such as ordinary mechanical, folding, or combined. The readers of WORK are familiar with the three last classes of designs from my pencil, or pencils; but I am frequently designing something quite new in cabinets, sideboards, bedroom suites, chairs, tables, etc., and number among my patrons many a large firm in London. In the few years I have been in the furniture trade, I have been made aware of the fact that a mere draughtsman will be of no value in a few years' time; the demand will be for designers; but there is not much to fear by contemplating a strong competition among the latter, as, although a man may be a good draughtsman, it does not follow that he will ever be a good designer; for—although, perhaps, I really ought not to say it, and would not, were it not for the fact that I am asked by you for advice—good designers must "have it in them." Another particular thing you must be careful to study well, and that is—colour. I am looking forward to the day when every book, such as WORK, shall be embellished with diagrams and drawings in colours, tinted and shaded artistically—not the mere uniform tint over an engraved sketch, such as is common now. You will find the study of colour in application to furniture almost as difficult to overcome as the study of drawing; but aim at an end, and you will surely reach it. As regards books of designs of first-class furniture, the best "tip" I can give you is to obtain, in addition to the publications mentioned below, catalogues from as many firms as you possibly can; which task, I can assure you, you will find a most difficult and troublesome one; for a firm usually, after posting the catalogue, posts a traveller, and the catalogue has to be returned, unless the traveller's good humour is courted. An occasional peep into old bookstalls will reward you, as it has me; for you will often pick up books of work from the pencils of old designers, which will give you a true foundation on which to build your ideas. Observe all around you. If you see anything at all striking, retain it in your memory. We can be original, but our ideas cannot be entirely new; it is the form in which we apply them which gives the originality. For instance, one part of an article the Editor has in hand (which you will recognise when published) was really suggested to me by the well-known boat-swings, so arranged in groups of four, that they work round, up and down, and yet each always retains its horizontal position. Sometimes an idea occurs to me out of my own head; but I feel sure that, were search made, the same idea would be found, applied differently, in a different form of construction. By all means subscribe to *The Cabinet Maker* (Mr. Benn, City Road, London) and *Furniture and Decoration* (Messrs. Smith & Botwright, 6, Eldon Street, Finsbury, London, E.C.), each 6d. monthly, and both first-class books, exclusively, as their titles indicate, devoted to furniture and furnishing. *The Furniture Gazette* (Messrs. Wyman and Son, Queen Street, Holborn, W.C.) will also help you. And you may get some architectural ideas from *The Builder* and *The Building News*. Get an index of Vol. I. of WORK, and select from it those numbers in which my fellow-contributors have given instructions in joinery. I daresay you possess Messrs. Cassell & Co.'s catalogue; in addition, get Messrs. Blackie & Son's catalogue, from Old Bailey, London, for drawing and colouring. Always satisfy yourself in your work, and you will be sure to satisfy your employers. Become on friendly terms with the masters and men in as many cabinet-making shops as you can: you will find the British workman an obliging and friendly fellow. Art schools are all very well; but my opinion is that the learners must, naturally, always work in the same groove, and become so used to it as to be too dilatory to strike out a path of originality for themselves. I have replied to you at some length, because I feel interested in you, and would endeavour to make your personal acquaintance, were you resident in London instead of in Bristol. I feel convinced that the Editor will not condemn me for so long a reply to a struggling young fellow, nor for asking you to write and tell of your progress in a few months' time. I wisb you well.—J. S.

**Valve.**—A YOUNG ENGINEER.—I suspect the reason why your valve face does not stick to cylinder is because the opposed faces are not scraped perfectly clean. Clean surfaces, covered with a thin layer of solder, raised to the proper temperature, but not overheated, and then pinched together and allowed to cool, cannot fail to adhere. —J.

**Use of Cardboard.**—A. E. R. (*Kingston*).—The variety of fancy articles which may be made from scraps of cardboard is almost endless. Among light occupations, few, perhaps, are prettier or more interesting than making architectural models in this material. The appliances needed are few, beyond scissors, a penknife, and gum. The block form of the building is usually glued together in thin wood, which is pierced with openings for windows, doors, etc.; this is coated with cardboard, bits being gummed upon it to form buttresses, pinnacles, mullions, traceries, etc. Wherever right angles occur, they are formed by scoring the card half through and bending it. Glass is fixed in the window-openings, and on this the tracery, cut out in cardboard, is gummed. Any moulding, however complicated, may be imitated by cutting out in card, and gumming one member of it over another. The effect of carving is best got by a little lining in Indian ink. With merely careful and patient work, admirable representations of buildings may be thus produced. Cardboard models may either be left white, or coloured to resemble the actual buildings. Ruins may be prettily imitated by vencering with sand-paper, marking out the stones, etc., with black or brown transparent varnish colour, and gumming on dried moss to represent ivy.—M. M.

**Labyrinth Puzzle.**—P. C. N. (*Shrewsbury*).—As merely application for patent has been made, there will as yet be no means of ascertaining the nature of the rival invention. P. C. N.'s idea is certainly ingenious, and, I should think, worth some little risk. In so simple a case, he might well apply for provisional protection without employing a patent agent. He would, of course, specify for "Improvements in Labyrinth Puzzles." Perhaps he might find some tougher composition in which the lines could be impressed better than the fragile one named, or some other kind of ball desirable; and would do well so to frame his specification as to include such variations. The *design* of the labyrinth should be protected by registration, fee 10s. If P. C. N. will cast his eye over the recent columns of "Shop," he will find there the address of an agent who communicates between inventors and manufacturers. Perhaps, when protected, P. C. N. might do well to put himself in communication with the rival above alluded to.—C. C. C.

**Drills.**—W. J. B. (*Sidbury*).—I am sorry that I cannot say certainly where the diamond drills are to be procured, not having had occasion to use them. But try Holtzapffel, Charing Cross; Pfiel, John Street, Clerkenwell; and Morris Cohen, Kirkgate, Leeds. To make and harden small drills, proceed thus: Procure the best possible steel wire; sometimes large sewing needles are used for the smallest. Draw the temper by making red-hot and cooling slowly; flatten the cutting end with a blow or two of a heavy hammer. The fewer the blows the better, because they tend to render the steel brittle. The cutting facets are then shaped with a file or on a hone. These small drills are usually hardened and tempered at once by heating them to a red colour, and plunging them into the body of a wax or a tallow candle. They may be heated on a piece of charcoal with the blowpipe, or on a red-hot iron bar. The cutting-point only should be hardened. Drills that are not very small require to be first hardened, and then tempered by the methods usual with engineers' cutting tools.—J.

**Model Horizontal Engine.**—F. C. (*Cardiff*).—It does not appear, definitely, of what parts you require the sizes. You say you have the "cylinder, etc." The "etc." may mean anything, or include everything. However, the following proportions may be of service to you, and any others you may require I shall be glad to give if you write again:—

| | |
|---|---|
| Piston | $\frac{1}{8}$ in. thick |
| Piston-rod | $\frac{1}{4}$ „ diameter |

(The length must be sufficient to clear the gland by about $\frac{1}{8}$ in. at least.)

| | |
|---|---|
| Connecting-rod, at ends | $\frac{1}{8}$ in. diameter |
| „ at centre | $\frac{3}{16}$ „ „ |
| „ | 4 „ long |
| Piston-rod crosshead | $\frac{1}{4}$ „ wide |
| „ | „ long and high |

(Groove out $\frac{1}{8}$ in. wide and $\frac{1}{16}$ in. deep top and bottom for guide-bars.)

| | |
|---|---|
| Guide-bars | $\frac{1}{4}$ in. wide |
| „ | $2\frac{1}{2}$ „ long |
| „ for $\frac{1}{8}$ in. of central width | $\frac{3}{16}$ „ thick |
| „ for each $\frac{1}{16}$ in. of side do. | $\frac{1}{8}$ „ „ |

(With $\frac{1}{8}$ in. diameter distance bolts at ends.)

| | |
|---|---|
| Valve-rod | $\frac{1}{16}$ in. (full) diameter |

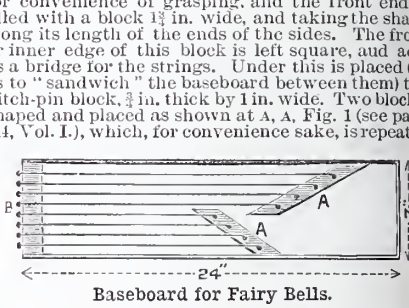
You will, of course, lay the lines down on paper before making the model. The travel of slide-valve and throw of eccentric will depend partly on width of port. I cannot give you the length of piston-rod, because I do not know length of gland or how much clearance (over the 2 in. stroke) you have in your cylinder; but you should find no difficulty in setting this out.—F. C.

**Chiffonier.**—A. W. M. (*Liverpool*).—The design you submit for chiffonier is not of sufficient merit to publish in WORK. If you send your full address, and a stamp, the MS. will be returned to you.

**WORK Numbers.**—INDEX.—The pages you require cover so many numbers, that it would be better for you to buy Vol. I. of WORK, containing a year's numbers.

**Wood Screwing Tool.**—W. H. N. (*Oldham*).—This is one of Peugeot Brothers' tools. Any tool-maker will procure it for you.

**Fairy Bells.**—CORKONIAN.—If CORKONIAN will turn to page 814, Vol. I., of WORK, he will find drawings of "fairy bells" which will help him very considerably in his construction of this instrument, which was originally known as "Oxford Chimes," and the essential character of the tone of which is the floating, waving quality imparted to it by the method of playing, viz., grasping it firmly with both hands, and swinging it about from side to side or in circles, while the notes are being plucked *with the thumbs*. This character is entirely lost by the instrument being placed on a table or fixed rest while being played, it being then, although still very sweet, very little, if any, better than the tone of a Prince of Wales's harp or toy zither. In the drawings above referred to, one of the original or eight-stringed instruments is shown; but there is nothing to prevent CORKONIAN making one of ten, twelve, fifteen, or, in fact, as many strings as his hand is large enough to cover, or his muscles strong enough to swing; bearing in mind that the more strings there are, the wider and longer must the instrument be, and the heavier and more unwieldy must it become, if the character of its tone is to be retained. The one shown in the drawing consists of a baseboard of pine, 24 in. long by 7 in. wide, and $\frac{5}{8}$ in. thick, and having sides and back end of the same material, about 2 in. deep, which thus forms a shallow box or tray. The sides are shaped as shown for convenience of grasping, and the front end is filled with a block $1\frac{3}{4}$ in. wide, and taking the shape along its length of the ends of the sides. The front or inner edge of this block is left square, and acts as a bridge for the strings. Under this is placed (so as to "sandwich" the baseboard between them) the hitch-pin block, $\frac{3}{4}$ in. thick by 1 in. wide. Two blocks, shaped and placed as shown at A, A, Fig. 1 (see page 814, Vol. I.), which, for convenience sake, is repeated




Baseboard for Fairy Bells.

here, occupy the interior, and are each $1\frac{1}{2}$ in. wide and $\frac{3}{4}$ in. deep. Observe, these two latter are placed in *opposite* diagonal directions, so that the shortest string may come in the centre. If they were placed in the same line, the shortest string would come on the outside, and the first part of the scale would have to be played backwards. No bridge is necessary on the front of these blocks, as the strings are wound round the wrest-pins so as to remain quite clear. All these blocks should be made of clean beech, and each should be planed perfectly true on the under side, so as to form a thoroughly good joint with the baseboard. If this is done, no screws will be necessary; although it would be safer, perhaps, to use a few in the event of the instrument being exposed to damp. Having fitted your wrest-pin blocks, mark off the length of each into four, five, or six equal parts, according to the number of strings you intend having (allowing $\frac{3}{8}$ in. in width on the baseboard for each additional string), and leaving 1 in. clear of the block at each end; and then, on these marks, bore the holes for the wrest-pins, which are ordinary piano pins, and must fit tightly. The hitch-pins are ordinary round-headed screws, $\frac{3}{8}$ in. long, and their position is determined in the block, into which they are to be inserted by dividing it into an equal number of spaces corresponding with those in the wrest-pin blocks. A cover, 18 in. long (which should be made to slide in and out *from the front*, or may be screwed on), must be provided, and should be of $\frac{1}{4}$ in. mahogany or cedar, with a brace, $\frac{3}{4}$ in. wide and $\frac{1}{4}$ in. thick, screwed and glued across its top front edge, to prevent warping or splitting. In this cover should be cut two *f* holes, which should come directly over the wrest-pins, and permit of tuning the instrument without withdrawing the cover; this latter operation being only necessary when a new string has to be put on. Previous to stringing up, size and varnish the inside with good spirit or copal varnish, and, if you wish it to look well, French polish the outside. This, of course, is optional. In stringing up, the eyes should not be twisted, but should be made thus: Fix a wire nail or peg, slightly larger than the hitch-pin, in a vice, and, taking the string in the left hand, grasp the end with the right, and take a turn round the peg, and then two turns round the string itself, close up to the peg; then cut off the free end of the wire, so as to leave a "tail" $\frac{1}{4}$ in. long. This tail comes flat on the block, and is quite sufficient to prevent slipping, and at the same time it presents no rough or jagged end to injure the hands or dress. When tuning, roughly pull up to within a note or two of the pitch required, and afterwards gradually raise to about half a note above; then, with a piece of wash-leather, rub briskly up and down each string with a moderate amount of pressure. This will stretch the wire, which should then be pulled up again to pitch and left for an hour, after which it may be put into proper tune, remembering that

the highest note is the right-hand centre one, and that the first half of the scale goes to the right hand, and the second half to the left, from the left-hand centre note. Everything necessary for the construction of these instruments can be obtained of Messrs. Chilvers & Co., 10, St. Stephen's, Norwich. —R. F.

**To Mount Maps or Plans on Linen or Calico.** —ONYX.—Tack, very tightly strained, on a piece of board, or, if very large, on a frame, a piece of calico or linen, of the requisite size, allowing an inch and a half margin beyond size of map. Give this a good coat of strongish size. When nearly dry, take your map; sponge the *back* with clean water. When well damped through, paste with well-strained paste, made with a pinch of alum, as before described in our columns; then lay down on canvas, pressing all over with roller or clean linen cloth. When dry, it can either be cut out and framed, or sized and varnished and mounted on rollers.—F. B.

**Painting on Glass.**—S. E. R. (*Rye*).—The glass used by glass painters will stand the test as recommended for silver, if you take the precaution to warm the glass gently, at first, instead of plunging direct into the fire. The very thin glass is that used for microscopic slides, but its very thinness is against its use in large pieces. Any good firm of glass merchants, such as Hetley, Soho Square, would supply you with what you require, and would also undertake to bend glass for you. The silvering can also be done by such firms; and probably the process you mention as a German one is the one used by London firms. Great improvements have been made this last few years in amalgams for silvering glass, quicksilver being more sparingly used than heretofore. Quicksilver itself will not stand a great heat, as it becomes a vapour if subjected to severe heat.—F. M.

**Wood Carving Manual.**—P. 2. (*Nottingham*).—P. 2. is recommended to write to the School of Wood Carving, South Kensington, enclosing 1s. 1d., and ask for the book to be sent him entitled "Hints on Wood Carving for Beginners," by E. Rowe.—W. E. R.

**Wood Carving Book—Covers for WORK.**—EDGAR L. R. (*Oxford*).—E. Rowe's "Hints on Wood Carving for Beginners" will be found most useful, and can be had post free for 1s. 1d. from the School of Wood Carving. If you want designs, write to B. T. Batsford, Publishers, 52, High Holborn, and ask them to send you their list of books on wood carving. They sell very good photographs in a folio of Signor Prullini's work. And from the School of Wood Carving you can get a folio containing 18 plates of photographs from carvings in the South Kensington Museum for 13s., post free, or single plates 9d., post free. F. Miller's "Wood Carving," published by Wyman & Sons, Great Queen Street, W.C., is a good, useful book on the subject. Covers for binding volumes of WORK can be had of any bookseller, or of the publishers, Cassell & Co., Limited, London, E.C.—W. E. R.

**Electric Bell Failures.**—A. W. S. (*Enfield*).—As your bells ring in dry weather, but fail to ring in wet weather, it shows that you have fixed some metal parts on direct to wood, instead of fixing them to a metal base. As the wood absorbs moisture from the damp air in wet weather, it swells, and alters the adjustment of the two metal parts fixed to the wood base. The defect may be on the bells, but is more likely to be in a push or a switch of bad design or construction. Such hard woods as teak or box should be employed in switches and pushes, and the contact pieces of metal must be furnished with a spring, to take up slight alterations in adjustment caused by the wood swelling or shrinking. —G. E. B.

**Netting Needles, Twine, Cotton, etc.**—G. T. (*Old Shildon*).—Ironmongers, dealers in fancy goods, and drapers, will generally supply or get for customers all the requisites for netting. Oiled twine, as used in making herring nets, may be got through any dealer in fishing tackle, of which there are generally one or two in each town.—G. E. B.

**Electrical Matters in Back Numbers of WORK.**—J. S. (*Kirkcaldy*).—As a mere list of the back numbers wherein papers on electrical matters have appeared would fill one column of "Shop," I hope you will be so kind as to excuse me the task of writing it. An index to Vol. I. will show you that there have been very few numbers in which there has not appeared some paper on electrical matters, or some useful reply in "Shop" on the same subject.—G. E. B.

**Galvanic Battery.**—J. S. (*Kirkcaldy*).—After all this time, I learn from your last letter that the thing you desire is not a galvanic battery but a medical coil. It is true that a coil must be worked by a galvanic battery, just as a steam boiler will be needed to work a steam-engine; but the battery will be useless without the instrument named a coil, as you could not get a shock from the battery alone. Instructions and illustrations showing how to make such an instrument as you require will take up too much space in "Shop."—G. E. B.

**Patent Agent.**—A. W. G. (*Jersey*) will probably, since the date of his letter, have read in "Shop" the address of a firm of London patent agents whose professional reputation is, we believe, beyond question. If not, we must ask him to refer to our answer to W. G. S. (*Bristol*) in a recent issue.—C. C. C.

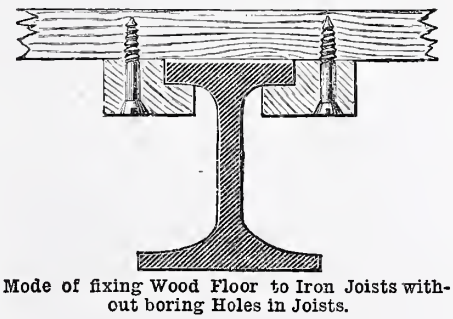
**Sample of Red Wood.**—E. L. H. (*Liverpool*).—The sample sent is a piece of padouk wood, and comes from India, most of it being brought from Calcutta. It is much used in the place of mahogany, being richer in colour, and, if grown on a favourable soil, of splendid figure. It is imported in planks of about 4 in. thick, and up to about 24 in. wide. It is very hard working, but gives great satisfaction when finished. The price is about the same as mahogany, and can be bought at many of the London yards.—A. J. H.

**Book on Locks.**—C. H. C. (*Pimlico*).—I do not know of any book published relating to locks and keys. The steel wire used for picks is usually about 11 or 12 W. G., tapering towards the end. It would be better to purchase them than attempt to make them. The cost is about 6d. each.—T. W.

**Stationery Holder.**—M. A. (*Suffolk*) asks for a full-size design for the Stationery Holder given in "Shop" supplement of No. 66. It is impossible for contributors to accede to such requests as these, involving, as they would, an expenditure of much time and trouble.

**"Shop" Insertions.**—L. B. (*West Bromwich*).—No charge whatever is made for any communication appearing in "Shop." You and others may make any remarks which are likely to be of service to readers of WORK, and, if of value, your communication will be printed, as a gratuitous contribution, in Sections 1 or 4.

**Laying Warehouse Floor.**—A. F. R. (*Birmingham*).—The question put has attached to it very difficult conditions, which, for the benefit of other readers, ought to be stated: Boards, 11 in. × 3 in., not to be reduced; no nails on surface; provision made for repairs; and to be ploughed and tongued; joists of iron, 3 ft. between centres, and 5 in. wide on top flange; and no bolt-holes are to be made in the joists. I fear that A. F. R. will have to modify one of these conditions, for there is to be provision for easy repair, which is impossible with ploughed and tongued work, especially as the tongue generally used is iron hooping. If A. F. R. will *rebate* the



**Mode of fixing Wood Floor to Iron Joists without boring Holes in Joists.**

under edges of the flooring, he may have a strip to exclude dust and draught; but it is, I admit, inferior to an inserted strip in a groove, as in the usual manner. Seeing, however, that the floor is 11 in. × 3 in., I should not insist on easy repairing. Few warehouses survive fire-risks long enough to require repairs to so stout a flooring. If the load on the floor is fairly uniform, fixing might be dispensed with; but fixing adds to the strength of a floor very much, and the simplest plan, without making holes in the joists, would be to make some rebated strips (3½ in. × 2 in. would do), and screw them underneath. Of course, I am assuming room enough to admit of this, which is probably the case. The strips sketched might be put on every or on alternate joists.—B. A. B.

**Thermometer and Barometer.**—IN DOUBT.—Your difficulty arises from the circumstance that the imprisoned air varies in volume, not only in proportion to its temperature, but also in proportion to the pressure to which it is subjected from time to time, one of these factors—the temperature—being under your control, the other not so. Your letter shows that you are unacquainted with the laws which govern the volume of gases, one of which is that the volume is directly proportional to the pressure acting upon the gas under observation. For instance, a volume of air—which is a mixture of gases—measuring exactly 1 cubic ft. at the normal pressure of about 15 lbs. per sq. in., would only occupy one-half that space under a pressure of 30 lbs. per sq. in.; whereas it would occupy double the space were the pressure decreased to 7½ lbs. per sq. in. The pressure of the atmosphere is constantly varying, and, consequently, the bulk of imprisoned air contained in your apparatus varies also, independently of the temperature; hence the corrugated disc—the most yielding part of the chamber—rises to different heights on different days. You might overcome your difficulty by filling the chamber with some liquid, such as water or alcohol, or a mixture of these if the boiling-point of the liquid chosen be in excess of the greatest temperature required; but you must not lose sight of the inflammable nature of alcohol. Would a metallic thermometer suit you? If so, such an article may be readily made and adjusted to act at any desired temperature, it being only necessary to take two long thin strips of brass (or zinc) and steel —one of each—say, 1 ft. long, ⅛ in. wide, and 1/32 in. thick, and carefully rivet them together at intervals of half an inch. Such a compound bar will *bend* under the influence of heat, and, if it be fixed by one end in a vertical position, the fixed end uppermost, the free end will move to and fro as the temperature varies; and you could readily arrange matters so that contact would be made at any desired temperature. If the heat required be not sufficient to melt the solder used, the two strips may be soldered together throughout their entire length; but in this case you will have a curved instead of a straight combination, on account of the unequal expansion caused by the heat applied whilst soldering. The curvature may, however, be corrected by placing the strip, hollow side uppermost, on a block of hard wood, and applying the "pene" of a light hammer in a succession of light blows across the strip, the entire length being submitted to this hammering, until the strip has been sufficiently straightened, when the hammer-marks should be erased by the application of a fine-cut flat file. You will, of course, understand that the entire length of the compound metallic strip must be submitted to the temperature to be measured.—QUI VIVE.

**Perfect Safety Bicycle.**—E. G. F. (*London, W.*). —A machine similar to Fig. 3 (see WORK, No. 66, Vol. II.) is manufactured by Humber & Co., Limited, of Holborn Viaduct. There must be other makers, but I cannot call to mind any others.—H. B. P.

**Micro. Mounting.**—J. P. (*Brighouse*).—The thin metal caps referred to for securing cells for mounting semi-opaque objects, as used by Mr. Enoch, may be obtained from most of the leading opticians who deal in micro. specialities, or from Messrs. Thompson & Capper, 4, Lord Street, Liverpool.—A. T. S.

**Incubator.**—L. G. W. (*Barnsbury*).—I should strongly advise you to send for Hearson's little manual, entitled "The Problem Solved," price 1s. As you have one of their incubators, the manual would be of special service to you. As to making a regulator to suit Hearson's Incubator, I have no doubt that it is beyond the abilities of an amateur. If I could be certain of the exact ingredients of the capsule, I would not advise anyone to make one, unless certain as to the ability of the worker to do the necessary soldering. Probably, the liquid used is some volatile spirit, or ether; in any case, its use is the special subject of Mr. Hearson's patent, and the company sell all the fittings at very moderate prices.—B. A. B.

**Piano Making.**—J. M. (*Midhurst*).—You seem to be in a little difficulty, but I think I shall be able to set you right. The lines made on p. 452 are not intended to show the setting-out of the strings, but are merely the bracings. The measurements are for a 7-octave piano. The back is quite wide enough if you have made it 4 ft. 2 in. Take the measurements on p. 502, second column, 41st line. Your first note will be 2½ in. from the treble end, and your last note 47½ in. This will leave you 2½ in. from the last bass note to the outside edge of your back. I expect your compasses have gained a little with moving them. Contract your compasses a shade, until you get the 85 notes within the limit of 2½ in. from each side of the back. Be careful to put your scale to the bottom edge of wrest-plank (see p. 565, third column). I think you will surmount your difficulty with a little patience. If you have got on so far, I am sure you will be equal to this. You will see on p. 502, second column. Glue all edges, except the bottom. This will answer your other question.—T. E.

**Cassell's "Popular Educator."**—W. B.—Vol. III. is now complete, and can be had of any bookseller, or of the publishers, Cassell & Company, Limited, London, E.C.

**Camera.**—I. T. W. (*Tamworth*).—The camera you name is very good, considering the price. The material and workmanship in the higher-priced instruments by the leading makers are, of course, superior, and will stand very much more wear and tear. *Any* plates may be used in *any* ordinary camera, provided they are the right dimensions. The make of plate has nothing to do with it. The detective camera mentioned is little better than a toy, and the work obtained by it must be judged accordingly. Occasional articles appear in WORK on this subject.—D.

**Camera.**—I. H. (*London, E.*).—Make a pattern in paper as a guide. If the measurements of the two ends are correct, lines drawn from the extreme corners of the larger to those of the smaller end will be quite right to fold by. The zigzagging of the bellows is, of course, horizontal. The principal difficulty, which is soon mastered, is pinching the corners into form, to make the bellows work smoothly. It must not be forgotten to allow a little for overlap in joining up.—D.

**Tempering Axes.**—J. S. (*Longsight*).—You must heat the axe to a low red, and quench in salt water. Then let down to a brown or a blue, according to the steel, and quench for tempering. If you find the temper is soft, gradually experiment with lighter tints, ranging between dark straw and brown.—J.

**Pipe over Plinth.**—J. G. (*Glasgow*).—I have looked at your model, and there is no way of getting at the angles except by drawing out the pipe in elevation and in front view, and bisecting the angles. You need not seek for any other way, for there cannot possibly be one better or more accurate. It is one of the commonest and simplest jobs in practice. —J.

**Ready Reckoner.**—J. G. (*Bradford*).—Try "Quantities and Measurements," by A. C. Beaton; price 1s. 6d. Published by Crosby Lockwood & Co. 7, Stationers' Hall Court.

**Connecting Rod Brasses.**—BRASS.—Such brasses are not usually lined out, but are centred tentatively in the lathe, so that all parts shall hold up to size. If lined out, you will simply clip the two halves with packing pieces between, insert a temporary centre, and from it strike the required circle.—J.

**Slide Rule.**—F. W. (*Worcester*).—The best book is "The Theory and Practice of the Slide Rule," by Campbell. Published by Spon, 125, Strand, London, W.C.—J.

**Small Iron Castings.**—S. & B. (*Bristol*).—The only way is to use very soft pig—No. 1 Scotch, with no admixture, or very little, of scrap.—J.

**Designs of Working Cardboard Models.**—C. W. S. (*Northallerton*).—Inquiries made by me fail to elicit any information as to where these are to be obtained. Probably some reader may know whether they are supplied, and if so, by whom. I should advise you to ask at the shops where working models are exposed for sale.—J. S.

**Triple Expansion.**—KIDDERMINSTER.—To give our correspondent the particulars he requires, and explain them clearly so as to be of any use to him, would take up far too much of our already limited space; as the subject is not of sufficiently general interest to our readers or the public, we cannot feel ourselves justified in so doing. The best thing our correspondent can do is to refer to "Seaton on the Marine Engine," where he will find the subject fully gone into, and all the necessary information fully set forth.—C. E.

**Gold Paint.**—W. H. F. (*Kingston*).—You say you have tried several ways of using bronze powder as a gold paint, but you do not state how you used it. Have you tried mixing it with gold size? This is what the majority of gold paints consist of. Gold bronze should be protected by a coat of varnish, or it will turn black.—R. A.

**Embossing Dies.**—C. S. (*Manchester*).—I do not think you need trouble about allowing for the thickness of the metal. The metal used with these dies for stamping name-plates, trade-marks, etc., is usually very thin, and if you get your two dies to fit nicely together, the result (for thin metal) will be satisfactory.—R. A.

**Sheet Metal Working.**—J. H. B. (*Norton*).—For instructions in sheet metal working, get the numbers of WORK that articles on the above subject have appeared in, and look out for others that have yet to appear. Cassell's "Drawing for Metal-plate Workers" is a useful book at a low price (3s.). "Millis' Sheet Metal Work" (Spon) is also a first-class work, but high in price (9s.).—R. A.

**Enginc.**—J. E. (*Cardiff*).—¾ in. bore by 1½ in. stroke would be about correct for such a boiler.—J.

**Sanitation.**—A. Y. (*Deptford*).—The following are good books:—"Sanitary Engineering," by Baldwin Latham, price £1 10s.: published by Spon, 125, Strand; and the "Municipal and Sanitary Engineers' Handbook," price 12s. 6d., same publisher.—J.

**Cover and Advertisements.**—W. N. H. (*Bradford*).—Thanks for your suggestions, which shall have consideration.

**Waterproof Glue.**—F. B. (*Aldershot*).—If you are thoroughly assured that no remissness exists on your part by way of address or postal delivery, why not take the advice of a solicitor?

**Saws.**—F. C. (*Belfast*).—Please state your trouble more definitely, and say whether it is a circular, frame, or band saw. If also you couch your question in a becoming way, you may rely upon a civil answer.—A. R.

**Refrigerator.**—DOUBLE GLOSTER.—From the sketch you send of an American refrigerator which you are using, but "find in practice an utter failure," it appears to be constructed upon sound principles, the only thing omitted is that of a small ventilator in the top—which you have probably left out of the sketch: you further say "that the heat to be kept is that of frozen New Zealand mutton." Does it not strike you that this is expecting too much? The temperature of your refrigerator, and, indeed, any refrigerator short of an *ice making* machine, will be *below* freezing point, since the cooling depends upon the *melting* of the ice, so that the work power you put in is 32° Fahr. at its best; the work done must be something less, useful enough for ordinary purposes, but insufficient to arrest the thawing of frozen meat; clearly, it would be of no use to introduce any mechanical means of moving the air.—C. M. W.

## III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

**Ready Reckoner for Timber Trade and Glass Trade.**—J. G. (*Bradford*) writes:—"Could some kind reader oblige me with title of book and publisher for joiners' and builders' tables, showing number of superficial feet in any given measurement of wood or glass?"

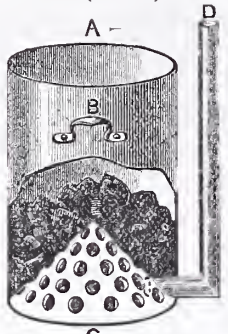
**Water-Colours.**—J. P. (*Belfast*) writes:—"Will any kind reader of WORK inform me how to make moist water-colour paints? I have made some, but find they get as hard as stone in a day."

**Ivory Tablets.**—SEA GULL writes:—"I should be glad to be informed where I can get ivory or xylonite name tablets as used by makers of cameras and dark slides. I want some wholesale maker."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Tuck Pointing.**—M. (*Bishop Auckland*) writes, in reply to SLATER (see page 462, No. 133):—"If you refer to No. 72, Vol. II., of WORK, you will find instructions for tuck pointing brickwork; and to No. 121, Vol. III., instructions for tuck pointing stonework. If you require any more information than is there given, if you will write again I shall be glad to assist you."

**Heating Water for Bath.**—C. H. (*Stroud*) writes in answer to ROUND O (see page 414, No. 130):—"The only way of heating cold water in a bath is by using a charcoal heater, similar to sketch, in which A is round sheet-iron cylinder; B, handle on either side for lifting; C, perforated cone grating; D, pipe reaching under perforated cone, the air rushing down pipe and up through the perforated cone, acting as a blower, and keeping the charcoal in a lively state. Place apparatus in bath of cold water and let it remain until water is sufficiently heated, then remove from bath room."



Charcoal Heater for Bath.

**Wicker Stains.**—L. S. L. (*Kirkcaldy*) writes to A. B. (*Westminster, S.W.*) (see page 462, No. 133):—"Wash the wicker, after being thoroughly cleaned, with a solution of eutch (catechu). The solution may be about 1 eutch to 20 boiling water. Allow to dry, and coat with solution of bichromate of potash of about same strength. Expose to the light until dry, and repeat the bichromate coating until the desired shade is produced. The colour is permanent, and can be left unvarnished if you like. I think you will like this method. Your chair was very likely coated with common brown varnish—not stain."

**Heating Room.**—RUSSELL writes to C. J. P. (*Derby*) (see page 462, No. 133):—"If you have domestic hot-water apparatus, I should carry pipes from them, you would find it cheaper than any other method. I shall be pleased to send you drawing for same if you can show existing pipes."

**Dry Battery.**—H. E. (*South Norwood, S.E.*) further writes in reply to J. A. M. (*London, N.W.*) (see pages 14, 110, and 203, Vol. III.):—"I must apologise for not noticing your letter before, but have been very busy for some time, and have not looked at some numbers. Going through this evening I came across yours, and hasten to reply. I am sorry to hear you could obtain no result after following my instructions, which I have re-read. I had not tried the first receipe, but gave you what I believe to be Gassner's mixture. I culled it from a reliable source, and have no doubt as to its correctness. This being so, I cannot account for your failure. The second recipe (with agglomerate Leclanché) I have tried, and found to work well. Here are some more which you might try. (1) Permanganate of Potash Dry Cell.—Get a pint jar, line inside with sheet zinc, allowing lug for connection, and well amalgamate all except the lug. About three parts fill the jar with a saturated solution of sal-ammoniac, add an ounce of permanganate, and well mix, then stir in sufficient plaster of Paris to make a thick cream. Insert a good-sized carbon plate in centre, and as soon as set, seal over the top with melted paraffin wax. (2) Mescrolo Dry Battery.—The mixture for filling the dry cells, prepared by M. A. V. Meserole, is said to consist of the following solid ingredients in the form of powder: charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts: lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry, and then worked into a paste of proper consistency with a solution composed of equal parts of a saturated solution of chloride of ammonium (sal-ammoniac) and chloride of sodium (salt) in water, to which is added one-tenth volume of a solution of bichloride of mercury (corrosive sublimate), and an equal volume of hydrochloric acid (spirits of salts). The fluid is added gradually and the mass well worked up. Elements and sealing as before. No. 1 should give a capital cell; of No. 2 I know nothing, but if fond of experimenting you might try it. I shall be pleased to know how you get on. A letter addressed to me through the Editor will reach me. I will also experiment a little if I can find time."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—B. B. (*Deptford*); F. H. J. (*Angelica*); E. P. S. (*Hanley*); H. T. M. (*Acton, W.*); H. C. (*Birmingham*); F. S. (*London*); DOWLAIE; R. A. B. (*Carmarthen*); C. H. (*Liverpool*); H. J. (*Rochdale*); W. D. (*Belfast*); BENCH; CONSTANT READER; A. R. (*Scorrier*); C. H. M. (*Portsmouth*); F. M. (*Bristol*); V. L. (*Newcastle-on-Tyne*); J. S. (*Peterboro'*); A. H. B. (*Stalybridge*); G. P. (*Elgin*); WOODWORKER; T. H. L. (*Dublin*); E. R. S. (*Gloucester*); G. A. S. M. (*Birmingham*); WEEDLESS; W. C. (*Deptford*); MUGGINS; W. L. H. (*Swindon*); GAMESTER; S. S. (*Grantham*); G. I. S. H. (*Coventry*); S. T. (*Wednesbury*); A. L. (*No Address*); C. W. C. (*Stockton*); R. W. M. (*Elgin*); LOVER OF MUSIC; E. G. (*Aigburth*); J. D. (*North Wales*); C. W. S. (*Lower Sydenham*); F. W. G. (*Glasgow*); J. T. S. (*Reading*); W. B. (*London*); J. S. (*Keighley*); W. E. (*Bristol*); G. B. H. (*Leeds*); W. E. T. (*Burton-on-Trent*); J. H. (*Leeds*); LOVER OF "WORK"; E. E. S. (*Cromer*); H. M. (*Keighley*); A. T. (*Canonbury*); J. S. (*London, N.*); E. AND S. (*Blackburn*); CONSTANT READER; WATERPROOF GLUE CO.; OSCAMAW; A. R. (*Birmingham*); S. J. W. (*Ystalyfera*); G. A. S. (*Edinburgh*); A. B. (*York*).

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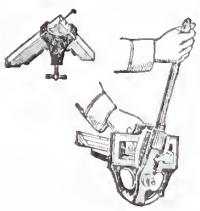

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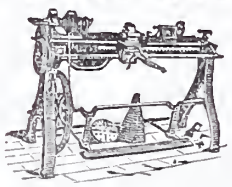

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# WORK

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VOL. III.—No. 141.] SATURDAY, NOVEMBER 28, 1891. [PRICE ONE PENNY.

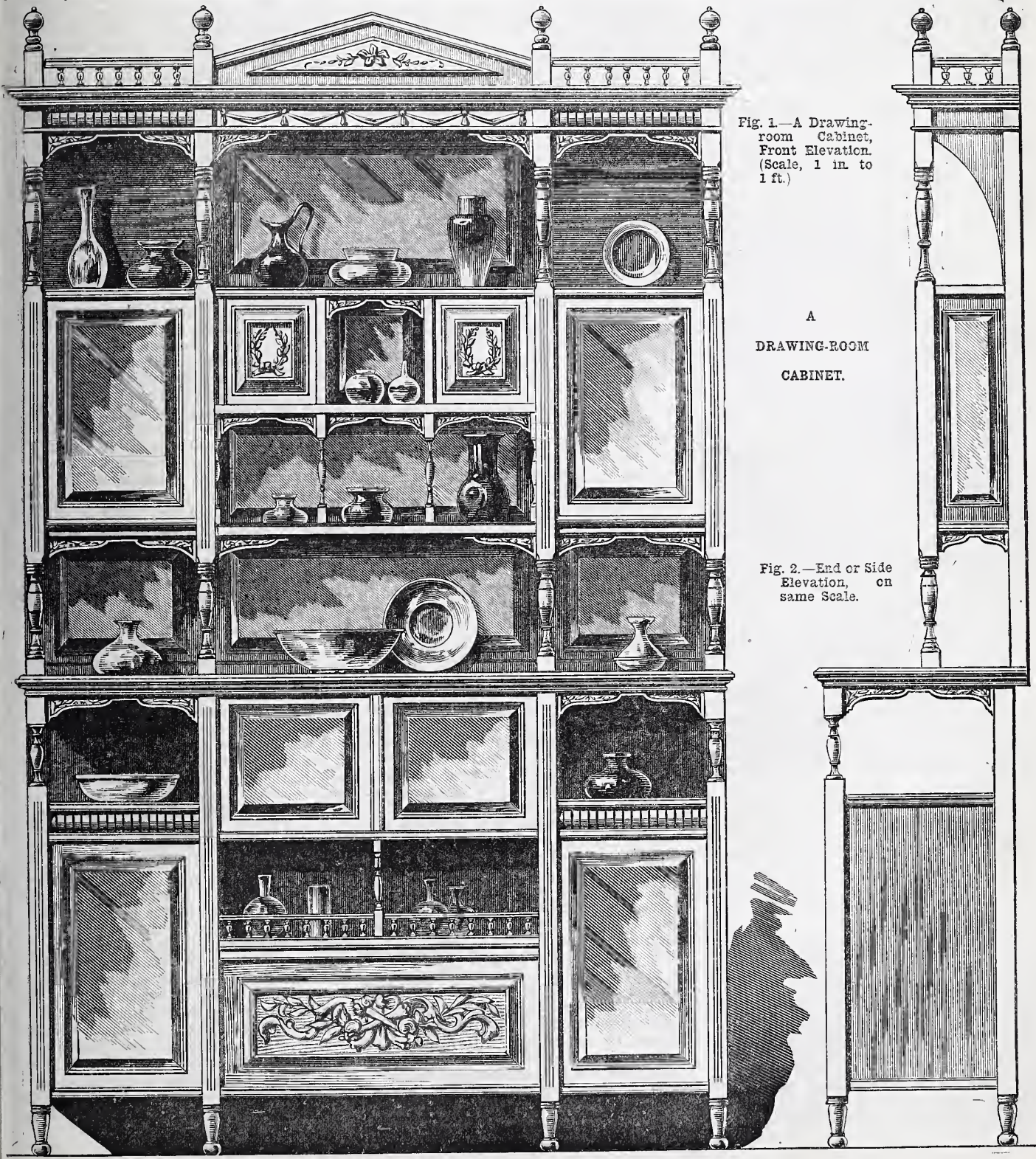


Fig. 1.—A Drawing-room Cabinet, Front Elevation. (Scale, 1 in. to 1 ft.)

Fig. 2.—End or Side Elevation, on same Scale.

A

DRAWING-ROOM

CABINET.

## A DRAWING-ROOM CABINET.

BY A. T. HARTINGTON.

INTRODUCTORY — SIMPLICITY OF CONSTRUCTION— MATERIALS — DIMENSIONS — ANALYSIS OF ARRANGEMENT OF LOWER PART—OF UPPER PART — GLASS — LINING CUPBOARDS— FULL-SIZED DETAILS.

THE cabinet is to the drawing-room what the sideboard is to the dining-room—the principal piece of furniture, or at any rate the most imposing in appearance. Originally, no doubt, the cabinet was a small portable cupboard, which, as it developed, was divided into separate compartments, more, perhaps, for utility than for ornament. Now the arrangement of the cupboards forms an important part, even so far as appearance only is concerned, and a cabinet may not inaptly be regarded as an assemblage of small cupboards.

The one which forms the present subject, as will be seen from the illustrations, Figs. 1 and 2, the former showing the front and the latter the end elevation, is admirably adapted for the display of those knick-knacks for the reception of which a cabinet is primarily intended. It also forms in itself a useful and handsome piece of furniture, which, if properly carried out, represents considerable monetary value. Possibly many readers may be inclined to think it too elaborate for them to construct, and very likely they are right, for it is just the kind of job which requires a fairly expert maker, as unless made well the result would not be so satisfactory as if something simpler had been attempted. At the same time, I may as well point out to those to whom the apparent complexity may possibly cause a degree of hesitation, or a doubt that they could manage to make the cabinet, that there is really no difficulty about it. If they can make any single part, say one of the cupboards, separately, they can do the lot. The construction is really very simple and not beyond the ability of any fairly competent cabinet-maker. He will require more time, but little, if any, more skill than if he were making a small two-door cabinet. Neatness and accuracy must be studied, and if he does so he may depend on turning out a presentable piece of furniture.

Now, without going into details which would be needless to those who can make this job, a few hints may be acceptable.

Originally designed for, and made up in, American walnut, with carved panels, as suggested, the cabinet is eminently suited for the fashionable rosewood, with marquetry substituted for the carvings, and inlaid stringings instead of the beads shown on the squares.

Figs. 1 and 2 are drawn to the scale of 1 in. = 1 ft., so that it will be seen that the principal measurements are as follows :— Width, 5 ft. ; height to top of lower part, 3 ft. 4 in., and overall, 8 ft.; depth from back to front, on top, 1 ft. 6 in., and 9 in. on the upper part, exclusive of the projection of the top moulding.

Analysing the design, the lower part is seen to consist of two end cupboards, with open space between them and the top ; in the centre a two-door cupboard, immediately under the top, and separated by an open space, with spindle-rail and turned column from the bottom cupboard, which is enclosed by a door hinged at the bottom and forming a convenient place for music or large books. The other cupboards have glass panels, either plain or silvered, as it may be desired to let the contents be visible or not.

The upper part, of course, is separate from the lower, and immediately above the top, in the back, are three silvered plates with bevelled edges—in fact, in a good job of this sort all the plates, whether transparent or silvered, ought to be bevelled. Above these plates are cupboards at each end, with a shelf on a line with their bottoms. Above this shelf, in the back, is a silvered plate, and immediately above it two small cupboards, with an open space between them, and with a glass at the back. Above the end cupboards the back, instead of being flat, is curved forwards to the top, or coved, the space between the coves being occupied by a glass at the back.

Other details will be seen more distinctly from the design, and few remarks about them will be necessary.

The end cupboards of the upper part are shown with transparent glass panels in the outer ends, and their backs should either be lined with velvet (plush) or with looking-glass. If a shelf is desirable inside, let it be of plate-glass with polished edges. The end cupboards of the lower part may be treated in the same way, but it is generally better to have the lower parts of cabinets, etc., more solid looking than the uppers. The principal details are given in the next page as follows :—

Fig. 3 shows one of the turned columns, all of which are the same in pattern, but vary in length according to their position. Above the turned part a sectional drawing gives the beading which is used on all the fronts of the squares, and by reference to Fig. 1 it will be noticed that they should be stopped.

Fig. 4 shows the moulding of the top, which the veriest tyro need hardly be told will be lined up, and not solid in the full thickness of the edge.

Fig. 5 gives a half-size representation of the moulding on top, together with its accompanying frieze. With regard to this a few remarks may be necessary. Above the coves it will be seen to be rounded and fluted as indicated in Fig. 5. As is, no doubt, well known to the majority of those who will make this cabinet, the rounded portion is simply planted on after having been turned in the lathe, and as four pieces will be required, two of them being in the lower portion above the end cupboards, they will be turned at the same time by being temporarily fastened on to a central block or core.

I do not think any practical cabinet-maker or joiner will experience any difficulty in carrying out the design, and, though I am not writing for novices or unskilled amateurs, if any of these intend to make the cabinet, and find there is some part of the construction which they do not understand, if they will state exactly where their difficulty lies I will endeavour to help them through "Shop." Vague requests, however, that they may be told how to make the cabinet, or any portion of it, will, however, hardly be worth noticing, so perhaps inquirers will please state just the points they want to know about.

It may be said that when it is completed the cabinet presents a splendid appearance, and will be found to be a handsome and comprehensive receptacle—if I may be permitted to use such a qualifying term in reference to the article of furniture now under consideration—for a fair percentage of the thousand and one things which collectors of bric-à-brac and curiosities generally delight to gather together, and with this I must quit my subject.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### THE PLANE.

IN our second lesson we were introduced to the "winding strips" and their use ; we ought now to make the acquaintance of the trying plane. The jack plane, which we have hitherto used, does not give such accurate surfaces as the trying plane, because it is smaller, and also because it is not usually sharpened so carefully or its surface so well kept. The trying plane in general use is 22 in. long, the jack plane being usually 17 in. ; this shows that the trying plane is much superior in producing flat surfaces.

Having, by means of trying plane, winding sticks, and careful work, produced a flat surface, mark it ; for it is much less trouble to obtain true surfaces from the first than to employ winding sticks for each fresh surface ; therefore, whatever angle it is desired that the second surface shall have in relation to the first, it can be obtained by the use of a square or bevel, for if a surface is everywhere in the same relation to a flat surface, the second is also flat. When two adjacent surfaces are thus planed, and the angle correct, the other two surfaces are generally required to be parallel to the first planed. This is generally accomplished by using a marking gauge, and when the pupil can plane a piece of wood, the section of which, cut at right angles to two adjacent sides, gives four equal and therefore right angles, he will have achieved much in the way of mechanical manipulation.

There are other varieties of planes in constant use for special purposes, but enough has been said to suggest the fact that a plane is a copying tool : the iron cuts, and leaves the wood the counterpart of itself.

The next attempt in the use of the plane may be to try and plane the edges of two boards until they agree. This is difficult for a beginner, so I have said "attempt," but the effort cannot be anything but beneficial even if not quite a success. The material for this exercise may be two pine boards, 11 in. wide and 1 in. thick. They should be well supported in the bench screw and upon a bench pin in the sideboard, supporting the board at a convenient height ; from 3 ft. to 4 ft. will be a suitable length.

Another useful exercise in planing is to make a straight-edge or a plumb-rule. In doing this the use of the gauge is involved, but it has also this advantage : that it is a test for the performance of the trying plane. If the plane is slightly untrue, as sometimes will be the case, through violent changes of temperature or from continual use, the planing of an edge and the use of a gauge, followed by the use of the *same* plane in the *same condition*, will be a test of the state of the plane. Should it have been used for small work for some time the plane will probably have worn hollow, and will therefore make the edge of the board rounding, and all the efforts of the worker cannot make a straight edge ; on the other hand, if the plane has worn, as planes generally do, chiefly in front of the cutter, then the plane will be more prone to work "hollow," for the plane produces the counterpart of itself.

The beginner must not, however, attempt to correct his trying plane, but must obtain skilled help from a joiner or take his plane to a plane-maker, telling him what he considers to be the fault, and when it is returned, do not drive the wedge in so tightly as to strain the plane.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

THE CROSSHEAD JOINT—CRANK-SHAFT—THE ECCENTRIC AND STRAP—THE ECCENTRIC AND VALVE-RODS.

FITTING CROSSHEAD JOINT—CENTRING AND TURNING THE CRANK-SHAFT—TURNING THE ECCENTRIC STRAP—CHUCKING AND TURNING THE ECCENTRIC—HOW TO TAKE UP WEAR IN THE BEARINGS—TURNING THE VALVE-ROD AND FITTING THE JOINT—PUTTING THE ENGINE TOGETHER AND ADJUSTING THE SLIDE-VALVE.

LET us now return to the crosshead and complete it. The first thing to do will be to file up the sides, or cheeks, of the upper part true with the hole, and bring it to 1 in. wide (see Fig. 8, page 328), so that it may fit between the sides of the fork of the connecting-rod. The little mandrel, *m*, of Fig. 53 (page 501), has been turned to the taper of the reamer used for cleaning out the hole for the crosshead pin; it will therefore fit into that hole projecting at both sides. Now, if on that mandrel we fit a little thick ferrule or annular disc of about 1 in. diameter, so that, while fitting on the mandrel, it can be brought up to touch one of the sides, it will form a guide for the filing just as the head of the crosshead pin did when we were working upon the fork of the connecting-rod. Take a bit of round iron or brass of about 1 in. diameter, and say 1 in. long, bore a $\frac{1}{4}$ in. hole through it, and try it on the small end of the mandrel, *m*, where it projects through the hole in the crosshead; if it will not go on, enlarge the hole in it with the reamer till it will go up into touch with the face of the crosshead; now take it off, drive out the little mandrel, and drive the little piece of iron on to it; put it thus in the lathe and square up both ends, or sides, of it; knock it off mandrel *m*, put mandrel into crosshead, and put the little piece on the projecting end, when it should fit the mandrel and come up into touch with the crosshead, so that you can use it to test the side of the crosshead and bring it true with the hole. The other side may be made parallel by means of the callipers, or the little ferrule may be bored a little larger with the reamer, so that it can be pushed further up mandrel *m*, and so be used upon the other side of the hole in the crosshead. The remainder of the crosshead may be filed up to look well, and the oil-hole at the top enlarged and tapped for the lubricator, when the crosshead may be oiled and laid aside.

Fig. 3.—Pattern for Turned Pilaster (half size).

We may now undertake the crank-shaft. A sketch of the forging supplied for this appears at Fig. 55. A round bar, 1 in. in diameter, is bent for the crank, and the flattened ends are turned up at A, A, to assist in the turning, which ends are afterwards cut off. The outer surfaces (*a b* and *c d*) may be roughly squared up first, and then the centres (*b* and *d*) found by placing the crank on the V's, marked with the centre-punch, square-centred in the lathe, and drilled up as usual for turning the crank-shaft, the arms, A, A, acting as carrier for the driver chuck. Next, a point-tool may be used to strike a circle on the ends of A, A, at *a* and *c*, just $2\frac{1}{8}$ in. from the centre of the shaft. When the arc is struck at *c* the tool would be withdrawn and the crank turned end for end, when it would be moved forward to strike an arc at *a* without otherwise disturbing it, so as to ensure the radius being exactly the same at each end. Do not on any account exceed the measurement of $2\frac{1}{8}$ in., or you will have to reduce the thickness of the piston or take other measures to prevent its knocking against one or both ends of the cylinder. The centres at *a* and *c* must be absolutely in the same plane as the centres *b* and *d*. To ensure this, try the forging on the surface-plate, and file the underside till it ceases to rock, and till the centres, *b* and *d*, both come opposite the point of the scribing-block. Now, with the point so set, scribe across the arcs previously marked at *a* and *c*; the points, *a*, *b*, *c*, *d*, will then be, all of them, equidistant from the surface-plate, and therefore they all lie in one plane. Countersink and drill the centres at *a* and *c*, and put the crank in the lathe to turn the main part of the shaft. Though the surfaces, *a b*, *c d*, are supposed to have been filed fairly square and true, yet it will be well, first, to turn them true in the lathe. The dimensions written on Fig. 55 are the forged dimensions, and give the size of the work before it is turned. In turning up the ends of the shaft and the arms, A, A, bring the extreme length to that written upon the drawing Fig. 5 (page 260), namely, $1\frac{3}{4}$ in. by 1 in. by $1\frac{1}{5}$ in. by $\frac{3}{4}$ in. by $1\frac{1}{8}$ in. by 1 in. by $1\frac{3}{4}$ in. = $8\frac{1}{2}$ in. When this is done, the end surfaces, *a b* and *c d*, will be used to measure from, and this will help us to get the necks for the two bearings, and that on the crank-pin, correctly placed. We may now proceed to turn the shaft on the centres, *b*, *d*. If the crank were weaker we should have to fit a bit of hard wood between the throws, or arms, of the crank; but this will hardly be required in the present case, except in square centring. Turn the main part at each end to $\frac{7}{8}$ in. full, leaving a little to come off at the final finishing, when the arms, A, A, shall have been cut off, and when the eccentric and fly-wheel are being fitted; turn the necks for the bearings, taking out the brasses and trying one of each pair upon the neck which is to turn in it, as it is quite essential the fit should be good, both as to diameter and as to the rounding of the corners. It is comparatively easy to make a fit when you can use one of the brasses as a gauge for your work as you turn the neck; whilst, if the shaft had been made first, it would have been very difficult. Take care to get the necks as smooth and round as possible, and well polished, then rub them over with marking, and rub the brasses round on them, to see whether they bear evenly; you may very likely find a little scraping necessary inside the brasses to make them fit perfectly. Having finished the main bearing necks, place the lathe centres at *a* and *c*, and turn the neck of the crank-pin in a similar way, trying the brasses of the connecting-rod upon it as before described. The crank-pin being thus finished, the arms, A, A, may be cut off with the hack-saw, the ends of the shaft turned, and, if desired, the arms or throws of the crank can be filed up and polished; or that part may be painted. The fly-wheel is supposed to be already finished, and to have a keyway cut in it $\frac{3}{8}$ in. wide and $\frac{3}{16}$ in. deep. The key should be of steel, as also that for the eccentric, which, however, need not be more than $\frac{5}{16}$ in. wide and $\frac{1}{8}$ in. thick. It would, of course, be more orthodox to sink a groove in the shaft instead of simply filing a flat as shown at Fig. 16 (p. 328); but this would require a slot-drill, and, by making the key for the fly-wheel rather wider than usual, it will hold the fly-wheel firmly if well fitted; the profile of the key for the eccentric is shown at Fig. 19 (p. 328). It and the larger one for the fly-wheel are about $\frac{1}{64}$ in. thinner at the point, so as to cause them to tighten up like a wedge, the bottom of the keyways being carefully filed to the same slope so that the key may bear equally hard all along its length. The fly-wheel

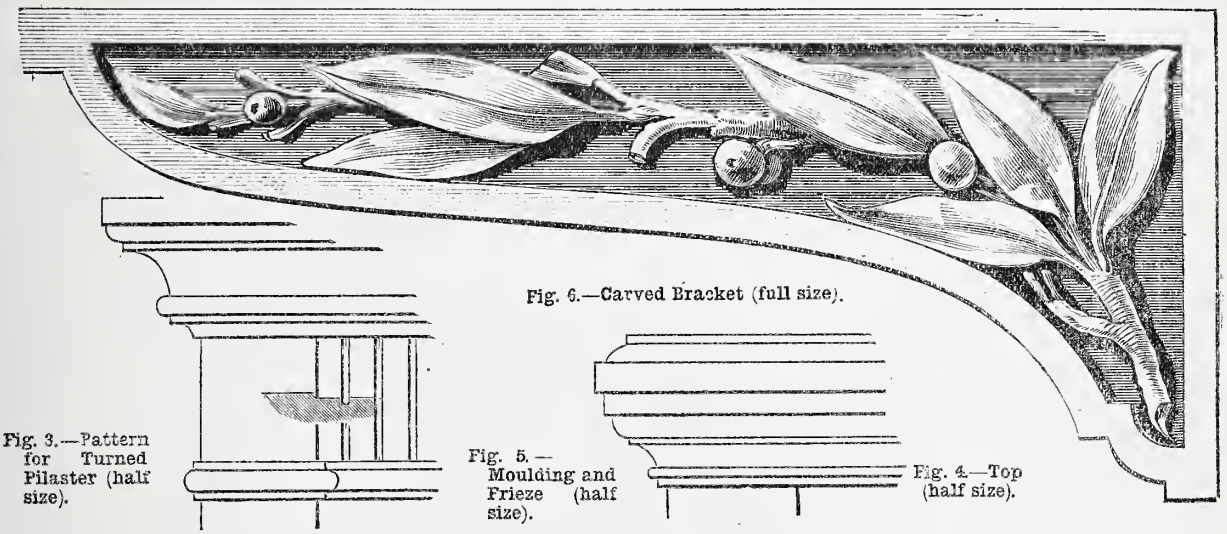


Fig. 6.—Carved Bracket (full size).



Fig. 5.—Moulding and Frieze (half size).



Fig. 4.—Top (half size).

being bored, we may at once finish one end of the crank-shaft, and make it fit accurately into the wheel; it may then be laid aside till the eccentric is finished, since it is easier to fit a shaft to a hole than *vice versâ*.

*Eccentric and Strap.*—The eccentric and its strap may next be undertaken; they are shown in Figs. 16, 18, and 19, as well as in the complete views. The eccentric for the feed-pump is so arranged that it may be added or left out, according as it is required to have a feed-pump or not; it is shown, with its method of attachment, in Figs. 19, 20, and 21: it is simply bored out to fit upon the boss of the slide-valve eccentric, and fixed to it with two screws. Taking in hand the eccentric strap first, file up the ears, where the screws pass through, to fasten the two halves of the strap together. These four surfaces should be got up with the help of the face-plate, using a square to try whether the half strap stands up straight on the plate; the ears are $\frac{3}{8}$ in. thick. When, therefore, the four little surfaces have been filed true, set the point of the scribing-block to $\frac{3}{8}$ in. high, and, holding the half straps in one hand, scribe across the ears of both, on each side, a line $\frac{3}{8}$ in. above each of the four finished surfaces so as to mark the thickness of the ears, then file to these marks so as to get a flat surface for the heads of the screws. Next set the scriber point to $1\frac{5}{8}$ in., and mark off the large flat surface on the one half strap and the small one on the other. Tin the ears and solder the two halves of the strap together, then fit the screws and screw them firmly in. Now file one side of the strap, thus united, perfectly flat; screw a piece of hard wood on to the face-plate, chuck, and turn it true and flat; lay the flat side of the strap upon this and fix it by means of two dogs, in a similar way to that shown at Fig. 36, the dogs clasping only about $\frac{1}{8}$ in. of the ears, so that almost the whole of the front surface of the strap can be turned true; face up this front surface, bringing the strap to $\frac{1}{2}$ in. thick, and turn out the interior, observing carefully the dimensions in Fig. 18; scratch a fine line round, to which you can file the outside, and take the strap from the lathe to finish with the file. You can then chuck it again the reverse way to smooth and polish the first side, then melt the solder and separate the two halves. Now take the eccentric itself, grasp it in a universal chuck by the boss, bore the hole $\frac{7}{8}$ in., and cut or mark the key-way; fit it on to a mandrel (the crank-shaft would do, but mind it does not get bent when you hammer it on and off)—it must fit rather tight—put it between the centres, and finish the outside of the boss and the sides of the eccentric, bringing it to $\frac{1}{2}$ in. wide. To turn the outside of the eccentric we need a die chuck, but, failing that, can manage another way. Put on the face-plate chuck, with a flat piece of hard wood upon it, truly faced up; prepare another piece of hard wood $1\frac{1}{8}$ in. thick, or more, and about 5 in. by 4 in., with edges nicely squared up; put two long screws through the corners of this and screw it upon the middle of the first piece, sinking the heads of the screws below the surface, so that you can face it up in the lathe; now bore in the lathe a $1\frac{1}{2}$ in. hole in the centre of this piece, 1 in. or more deep, into which you can press the boss of the eccentric; the radius of the eccentric which joins its two centres must be placed parallel with two sides of the squared-up piece. Fig. 56 will make this plain: A is the face-plate; B, the first piece of wood; C, the second, in which the boss of the eccentric is fitted, the eccentric standing up on a line, *a b*, parallel with lines *c d*, *e f*, drawn on B. Now it is evident the two screws holding C to B may be taken out, and the piece C moved down $\frac{1}{2}$ in. along the lines *c d*, *e f*, and refixed there; thus the piece C acts like the slide of an eccentric chuck, and enables us to bring the sheaf of the eccentric true with the centre of revolution of the lathe, so that the outside of the eccentric can be turned. Lest the eccentric should move while being turned, owing to the boss turning round in the hole in C, an iron clamp, *g*, may be placed across the hole and secured by a screw passing through that hole into the wood. The half of the eccentric strap will, of course, be used to test the work, and the eccentric should be made to fit, both on the $\frac{1}{4}$ in. middle band, and on the smaller $\frac{1}{8}$ in. bands on each side of it, so that the eccentric may bear upon the whole $\frac{1}{2}$ in. width of the strap, an advantage this form of construction has over the older arrangement, where the strap works in a groove in the eccentric, which latter must then be the widest and, therefore, must take up more room on the shaft. When the straps wear, as they must do in time, as also the brasses of the connecting-rod, etc., they must be taken apart, and a little filed or scraped off the ears where the straps are screwed together, or off the brasses where they touch, until all looseness is gone and the fit is again perfect. If this is not done the engine will "knock" on each "dead centre"—that is, there will be a thump heard every time the piston changes its direction of motion. Whenever such a thing happens the cause should be sought for, and the noise stopped. An engine in proper order makes no knock or thump; the slightest noise of that kind suggests bad workmanship. Our engine should be quite inaudible in the next room; no one need object to have it in a room in the house if the workshop be so situated; its presence will not be suspected if it be kept in proper order.

The eccentric-rod and the valve-rod would seem to come next in order. A casting is provided for both. The valve-rod will require to be turned up, and draw-filed like the piston-rod, to avoid wearing out the stuffing; but, as it is only $\frac{3}{16}$ in. in diameter, it will require some kind of a back-stay to support it whilst being turned. When the shaft is finished to size the thread may be cut with stock and dies, taking care not to cut it too high up, so that the threaded part will be drawn into the stuffing-box. Then the nuts may be threaded in a three-jawed universal chuck, and trued up in position on the rod.

The joint is the only remaining point which need delay us. File up first that part which belongs to the valve-rod. It requires to be $\frac{1}{4}$ in. thick; and the flat surfaces on each side to be parallel with the centre line of the rod, and equally distant from it. These conditions can be simply ensured by pressing one of the surfaces down upon the surface-plate, so that the length of the rod is supported in the air, when it will be easy to see whether it is parallel with the plate or not.

When this part is satisfactory file up one side of the joint on the eccentric-rod, taking care that it is parallel with the length of the rod, and "out of wind" with the flange at the large end; then file the other three surfaces of the joint to this first one, as before described for the fork of the connecting-rod. Bore both parts of the joint with a $\frac{1}{4}$ in. drill, put them together, clean out the hole with a $\frac{1}{4}$ in. reamer, and turn the pin of cast steel to fit. Then harden both parts of the joint with prussiate of potash, harden the pin, and grind it in with emery powder. Clean off the emery, and the joint is finished.

No directions appear to be needed for fitting the flange at the larger end to the eccentric-sheaf; and the eccentric-rod itself may be got up bright, draw-filed, and finished with emery-cloth, or it may be simply left rough and painted.

*Putting together the Engine.*—It will be well at this stage to fit the parts, thus far finished, together.

The cylinder being bolted to the bed-plate, the piston and rod in place, the crosshead and guide plates fixed, put the crank-shaft into the two bearings, and put the connecting-rod on to the crank-pin, and, after laying these parts on the bed-plate, bring together the fork end of the connecting-rod and the crosshead, passing the pin through, and securing the joint. Push the piston to the bottom of its stroke, as it appears in Fig. 5; place the crank horizontal, and mark on the bed the position occupied by the soles of the two crank-shaft bearings. Now turn the crank half-round, pulling out the piston to the end of its stroke. Set the crank again horizontal, and mark again the position of the soles of the bearings on the bed-plate. This position should be the same as before, but if the bearings have moved a little in the direction of the length of the bed, you have only to place them in an intermediate position, so as to split the difference; scribe through the bolt-holes in the feet of the bearings on to the bed, drill and tap these holes, fix the four studs, and bolt the bearings down on the bed.

The brasses of the large end of the connecting-rod having been clasped on, the crank-pin should suffice to place the crank-shaft fairly at right angles with the centre line of the engine. Any error that might arise would be eliminated by splitting the difference between two positions. The studs which secure the bearings should fit fairly well in the holes, so as to act partly as steady pins.

Now you may as well file a flat on the crank-shaft, and make the key to secure the fly-wheel. Fit this carefully, and drive it in pretty firmly, and you can then turn the engine round by the wheel. Try it round to see whether it moves evenly, or whether it sticks or moves stiffly at any point. If it does, seek what is wrong by taking off one thing after another, till you find what is tight.

For instance, you might disconnect the crosshead joint, and try the three brasses on the crank-shaft alone. Suppose there is still a tightness, then you could loosen them one by one, then tighten one at a time, turning the wheel every now and then.

Your aim should be to have the bearings all equally tight, so that the shaft can freely revolve without much friction, and yet without being loose enough to knock. However, there is sure to be a slight stiffness in a new engine, which will wear off by-and-by.

We could prevent this by grinding in the joints, but if we did so there would probably remain in the bearings a little of the sand, which would cause them to wear away continually, so that it is a dangerous thing to advise. A shaft may be ground in with emery if, like the mandrel of a lathe, both it and the collar, or bearing, are left "dead" hard—because emery powder cannot get embedded in hard steel. A joint or bearing of iron or brass would be ruined if ground together with emery, because the emery could never be got out again. A

joint of brass or iron can be ground together with the grit from the grindstone trough, if, like the plug of a tap, it is only moved occasionally; but if, like the bearings of our engine, the shaft is to turn continuously, it is better to trust to scraping out the brasses where they seem to bind, and to keep all abrasive powders far away.

Having now, thus far, put together or erected the main parts of our engine, we will proceed to adjust the slide-valve. Pass the valve-box over the studs, and, leaving off the cover for the present, put in the slide-valve, and pass the valve-rod in through its stuffing-box; two nuts, slide-valve, and two more nuts, locking these in pairs on each side of the valve. Now connect the eccentric-rod with the valve-rod and with the eccentric, this latter being in its place on the shaft, but not keyed—the keyway being cut in it, and fitted with a temporary key bearing upon the round shaft, on which the flat has not yet been filed. Place the piston in the position shown in Fig. 5, the crank being horizontal, and the piston at the end of its stroke. Now turn the eccentric round upon the shaft till it points upwards, and away from the cylinder, in the position shown at Fig. 16, making an angle of about 120° with the crank. The valve should now be just beginning to uncover the port leading to the bottom of the cylinder, as it is seen in Fig. 5.

If this is not the position of the valve, that will be owing to one of two causes: either the angle of the eccentric is not correct, or the length of the connection between the eccentric and the edge of the valve is not exact. Turn the eccentric on the shaft till the valve uncovers the edge of the port, so that you can get in the corner of a visiting card. That distance is called the lead of the valve, as explained in the introduction. Fix the eccentric by the temporary wedge, and turn the crank just half-way round, till it stands level, whilst the piston is at the opposite end of the stroke. Now, the valve, to occupy the proper position, should be uncovering the other port by the same distance, and then we should say the lead was equalised; this, however, is not likely to be the case till the length of the eccentric-rod, etc., has been adjusted.

Let us suppose the valve, instead of having only just opened the port, has opened it by half its width—*i.e.*, it has moved too far by ⅛ in. This would prove the eccentric and valve-rods were too long by half that distance. Now, we can shorten the effective length of the valve-rod by moving the nuts. Move these nuts, then, so as to diminish the excessive travel of the valve by one-half of ⅛ in., so that, without moving the other parts, the valve shall be open but one-quarter of the width of the port. Now loosen the wedge of the eccentric, and turn it round on the shaft till the valve is open by the thickness of a card, fix the eccentric by the wedge, turn the crank round to the first position, and observe the valve, when we should find the lead is about right. Enough has now been said to show how the lead can be equalised, and the proper angular position for the eccentric found. When this has been determined, mark on the shaft the position of the keyway of the eccentric, and take off the eccentric to file the flat on the shaft for the permanent key. When the key is being finally fitted test the lead again, to make sure you have the flat filed just right: it is easy to adjust with a flat on the shaft, a thing that cannot be done with a sunk keyway.

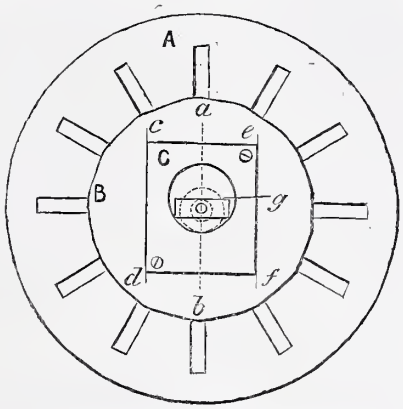



Fig. 56.—How to Chuck the Eccentric.

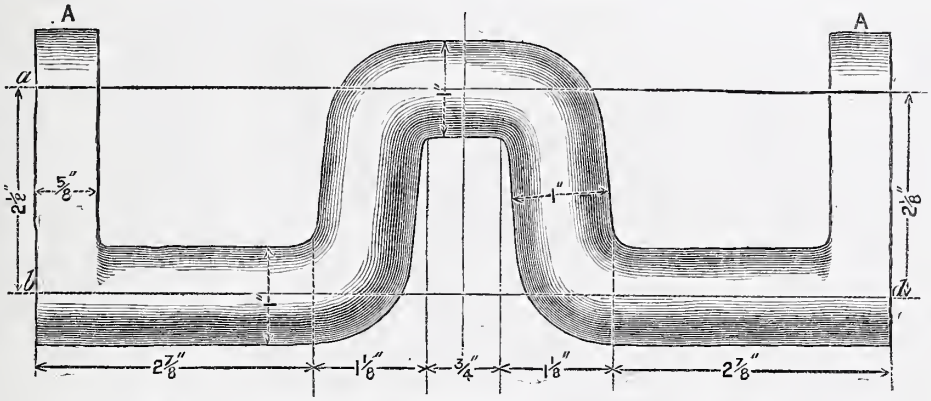



Fig. 55.—Sketch of Forging for Crank, with Dimensions of Forging.

## A FEW PHOTOGRAPHIC EXPEDIENTS.

BY AN OLD HAND.

When almost everybody, gentle and simple, turns or tries to turn photographer, there are necessarily some to whom the good things of this life have been meted out with a sparing hand, and to such a few hints of how to make most of a little will perhaps be acceptable. There are two things without which it is impossible to take a photograph satisfactorily. A cigar-box and a pin-hole is all very well for those of the impressionist school, but for real practical work there is a *necessity* for a *camera* and *lens*. Although the cost of these articles has, during the last few years, been marvellously reduced, still, if the would-be photographer has to buy them, and requires good things of the kind—things that will bear some wear and tear—he must put down a certain amount of cash, that may not at all times be conveniently found. I would advise such to try and manufacture their own lenses and cameras—not so difficult a matter as appears at first sight. An article, or rather a series of articles were published in early numbers of Work, giving directions how to make a camera of a thoroughly good pattern at a much less cost than it would be possible to purchase one of a similar kind. A rough substitute for a camera could, of course, be knocked up with hammer, nails, wood, and bookbinder's cloth, but such are not worth the labour bestowed upon them. The failing of almost all cheap apparatus is its liability to get out of order and the wearing out of important parts. It is better by far to have an old pattern well-made thing than a common modern one with all its multifarious movements—that is, supposing one is purchased, but my advice is make them yourself. Now about lenses. In the spring of this year a Mr. Lionel Clarke read a paper at the Camera Club, giving the results of his experiments with *spectacle lenses*. This paper was published in most of the photograph literature at the time, and it is to this I would call special attention. A long time prior to this I had made use of this device in an emergency, and can fully bear out most of Mr. Clarke's assertions, and go yet further by attributing better qualities to such lenses than he felt inclined to concede. The first question is, What sort of spectacle lenses are to be used? as they vary so much in kind and quality. The answer is: get lenses of the periscopic form—that is, convex on one side and concave on the other, the curves on each side being different, the inside curve following the lines of a large circle, and the curve of the convex, or outside, that of a smaller one; the proportion of these curves to each other determine the focal length of the lens. Spectacle lenses of this form are generally used for old sight, and vary in focus considerably. They can be purchased separately at a lens dealer's, at a price from threepence each for ordinary glass and about fifteenpence for one made of pebble; the gradations of focus are, I believe, by two inches—26, 24, 22, etc. Now, for photographic purposes the use of these lenses singly is not altogether convenient. In the first place, the lines of the image are not straight, and the area of good definition is small compared with the length of focus; we therefore adopt the plan of placing two together, with the concave or hollow sides towards each other, with a very small stop between them. The small amount of light passing through such an opening makes it difficult to focus with unless on a very strongly illuminated subject; therefore, for convenience to the amateur in making such a lens, the stop may be placed close in front touching the lens. The focussing and arrangement of the subject may be done without the stop, which can be inserted afterwards. There will be only a very small portion, if any, of the picture absolutely sharp without the stop, but it will be remedied by its insertion. There are two kinds of foci in uncorrected lenses, called the optical and visual. The optical one is the one that forms the image on the sensitive plate, and the visual one is the one we see on the focussing screen in properly corrected lenses, such as the best sold for photographic work. These two foci are made to fall on the same plane, consequently, if the image looks sharp it photographs sharp; but with spectacle lenses it is not so, and this peculiarity has to be taken.

into consideration. The optical focus, the one we want, is about a fortieth of the length of the focus of the lens *shorter* than the visual, which means that with a combination of lenses having a focus of ten inches, the plate will have to be just a quarter of an inch *nearer* the lens than the distance that gives the sharpest image on the focussing screen, therefore in focussing prepare for a distant object in preference to one in the foreground. Knowing this much, we will put a lens together suitable for a picture whole-plate size, or less. First of all there is the tube or lens mount. Very often an old discarded tube may be had at the dealers in, or repairers of, photographic lenses. If this cannot be had, two short pieces of brass tube about an inch long and three-quarters of an inch in diameter will answer the purpose; a flat ring to act as a flange, with a thread turned on the inside suited to threads turned on the ends of the tubes, will be required to fix the lens to the camera. We now procure a couple of the periscopic spectacle lenses, made of pebble by preference, as the surface is harder and better in all respects than glass of twenty-four inches focus. Fasten them together, hollow sides inwards, with a little gummed paper round the edges; they must be exactly centred by placing the edges accurately together. Now make a disc of cork to fit accurately into the brass tube with a round hole in the centre, half an inch in diameter, in which the lens is to be fixed; the oval shape of the lens may be reduced by cutting it with a diamond and chipping off with a pair of good pliers; at any rate, the lens must be fixed upright in the tube—that is, at right angles with its sides—so that a stop made of thin metal, the aperture to be $\frac{1}{16}$ in., can be put in close contact with the glass; and in front of it another stop, with an aperture of $\frac{1}{32}$ in., will sometimes be useful. Any other means may be devised to fix the lens in position; so long as it is in the right position, the means by which it is done is immaterial. It will be found that when two lenses of equal foci are placed together the focus will be reduced by half—that is, the 24 in. will become 12 in.; add another lens of 24 in., and the focus will be reduced to 6 in. The focus will always be found to be nearly half that of the shortest focus, whether formed by a combination of lenses or single lenses. In the combination just referred to—two 24 in. to make a 12 in.—this forms a moderate angle view on a whole plate, and comes well to the corners. If we take a 24 in. lens and fix to it one, say, of 16 in., we have a much wider angle lens of a shorter focus; the variety of foci differs with every different lens used, and it is easy to make a combination to suit the purpose for which it is required, bearing in mind the longer focus lens should be the outside lens, and that the position of the stop not only regulates *the definition* but the size of the image. The more in front the stop is placed—that is, the further from the lens or front—the smaller the *area* of the image, and *vice versâ*. This indicates that a stop *between* the two lenses is the best place for it, as there we get a maximum of area and of definition. It may be thought that with such small stops the time of exposure would be enormously prolonged; it is not so, however, as compensation is afforded by the very trifling absorption of light of the thin media through which it passes. The lens just described would take a thoroughly exposed picture in an average light with the $\frac{1}{16}$ in. stop in five seconds, which is not abuormally long, with plates like the Ilford ordinary. With very rapid plates and a suitable sea-side subject the exposure, in spite of the small aperture, would be instantaneous. At any rate, I have said enough to enable anyone of constructive ability to make a thoroughly good working lens that will take pictures equal to the most expensive kinds, and at an exceedingly small outlay.

## THE WINTER ELECTRICAL MACHINE AND ACCESSORY APPARATUS.

BY CHAS. A. PARKER.

PREPARATION OF MACHINE FOR WORKING—ELECTRICAL AMALGAM—LEYDEN JAR—DISCHARGING ROD — DIRECTOR — JOINTED DISCHARGER — LEYDEN BATTERY—DIAMOND-SPOTTED JAR—SPORTSMAN JAR — LANE'S DISCHARGING ELECTROMETER—SPIDER JAR.

BEFORE passing on to the consideration of other accessory pieces of apparatus, a few hints with regard to the proper management of the Winter machine will doubtless prove acceptable to the majority of our readers. Owing to the fact that frictional experiments are usually performed in the winter-time as a means of amusement aud instruction for the young people during the long evenings, it becomes necessary to exercise the greatest possible care to prevent the condensation of moisture upon the apparatus, which is extremely liable to occur at this time of the year, for, if everything is not perfectly dry, it will be impossible to obtain uniformly good results.

Bearing the above in mind, it will be found advisable to thoroughly warm the machine previous to turning the handle, as any moisture conveyed by the plate to the rubbers will materially affect the results obtained. For this reason the machine should be placed at some little distance from the fire before it is put into action, as this precaution will have the effect of disseminating any moisture which would otherwise form on the plate. It is also necessary to carefully wipe the machine each time before it is put into use, as electricity, by virtue of its attractive power, collects innumerable particles of dust from the surrounding air, which act like so many points on the plate being revolved, and thus assist to dissipate the electricity as fast as it is generated. The electricity may be developed to a much greater extent if a small quantity of electrical amalgam is spread over the face of the rubbers.

*Electrical Amalgam* is a mixture composed of mercury, tin, and zinc, and can be obtained from any electrician, ready for use, at about 6d. per ounce, or, if preferred, it may be readily made in the following manner by the student himself: Melt together five parts of zinc and three parts of tin, and then pour nine parts of heated mercury on to the melted mass, and stir the whole together thoroughly. It is now poured into an iron or wooden box, and shaken up well until quite cold, when it should be collected and reduced to a fine powder, after which it may be placed aside in a convenient box or wide-mouthed bottle ready for future use. A small portion of the powder should be mixed up with lard in the form of a thick paste as required, and then smeared over the face of the rubber by means of an old knife. No more lard should be employed than is absolutely necessary in order to make it adhere. When it is wished to remove the rubbers from the holder, the plate should be given a few turns in the wrong direction, which will cause them to come out readily. A thin, even coat of amalgam may then be spread on the face of each one, after which they are returned to the holder.

To do this, hold them in position, one on either side of the plate, with the springs pressed down, and then push them forward with the plate until they are in the holder.

If the handle of the machine is now turned with a uniformly steady motion, the positive electricity will be driven over the surface of the prime conductor, from whence it may be drawn in the form of a bright spark; but, assuming the rubber and the prime conductor to be in their present insulated condition, the sparks will gradually become weaker and weaker, until at last they will cease altogether when the electricity of the plate has become exhausted.

In order to secure a continuous supply of electricity, it becomes necessary to connect the rubber with the earth by means of a length of chain attached to the nearest gas- or water-pipe. A suitable length of Dutch clock chain will be found to answer admirably for this purpose. Chain of this description, having small links the size and shape of Fig. 19, can be obtained from any watch and clock tool warehouse at about 3d. per yard; or, if preferred, the rubber can be connected with the earth by means of spirals of thick copper wire. When the machine is in use, it should be located on a table, quite clear of surrounding objects, as these will only tend to weaken the discharge by imperceptibly drawing off the electricity. It will also be found an advantage to clamp the machine firmly to the table, as it will then allow the student to work with greater freedom. It is a distinct disadvantage to work the machine at an express rate of speed, as the best results are obtained when a steady, uniform motion is maintained. With proper and careful management it will be possible to take 6 in. sparks from the small ball of the prime conductor when the Winter ring is attached to the machine, but the length of spark will be considerably lessened if it is drawn from the large ball of the conductor itself, owing to the fact that the tension is always greater at projecting portions than at approximately flat surfaces. After use, the rubbers may with advantage be removed and wrapped up and put away, the machine also being covered over. This precaution will have the effect of preventing any very great accumulation of dust, and will leave the machine ready for use when required.

*The Leyden Jar*, which is illustrated in Fig. 20, may be said to be one of the principal pieces of apparatus used in conjunction with an electrical machine. It takes the form of a thin glass jar or wide-mouthed bottle, which is lined inside and out with tinfoil, and provided with a wooden cap, through which a metal stem passes into the interior of the jar for the purpose of charging it with electricity. The lower end of this metal stem is furnished with a few inches of chain or a strip of thin sheet-brass, in order to make contact with the inner coating, and the upper portion terminates in a knob outside the jar, for, without this precaution, the electricity would be liable to escape from the end of the rod. The Leyden jar can, of course, be made to any size desired, but for all ordinary purposes a jar measuring about 12 in. in height and 8 in. in diameter will be found a useful size, sufficient for all ordinary purposes. Select a perfectly sound glass jar, entirely free from all cracks or imperfections, then proceed to coat the interior with tinfoil cut into strips about a couple of inches wide and of a suitable length to reach from the

bottom of the jar to within 2 in. from the top. The pasted strips of foil must be carefully introduced into the jar, and then made to adhere to the side by means of a small mop, which can be readily made by tying a piece of wadding on to the end of a strip of wood. Each succeeding piece of foil should be made to slightly overlap the preceding one, until the entire surface inside the jar has been completely covered, when a circular disc of foil a trifle smaller than the inside of the jar is cut and pasted over the bottom, thus completing the arrangements of the interior. For the outer coating, a single strip of foil of suitable size should be pasted and wrapped completely round the outside, with the edges slightly overlapping, not omitting to turn a narrow margin underneath at the base, after which the coating is completed by a suitable-sized disc of foil pasted on to the bottom. It is highly important for the outer covering to be laid on perfectly smooth and entirely free from creases or wrinkles, as, being open to inspection, any slipshod details will show with damaging effect. It is almost needless to say the two coatings should be of a uniform height.

For the rod we shall require a piece of stout brass rod, about ⅛ in. thick and a third longer than the total height of the jar. A narrow strip of thin sheet-brass, a trifle longer than the width of the jar, is now bent to the form of A, Fig. 21, and afterwards drilled through the centre, and then fitted and soldered on to the end of the rod, after which the latter is made to fit tightly into a hole bored through the centre of an ornamental lid or cap (B, Fig. 21), which is turned to a suitable size proportionate to the jar. Four small slips of cork, glued round the under edge of this wooden cap, will ensure the latter fitting tightly to the mouth of the jar. The cover, which should be turned from a piece of thoroughly dry mahogany, will require to receive two or three coats of good shellac varnish for the purpose of better insulation. An ordinary brass stool ball of suitable size will be found to answer very well for the knob of the jar. These balls, which can be obtained from any ironmonger, are provided with short screw stems soldered to the inside of the ball. It will be found a simple matter to heat the ball over a gas flame and melt out the screw, and then solder it to the end of the rod, thus forming the knob of the jar. After the stem and knob have been carefully lacquered, the brass spring should be pressed together slightly, in order that it may just pass through the neck of the jar; then the rod is steadily pushed downwards until it touches the bottom, when the strip of brass will adapt itself to the form of the jar, and thus ensure metallic contact with the inner coating of foil. A great many jam manufacturers are now using wide-mouthed jars made of hard, white glass of good quality, similar in shape to Fig. 20, which are admirably suited for use as Leyden jars, as the mouths are almost the width of the jar itself, which thus renders the attachment of the inner coating a very simple matter. The writer has seen these jars in two sizes, of ½ lb. and 1 lb. capacity, measuring outside 4 in. by 3 in., and 5½ in. by 3½ in., respectively.

*A Discharging Rod* is a very useful appliance, which is used for the purpose of discharging a Leyden jar when it is undesirable for the experimentalist to receive the shock himself. The discharger takes the form of a stout piece of brass wire about 12 in. long, which is bent in the form indicated in Fig. 22, and then inserted in a 1 in. length of brass tube ⅜ in. in diameter, to which it is secured by means of soft solder. Two small brass balls are now soft soldered to the ends of the brass arms, after which the central socket is cemented on to the end of a 6 in. length of ½ in. glass rod, which forms the handle. The width apart of the arms can be regulated to suit requirements by bending each one to the form desired. The piece of glass required for the handle may be broken from a larger rod, if a slight groove is first made round the rod by means of a file, after which the lower end should be rounded off on a grindstone. Another plan of making this discharger is to cement a small brass gas cap on to the end of the glass rod, and then insert the wire in a couple of holes of suitable size drilled through the cap on opposite sides as shown in Fig. 23.

*A Director* (shown in Fig. 24) is another form of discharger, which will be found very useful when discharging a Leyden battery and in manipulating various other pieces of apparatus. It consists of a 6 in. length of stout brass rod, which is soldered into a hole drilled in the end of a small brass gas-tap, and then cemented on to a 6 in. length of glass rod, after which the outer end of the brass rod should be bent in the form of a curve, and provided with a small brass knob.

*The Jointed Discharger* (illustrated in Figs. 25 and 26) will be found much more useful for all ordinary purposes than either of the foregoing, as the width of the arms can be accurately adjusted to the purpose for which they are required. A couple of pieces of stout brass rod should be softened in a gas flame, and then bent in the form of a loop at one end, which is afterwards flattened out on an anvil in order to spread the metal as much as possible. Thus prepared, the two arms are placed together, with a small washer in position on either side, in order that they may be joined together by means of a small brass nail passed through a central hole in the washer, and then riveted up tight, so that the arms may move stiffly. A couple of brass gas caps, ¾ in. diameter, are now procured from a gas-fitter, and provided with a couple of holes, which are drilled across the diameter of each cap near to the closed end. When this has been done, each cap is tightly fitted on to one of the jointed arms, and then soldered in position at about an inch from the joint. A couple of 4 in. lengths of glass rod of suitable diameter are now cemented into these caps, thus forming the insulating handles by which the discharger is held—a small brass ball being lastly soldered on to the end of each arm.

*The Leyden Battery* (which is shown in Fig. 27) will be found indispensable for the performance of certain experiments—when it is desirable to pass a powerful discharge through a body, or for the purpose of fusing or igniting various substances. The Leyden battery is formed by connecting the internal and external coatings of four or more jars, in order to render it possible to pass the full discharge from all the jars at the same instant. A wooden box of sufficient size to hold the jars, and about 2 in less than the total height of one of the latter, is provided with four supporting feet, and then French polished or varnished outside, after which the interior is carefully coated with tinfoil, and a brass drop handle is lastly screwed on to either end. Thus prepared, the jars may be placed in the box as required, the knobs which represent the inner coatings being connected together by means of a piece of brass chain, which is twisted round each jar. The Leyden battery is charged and discharged in precisely the same manner as a single jar. The inner coatings are put in communication with the prime conductor by means of a suitable length of chain brought from the knobs of the jars and hooked on to the latter, and the necessary earth contact is obtained by suspending a short length of chain from one of the handles. These handles, by the way, should be in metallic contact with the inner tinfoil coating of the box. This arrangement of Leyden battery will be found very useful when the jars are frequently used singly; but, supposing that several jars are kept solely for use as a battery, it will be found a good plan to connect the inner coatings together by means of cross rods of stout brass wire, which are sprung into holes drilled for their reception in the knobs of all the jars, as will be seen by reference to the cut.

*The Diamond-spotted Jar* (illustrated in Fig. 28) forms a very beautiful experiment when the discharge is viewed in a darkened room. The tinfoil with which the jar is covered is cut in the shape of small 1 in. squares, pierced with a central opening about ½ in. in diameter. Each piece of foil should be punched separately, whilst supported on a block of hard wood, using a ½ in. cork borer for the purpose. When a sufficient number of pieces of foil have been prepared, it will be time to begin coating the jar, commencing with the lower conducting surface. For this, first lay a disc of foil of suitable size over the bottom on the inside, and then paste a ¾ in. strip of foil round the sides and in contact with the disc covering the bottom. Thus prepared, the small discs of foil are carefully pasted on to the glass with the diagonals of the squares horizontal and vertical, and arranged in such a manner that the points nearly touch one another, as shown in Fig. 29, which is an enlarged detail of the coating, the shaded discs representing the inner coating. When a sufficient height for the coating has been reached, another narrow strip of foil should be pasted all round the top, after which the outside of the jar is coated in a precisely similar manner—a narrow strip of foil being pasted at the top and bottom in a corresponding position to the strips on the inside, with a circular disc of foil covering the bottom of the jar. The points of the outer discs of foil should be so arranged as to nearly touch each other in the centre of the opening of the inside pieces. By this means the sparks will be seen to simultaneously illuminate both the inside and outside on the jar being discharged. When the jar has been coated in a satisfactory manner, it should be furnished with a sound, dry, wooden cover, which is then varnished and fitted with a brass stem and ball in the manner before described. On the jar being charged, bright little sparks will be observed scintillating all over the surface when viewed in a darkened room; and when the discharge takes place, a beautiful bright spark will appear at the same instant at each angle over the entire surface.

*The Sportsman Jar* (which is shown in Fig. 30) forms a very amusing and interesting piece of apparatus, which is by no means difficult to construct. First solder a small brass ball to one end of a short length of stout brass rod, and then bend the latter to the form indicated in Fig. 30, at A, and afterwards solder it at about two inches below the knob of an ordinary Leyden jar, in the manner shown in the above cut. When

this has been done, carve a small wooden figure about the height of the jar to represent a sportsman with a gun at his shoulder, and then paint the figure in suitable colours, after which a small wooden stand, shaped in the form indicated in the cut, should be carefully moulded on which to stand the jar and the figure, the latter being attached to the base by means of a couple of screws and some glue. Before finally fixing the figure to the base, it will be necessary to polish or varnish the latter, and then cover the entire upper surface with a sheet of tinfoil cut to the required shape and then pasted on the wood — any wrinkles or creases being smoothed down flat by means of a piece of wadding or cotton-wool. Two or three pieces of pith are now cut to resemble birds, and then attached to the extended arm of the jar by means of silk threads, after which the apparatus is finally arranged in the manner shown in Fig. 30. The gun should be placed in metallic contact with the outer coating of the jar by means of a strip of foil led from the gun down the side of the figure to the foil-covered base, and the gun—which may be made of metal—should be furnished with a small knob at the end. On the jar being charged, it will cause the birds to rise and fly as far away from the central knob of the jar as the length of the silk threads will allow, and, as soon as the jar has become fully charged, a spark will pass from the knob of the jar to the gun, thus discharging the jar and causing the birds to fall as though shot. Small carved Swiss figures, suitable for this purpose, can now be obtained from any toy-shop at very reasonable charges, and one of these can generally be found which will answer the purpose with but slight alteration.

*Lane's Discharging Electrometer* (shown in Fig. 31) is a very useful appliance for regulating the sparks given off by a jar, and is almost identical in principle with the Sportsman jar, above described. First obtain a pair of small brass bedstead knobs, and then drill a hole on opposite sides through the centre of each one. When this has been done, one of the knobs should be tightly fitted on to the stem of an ordinary Leyden jar, to which it is affixed, about midway between the knob of the jar and the wooden cover of the latter, by means of a touch of soft solder. A 6 in. length of stout brass rod is now bent in the form of a ring at one end, and then made to fit tightly into the holes drilled through the other knob, after which a small brass ball is soft soldered on to the straight end of the rod. The rod will not require to be soldered, but should be arranged in such a manner as to move stiffly through the knob. Thus prepared, an 8 in. length of soft glass tubing of suitable diameter to fit the open ends of the two knobs is now softened in a Bunsen flame and then bent up to right angles at about a couple of inches from one end, after which the short arm of the glass tube is cemented into the knob provided with the adjusting rod, the remaining end of the glass stem being attached in a similar manner to the knob of the Leyden jar.

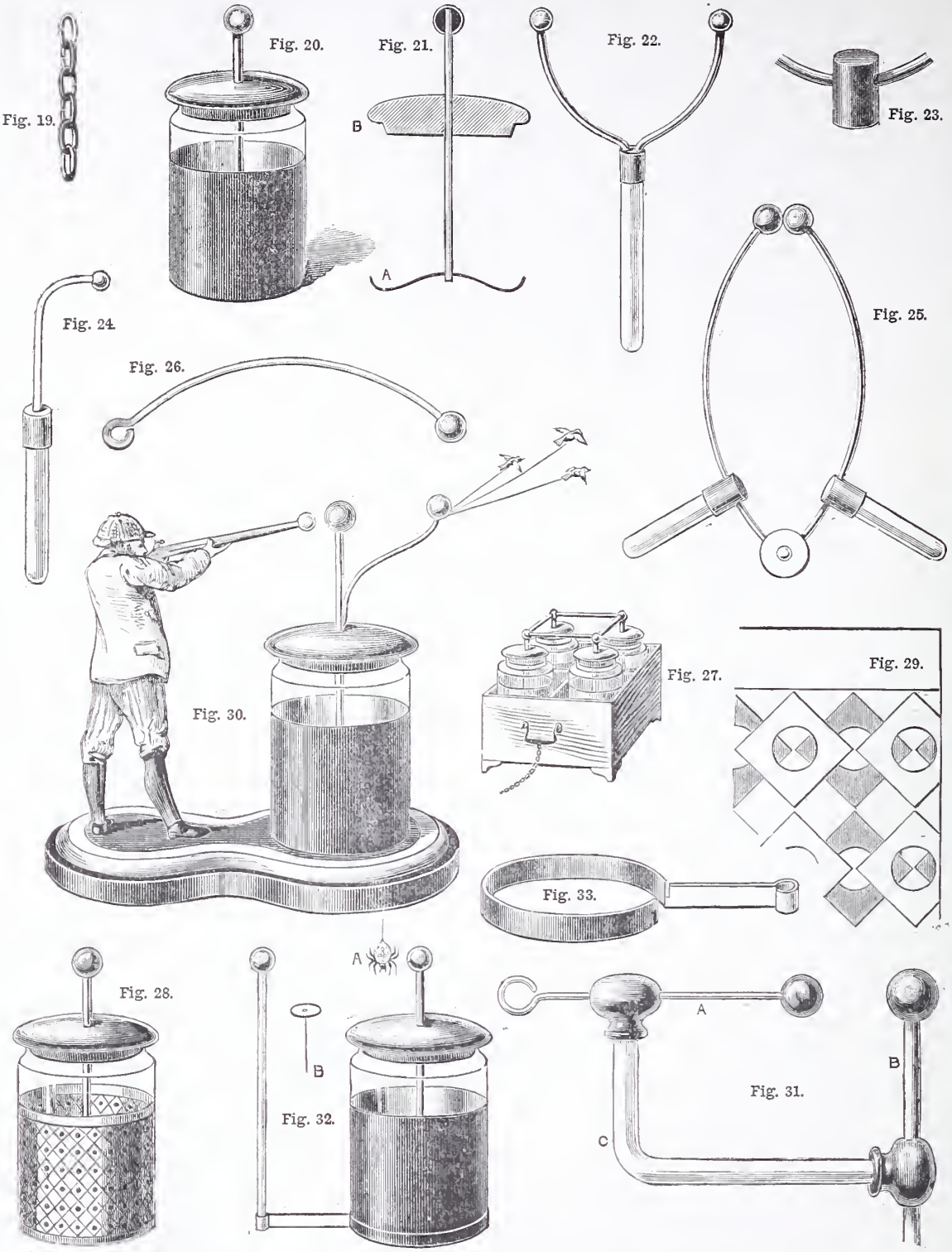



Fig. 19.—Brass Connecting Chain. Fig. 20.—Leyden Jar. Fig. 21.—Section of Cap and Conducting Fittings of Jar—A, Spring; B, Wooden Cap. Fig. 22.—Discharger. Fig. 23.—Alternative Plan for Cap of Discharger Handle. Fig. 24.—Director. Fig. 25.—Jointed Discharger. Fig. 26.—Arm of Jointed Discharger. Fig. 27.—Leyden Battery. Fig. 28.—Diamond-spotted Jar. Fig. 29.—Enlarged Detail of Diamond Coating. Fig. 30.—Sportsman Jar. Fig. 31.—Lane's Discharging Electrometer—A. Adjustable Stem; B, Stem of Jar; C, Glass supporting Stem. Fig. 32.—Spider Jar—A, Spider; B, Card Disc from which Spider is suspended. Fig. 33.—Brass Collar for Spider Jar.

When in use, it is simply necessary to hang a chain from the loop of the adjustable arm, and then twist it round the base of the jar. It will now be readily understood that, by pushing the adjustable arm in or out of the insulated bearings, it will increase or diminish the distance between the two knobs, thus regulating the strength of spark obtained.

*The Spider Jar* (which is illustrated in Fig. 32) is an amusing method of slowly discharging a Leyden jar, which finds great favour with young folks. A suitable length of ⅜ in. strap brass should be bent once round an ordinary Leyden jar, with 4 in. of the metal bent out at right angles from the jar. A slot is now filed from the upper edge to half the width of the metal just at the angle where the straight portion joins the ring, after which another slot is filed to a like depth at the extreme end of the ring, but from the under side, as will be seen by reference to Fig. 33, which represents the collar ready for attachment to the jar. By this means the ring may be bent round the jar and thus locked together securely. The extreme end of the straight arm is now bent in the form of a small loop, into which a stout brass stem is fixed in a vertical position by means of soft solder, a small brass ball being soft soldered to the upper end. A small piece of pith is now carefully cut and painted to resemble a spider (see A, Fig. 32), being provided with a few pieces of dried grass to represent the legs. When ready, it is suspended from the ceiling by means of a silk thread passed through its body and then knotted, the other end of the silk being passed through a hole in a small disc of card, to which it is secured by another knot (see B, Fig. 32). Thus prepared, the disc of card is gummed to the ceiling, with the spider suspended at a convenient height over the operation table. If the jar is now charged in the usual manner and then placed in position on the table, with the spider suspended between the two knobs, it will be alternately attracted backwards and forwards from one knob to the other, until the jar is finally exhausted.

The above are a few of the articles which may be utilised as accessory apparatus to the Winter Electrical Machine. In the three papers to follow this I shall describe others, and thus put the reader in possession of the means and mode of making things which may be fairly described as electrical toys.

## A CYCLE HOUSE.

BY J. H.

JOINTING AND FITTING—POSTS—HORIZONTALS—RELATION OF UPRIGHTS AND HORIZONTALS—FIXING POSTS IN GROUND—TOP FRAME—FITTING OF SASH—BOARDING—DOOR—FLOORING—FELT—TAR.

*Jointing and Fitting.*—I will now describe in detail the jointing and fitting of the various members of the house the general construction of which was shown in the previous article.

*Posts.*—Taking first the four uprights, A, A, B, B (Fig. 4, page 513), allow 2 ft. to go into the ground, pointing the ends with an axe. These ends will be either tarred or burned. The latter is the better method, and the operation simply consists in holding them in a wood fire for two or three minutes until the surfaces are charred and well blackened. They will then resist damp without rotting for a much longer period than if they were put into the ground without any preparation whatever.

*Horizontals.*—Into these uprights will be mortised the bottom horizontals, C, C, and D, D. Note that these are not on the same plane, but C, C, are higher than D, D, by the amount of their thickness, or their depth—3 in. There are two reasons for this; one is that better mortise and tenon joints can be made by this arrangement, because the tenons of C, C, and D, D, can go right through the uprights instead of meeting in the centre, as would necessarily be the case if the bars were in the same horizontal plane. The other is that the bars, C, C, form with L, L, good supports for the flooring boards.

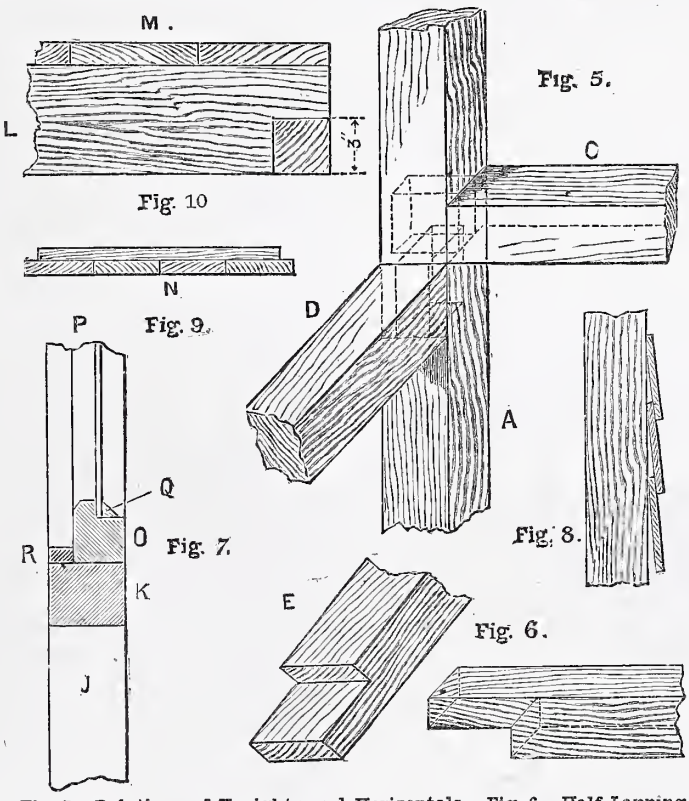



Fig. 5.—Relations of Uprights and Horizontals. Fig. 6.—Half Lapping. Fig. 7.—Fitting of Sash. Fig. 8.—Fitting of Boarding. Fig. 9.—Battened Door in Section. Fig. 10.—Flooring.

*Relation of Uprights and Horizontals.*—Fig. 5 shows the relation of the uprights and their two horizontals. The making of tenoned joints has been frequently described in WORK, and I need not, therefore, occupy space therewith. For rough outdoor work no glue is used, but a tight-driving fit made between tenon and mortise. Some paint or tar may be smeared over, and the joints should be either wedged or pinned.

Before the tenons are finally secured into the mortises, it will be advisable to cut the mortises in the front horizontal, C, and in the end horizontal, D, D, to receive the tenons of the uprights, J, J, for the window-sash, G, G, for the door, and H, H, for the support of the boarding. Then, the main framing being thus prepared, the posts, A, A, B, B, can be driven into the ground.

*Fixing Posts in Ground.*—There is not, however, much driving required. The proper way to fix the corner posts is this:—Dig four holes, about 18 in. deep, in the positions to be occupied by the posts, and drop these—the bottom horizontals being already finally tenoned and fixed—into those holes. Drive them with a sledge down to a firm bedding—six or eight inches will be sufficient, dependent on the nature of the soil. At the same time, see that the horizontals lie quite in winding with one another. When this is done, shovel a quantity of small stones into each hole, and ram them tightly round the posts with a mason's rammer, or with a sledge, or other suitable implement. Earth may be afterwards thrown amongst the stones and rammed down.

*Top Frame.*—Prepare the top frame, either by tenoning the corners of E, E, and the outer bars, F, F, or by making a half-lapped joint (Fig. 6). Half-lapped joints will be held with screws or with wooden pegs. Tenon the cross-bars, F, F, into E, E. The frame will then be laid bodily on the uprights, and spiked firmly upon these with 5 in. nails. The verticals, G, G, J, J, H, H, may be tenoned into the top rails, E, F, F, or abut simply, and be fastened with 5 in. nails. This completes a good firm framing, to which the rest of the work has to be attached.

*Fitting of Sash.*—An old sash, bought of any builder, will be fitted between J, J, K, and E. The sash, of course, must be bought at first, and the frame made to suit. There is no difficulty in fixing. The size of the recess is the same as the outside dimensions of the sash. The latter is made to rest against strips nailed inside the recess. Fig. 7 shows this in section, where K is the horizontal rail, J a vertical rail, O the sash-frame, P the glass, Q the putty, and R the strip that keeps the sash in place. A few screws or nails, driven in diagonally, may unite the sash to the rails.

*Boarding.*—The ⅜ in. boards on sides and roof are fastened with 1 in. wire nails to the frames; the overlaps are about 1 in. (Fig. 8).

*Door.*—The door, N, is made by battening 1 in. flooring board together, as shown in section, Fig. 9. It is hinged with strap hinges, not butts, and fitted with a staple for the padlock, a staple also being fastened into the post to correspond.

*Flooring.*—Two joists, L, L, to carry the floor, are fitted as shown (Fig. 10). The height of the shouldered portion is 3 in., equal to the depth of the quarterings of the frames. The boards, M, are then nailed on joists, L, L, and on frame timbers.

Felt is nailed on the roof with flat-headed nails, sold for the purpose. The house is tarred with two coats of tar. Shelving is put inside to carry oil-cans, spanners, and so forth.

## HOT-AIR ENGINES.

BY FRANCIS CAMPIN, C.E.

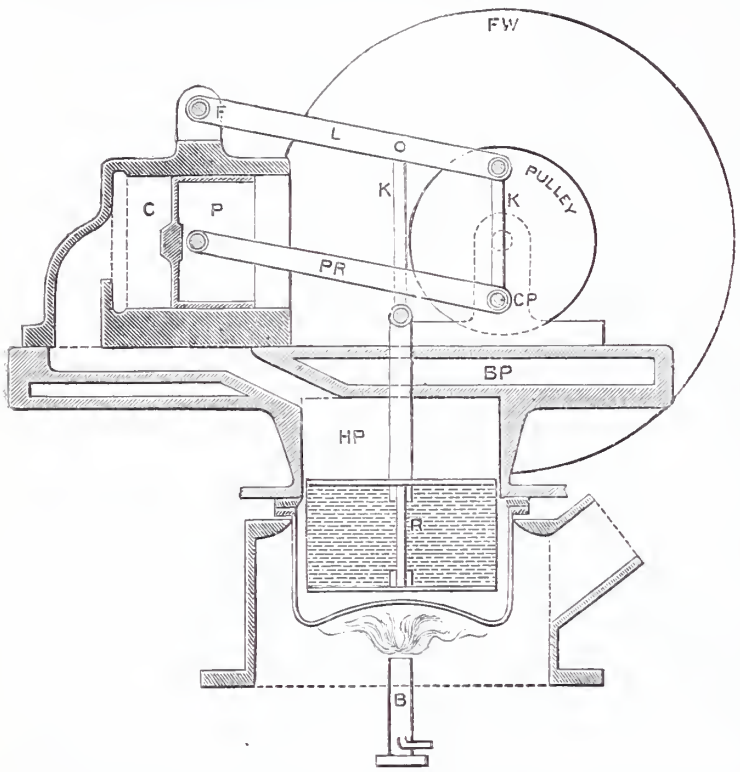
IN the early days of steam engineering Mr. James Stirling pointed out the economy that might be expected from the use of

heated air in place of steam in an engine. Subsequently Messrs. Ericson and Braithwaite took the matter up, and a steam vessel was refitted with caloric engines, as they were then called. This attempt was a failure—the late Mr. John Braithwaite told the writer that while the engine saved $10,000 in fuel, $100,000 worth of machinery was burnt out. This was in 1859.

Since that time many improvements have been made in hot-air engines, chiefly directed towards preventing the burning-out of the working cylinders, but on a large scale none of these have been successful.

Methods of applying water to the working parts have been used, but with the inevitable result of wasting fuel, for heat so abstracted must be a direct loss.

For small powers, however, there is a market for hot-air engines, and the best that I have seen is that made by Messrs. Potter & Co., in accordance with Robinson's patent. These engines may be driven by gas burners up to one-eighth horse-power, the gas being consumed in a Bunsen burner, so that there is no smoke whatever, or any escape of uncondensed gas.




A perspective view of the engine was shown in page 570, and the figure here given is a vertical section of the same. In this, C is a single-acting cylinder in which a trunk piston, P, works. The trunk piston is connected by a rod, PR, with a crank-pin, CP, fixed in a disc on a shaft which carries a fly-wheel, FW. Connected to the same crank-pin are links, K, K, which operate a rocking lever, L, and through links, K, K, actuate a plunger, R. The plunger, R, works in a hot-pot, HP, beneath which is a Bunsen burner, B. The rear end of the cylinder, C, communicates with the hot-pot, and the atmospheric air contained between these vessels is alternately expanded and contracted by the action of the regenerating plunger, R, and the burner, B. When the plunger, R, descends heated air passes up through the metallic gauze layers with which it is filled, and acts on the piston, P, which then makes a working stroke; the regenerator then rising absorbs the remaining heat from the air passing through it, and the momentum of the fly-wheel makes the return stroke.

These engines may be purchased at the subjoined prices :—

| Nos. | Diameter of Cylinder. | Approximate Power. | Fuel recommended. | Prices. |
|---|---|---|---|---|
| | inches. | | | £ s. d. |
| 1 | $1\frac{1}{4}$ | | Gas. | 4 4 0 |
| 2 | $2\frac{1}{2}$ | | ,, | 6 10 0 |
| 3 | 4 | $\frac{1}{32}$ h.p. | ,, | 10 10 0 |
| 4 | $5\frac{1}{2}$ | $\frac{1}{16}$ h.p. | ,, | 16 10 0 |
| 5 | $7\frac{1}{2}$ | $\frac{1}{8}$ h.p. | ,, | 25 0 0 |
| 6 | 10 | $\frac{1}{4}$ h.p. | Coal or Coke. | 33 0 0 |

This is a very interesting little engine, and is worth a little thought, especially in regard to the regenerator, R. I do not want any of our readers to be led into the idea that this regenerator gives us "perpetual motion;" it merely absorbs residual heat from the air passing from the cylinder to the hot-pot, and it gives that heat back to the air re-entering the working cylinder; but a certain amount of heat is converted into "work" by the action of the engine, and this heat is supplied by the Bunsen burner, B. The bed-plate, BP, of the engine is made hollow, so that water may be circulated through it if desired.

As it has been said above, a perspective view of the exterior of an engine on this principle was given on page 570. It was thought, however, that many readers of Work would be desirous to obtain a description of the internal construction and arrangements, which was not given in the notice itself, and hence the appearance of the article and diagram by which the missing link is supplied.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

89.—Forty Plates on Building Construction. Some time ago I had the pleasure of noticing in Work some volumes of a technical character prepared and written under the auspices of the Polytechnic Institute, Regent Street, London, W., and published by Messrs. Cassell & Company, Limited, La Belle Sauvage, Ludgate Hill, London, E.C. I have now to draw the attention of the readers of Work to a handsome folio volume entitled "Forty Plates on Building Construction," by Mr. Charles F. Mitchell, Member of the Society of Architects, Member of the Architectural Association, Lecturer on Building Construction at the Polytechnic Institute, and Registered Teacher of the Science and Art Department, and City and Guilds of London Institute. Mr. Mitchell has been assisted in his task, or rather in his labour of love, by the lecturers of the Polytechnic Institute. It will be useful to reproduce here at length Mr. Mitchell's prefatory remarks, which show far more clearly than anything I might write to this effect, the *raison d'être* of the work itself. "These plates," he says, "have been prepared to render assistance to students studying for the examinations in the elementary, advanced, and honours stages of 'Building Construction and Drawing' conducted by the Science and Art Department, and for the examinations in carpentry and joinery, brickwork and masonry, and plumbing of the City and Guilds of London Institute. I trust they will be found of service to those professionally or practically connected with the building trades. I also take this opportunity of thanking my colleagues for their help in the revision of those plates against which their names are placed, and to Messrs. E. G. Davey, Polytechnic Medallist, G. A. Mitchell, National Honours Silver Medallist, and F. G. Conyard, National Competition Prizeman, for the assistance rendered in executing the drawings. The text for the plates, together with additional subject matter and illustrations, will most probably be published early in 1892, under the title, 'Part II.—Building Construction and Drawing.'" Regarded as a whole, the volume may be described as a bird's-eye view of the various operations combined in the building of a house from the foundation to the completion of the roof, with all details of internal work in joinery, staircasing, etc., and all that is needful to be carried out with reference to plumbing, ventilation, and hot and cold water supply. To mention *singulatim et seriatim* the subject matter of each plate would take far more space than I have at my command, and it will be sufficient, while touching on this, to say that Plates 1 to 8, inclusive, are devoted to brickwork and masonry (1); Plates 9 to 22, and 25 to 29, to carpentry and joinery (2); Plates 23, 24, 30, 31, 32, to plumbing (3); Plates 33 to 37 to constructional ironwork (4); and Plates 38, 39, and 40 to details of a small town residence, with complete sets of working drawings illustrating fire-resisting construction, sanitation, ventilation, and the necessary arrangements for laying on hot and cold water in various parts of the dwelling. The price of the volume complete, strongly bound in cloth, is 10s. 6d., but those who do not require it in this form are privileged to obtain the plates in different sections, as described and numbered above: No. 1 at 1s. 6d., No. 2 at 3s., and Nos. 3, 4, 5 at 1s. each; or copies of any single plate may be obtained in quantities of not less than one dozen at 1s. 6d. per dozen. This offers a great advantage to technical schools, in which this work will be found of the utmost service, and to classes in which any particular branch of the building trades is under consideration; and, owing to the number of students in the class, a single plate among so many would be well-nigh useless. The drawings themselves are well defined and clearly executed, and in all cases are drawn to, and accompanied by, a scale of feet showing the proportions of each piece of work, or species of work, that is illustrated, and affording facilities for enlargement, also to scale, a kind of practice in drawing office work that is extremely useful to and much needed by students. As a work of reference it should be found in the office of every builder whether on an extensive or limited scale, where it will also prove of service in reminding its owner and user of the right thing to do and the right way to do it, at times when through stress and pressure of work and the worry that is consequent upon it, the brain will not answer the helm quite so readily as it will when all is plain sailing and there is nothing to distract and weary and divide the attention.

The Editor.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Patent.**—S. E. (*Upper Clapton*) writes:—"'It is amusing to see the readiness with which persons entirely ignorant of a subject will set themselves up to guide and instruct others, and what useful and infallible authorities they consider themselves.' In these words our friend C. E. commences one of his usual instructive and useful articles, on p. 492, No. 135, and his words are perfectly true as applied to the nonsensical and misleading statements made some time ago by C. C. C., and in other papers by many other would-be authorities in such matters. But C. E. has himself made a serious slip in the article in question, and I hasten to correct it, as if any of your readers rely upon this particular statement of his, they may regret it when too late. C. E. tells us (speaking of the filing of the complete specification) that, 'if it is found that what has to be done cannot be completed within that term (nine months), an extension of time of one, two, or three months may be applied for, for one of the three periods named, with the stamps for fees of £2, £4, or £6 impressed upon the application; but *no further* extension of time will be granted.' The fact of the matter is that one month, and one month only, beyond the original nine months, can be obtained for filing the complete specification, and the stamp duty required on the application form is £2. I am sure that C. E., in his usual fairness, will be ready to admit his error in the case. As an inventor myself, I have found that what you want is an old-established, experienced agent, doing business in a comparatively small way, and whose personal attention you may rely upon obtaining."

**Patents.**—S. G. T. (*Penarth*) writes:—"Many of your correspondents tell us novices how to go about getting a Patent, and in a very clear and able manner; and there is no doubt but that anyone of average ability could get his ideas patented by following their directions. Among other things, they tell us to go and search the Patent records before we apply for a Patent, and see if we have been anticipated. Now, I have what I believe is an excellent idea for a cushioned tire for bicycles, etc., and I went, before applying for protection, and searched the Patent lists to see if any other 'inventor' was before me. I looked through all the lists of sealed Patents for this year, but found nothing like mine, but on searching the lists of applications for Patents, I found that there were about two a day for the last three months for the same kind of thing. Now, can any of your correspondents tell how we are to know that some of these applicants may not have the very same thing as ourselves, and being before us, of course, have the preference? A little more information would be very useful upon this point, and doubtless some kind reader will supply it without appealing to your specialist for so small a matter."

**Boot for Shortened Leg.**—J. F. (*Glasgow*) writes:—"Could you kindly send me Mr. Tyrrell's address (see Work, No. 135, p. 490—Improved Boot for Shortened Leg), as I wish to make inquiries about above?"—[No addresses can be given in Work elsewhere than in the advertisement columns.]

**The Utility of Work.**—The Rev. L. M. (*Roscrea*) writes:—"I have often thought of writing to you to say how pleased I am with Work. It is a splendid paper for all professionals as well as amateurs, and I have tried to show my appreciation of its value by recommending my friends to subscribe to it. I am glad to say half a dozen, at least, have been wise enough to follow my advice, and they all agree in saying it is 'A 1.' I say this by way of encouragement, Mr. Editor—if you need any—though I think the success of Work ought to encourage the most despondent of editors, and I know *you* do not belong to that class. Now see what an advantage Work has been to me. Four years ago my 'kit' consisted of an axe, a rusty saw, and a sardine knife. But Work put different ideas into my head, and showed me the way to carry them out. First I made the Cheval Screen Escritoire. Then I took up the Battlesden Car—in spite of gloomy prophecies by my friends as to the result when the trial trip was made. Then came other things, among which I may mention folding table, two overmantels—one from design by Mr. Gleeson-White, the other by Mr. Adamson—a settee, wardrobe, dressing-table, and a dozen other things; the last a zither, which my wife is now playing. So you see Work has been a real source of profit to me to say nothing of the pleasure, and with regard to the last item, I have spent some of the happiest hours in my 'shop' I ever spent. I am not afraid now to tackle any job that lies in the carpentry line, for the reading of Work has been as good as an apprenticeship to me. I live within a dozen miles of one of your contributors, the Rev. J. L. D., who has been very good to me in giving me hints; and Opifex was once in this diocese. I must apologise for trespassing on your valuable time, but after all the pleasure and profit I have derived from Work, the least I can do is to write and express my gratitude."—[Insertion is given to this letter because it not only illustrates the extent to which the publication proves serviceable in the hands of the intelligent worker, but because it contains an excellent suggestion bearing upon the large circulation of Work. If the many subscribers who write anxiously desiring to "do something" for Work were to follow the Rev. L. M.'s example, there is no saying where the circulation of the Magazine would end.]

**Framing Engravings, etc.**—T. S. (*No Address*) writes:—"I so often see good engravings spoiled by careless framing that I am induced to send to your readers the way in which the work should be done instead of the usually imperfect mode. A valuable engraving is sent to be framed, and if nine out of ten are examined they will be found to be done as follows: The glass is put into the frame and strips of paper pasted round more or less carefully, thus the frame and glass are secured together; then the picture stretched on a frame, or stuck to a mount, is put in with a few brads, and brown paper stretched over all. The effect of this plan is that, however perfectly it is done, the act of cleaning the glass presses the brads down and loosens the paper that is intended to secure all dust-tight, and in the course of a year or two a brown streak of smoke-dust extends like a shadow across the picture, often impossible to remove again, or a general cloud veils the picture, causing a proof engraving to look like one of the last dozen prints taken off the plate. Now the proper way is to carefully clean the glass—and even in this some extra care is necessary, as brisk rubbing to a sheet of glass will make it electrical, and every particle of dust will fly to it, and require some trouble to remove—and you will find when the work is done, that your glass has a quantity of fibres of the cloth you used, or any other small particles that happened to be near, between it and the picture. Place the glass cleanest side up on the table, projecting an inch or two over the edge; lay the picture on it, and if it has no mount, a sheet of brown millboard, or at least a sheet of stout paper should be added. Then with a straight-edge cut some strips of brown paper of width sufficient to bind the glass and picture together (about ⅜ in. on the glass and ½ in. on the back); add to this the thickness of glass and picture. Damp the strips and glue them on to the edge, like what the ladies and tailors call binding; follow round all four sides, so that, when the work is done, all that is required is the ornamental frame, and something to hang it by. The picture, but for appearance, is perfectly dust-proof, and will always look bright and clean. It will sometimes happen that the frame has a very narrow rebate, and the binding will show, so when quite dry you had better pop it into the frame to see how it looks, and if any binding shows, run a pencil-mark round; take it out, and with straight-edge and point of knife, cut down through the binding to the glass, when the superfluous binding can be easily scaled off, leaving the glass quite clean. I have often had to leave only ⅛ in., but if properly done it is enough. Another piece of millboard, or a thin wood back, secured with a few brads and a damped sheet of brown paper glued over all, will make a complete job. Thus the frame is, as I have before stated, merely as a means of support and ornament to the picture, which, for protection against dust, etc., is completely framed without any frame at all. In fact, I have often stuck a strip of gilt paper on the glass over the binding, and glued a loop on the back and hung up small photos without any frame at all."

### II.—Questions Answered by Editor and Staff.

**Die Cutting and Stamping.**—M. (*York*).—(1) I have made inquiries as to the presses you require; and, no doubt, you have received price-lists, etc., by post, as great pressure on the columns of "Shop" will prevent this appearing for some time. The "Model" Press Company, of Farringdon Street, E.C., have them in all sizes; and Mr. John Esson, of Fetter Lane, Engineer and Printers' Broker, has several, second-hand. The specimens of relief stamping are very good; the engraving of the dies, however, seems to me to be rather shallow, if anything. (2) The black composition for filling in door, window, or coffin plates, whether zinc or brass, is best black sealing-wax; and for red letters, best red sealing-wax. The plate should be heated till the wax completely fills up the cutting; then grind off all burr left by the tool, and all superfluous wax, with a stone and water first: afterwards polish with oil and crocus (finest emery powder), and, lastly, with whiting and oil.—J. W. H.

**Type Cases—Soda Crystals.**—No Name.—Mr. John Esson, Printers' Broker, Fetter Lane, E.C., will, I think, give you the information you want as to the half-cases you require, and, probably, has some second-hand ones in stock. Any large oilman, such as Mence Smith, would supply you with the soda.—J. W. H.

**Paraffin Mixing.**—W. S. (*Glasgow*).—It is a difficult matter to connect your bare inquiry with any purpose or calling; otherwise, to answer it usefully might be a more definite matter. A friend, who is an analytical chemist, tells me he would mix them by turning a current of steam into the paraffin, or that alcohol would help to effect the purpose. My own experience in trade matters may be more serviceable, perhaps, in your case. Water—preferably "soft" water—can be amalgamated with oil paint by a continuous "agitating" action; and hot oil and turpentine may be readily mixed with water-paint liquids in a similar manner. In both instances the purpose is effected sufficiently thoroughly for spreading the mixture upon flat surfaces. From this I assume that paraffin—*i.e.*, petroleum—could as readily be amalgamated with water, especially in the small proportion of the former you name. I expect equal parts, agitated in a bottle, would soon mix, and then could be turned into the bulk of water. If there is any special chemical article used in certain processes for assisting the mixing action, I should suggest *borax* as being the factor. Why not state, simply and openly, your object and purpose?—F. P.

**Veneering.**—Ivanhoe.—You cannot do better than read the articles on Veneering in Vol. I. of Work. They deal thoroughly with the subject, and, having so recently appeared, it is impossible to go over the ground again in "Shop." Of course, after reading them, if you find yourself in a difficulty, write us, and you may be assured every assistance will be given you; but, after the very lucid directions which were given about the side of the wood on which the veneer should be laid, I hesitate to say the heart side, in case you should still misunderstand which side. If you have not got all the back numbers of Work, and do not care to buy them—though I strongly advise you to invest a penny in an Index to Vol. I., so that you can see what subjects have been treated—you will find a "few hints" (much good may they do you, for I rather think you want full directions) on a sliding-frame dining-room table in the number of Work for 7th June.—D. D.

**Distemper.**—Beeswax.—The amount of *genuine* yellow beeswax which—having been already scraped into shreds and then dissolved in oil of turpentine—should be added to a half-bucketful of distemper, in order to make a *tempera* paint for good decorative work, would be about 4 oz; or for a good pailful, prepared according to the instructions quoted on p. 787, Vol. I., the proportions would be ½ lb. pure beeswax in 1½ pints of turps, the two well amalgamated, and then added as directed. Respecting your second query, sufficient finest isinglass to make a pint of glass-gilding mordant could be readily placed upon a shilling. For further information, see answer "Acid and Gilding," when published.—F. P.

**Bell Telephone.**—J. R. M. (*Walton*).—I do not know of any very cheap telephone which would answer your purpose, unless you like to use the apparatus called "The Lovers' Telegraph." It can be made with two empty meat tins. Remove the bottom of each, and, in lieu thereof, stretch a piece of parchment over the end; in the centre of these bore a little hole, and pass a cord or wire through them, connecting both tins together, with a knot or button on the inside of each. The string must be kept strained when the instrument is in use. Words spoken into one cylinder can be clearly heard by a listener at the open end of the other. This is really a mechanical telephone, and, if properly made and connected, would answer your purpose very well. But I think you should try and make a set of telephones, with transmitter and receiver at each end, such as have been illustrated fully in Work already. They are as cheap as any I know. Sometimes you know that a cheap thing turns out very dear in the end. As all the necessary connections, etc., have been given before, it is not worth while taking up space with rough drawings. And, as you are a constant reader, you will have no difficulty in getting what you want from back numbers.—W. D.

**Micro-polariscope.**—B. J. T. (*Southsea*) asks if the angle of 26°, as given in my article, is the correct one, and if it has been given from experience, as in Ganot's "Physics," 54° 35' is stated to be the proper angle for glass to polarise. I will answer the last question first, and say that I arrived at my conclusions after long and exhaustive experiments, and the angle I have given is the one by which I have worked. From experiments I have made, I am led to think that the same angle does not answer for all kinds of glass, and, to obtain the best results, experiments must be made. Different writers seem to range from 50° to 60°. That being so, the discrepancy between such an angle and that given by me is only in appearance. Before I began experimenting, I read, "Glass will polarise at an angle of, say, 54°," by which I understood an obtuse angle containing 54°. I accordingly made a tube, and cut off the end at this angle; the result was, not the least polarisation. I was much perplexed thereat, and wondered where the mistake could be. I began experimenting, gradually tilting the glass at a more acute angle, until I obtained polarisation. I now found, by measurement, the angle at which I was working was just exactly the complement of 54° or 26°. I then understood that what was intended was that 54° were to be cut off. This is really the solution of the seeming difficulty. Having been

perplexed myself in the matter, I thought it would simplify matters to say that the tube should be cut at an acute angle containing 26°.—O. B.

**Planing.**—J. R. (*Hillsborough*).—You give no clue as to your acquaintance with wood working; but, probably, it is of a very recent date. I could advise better if you had given fuller particulars. I join with our Editor and contributors in asking our querists to ask their questions very fully, giving particulars of the special difficulty that presents itself, in order that we, who are still learning, may learn to give full, exact, terse, and helpful replies. For planing pieces of wood ½ in. square, 2 ft. long, use a jack-plane, well sharpened and set. Read how to do this in WORK, No. 20. With proper treatment, the wood does not want *fixing* on the bench; but if J. R. has many pieces to plane to a size, it may be worth while to make some contrivance to assist in doing this. I have a paper in hand on this very subject, which I will send to the Editor as soon as I am able, and hope it will be of use to J. R. and many others.—B. A. B.

**Cog-Wheels.**—A. Y. (*Blackburn*).—When the saw bench on p. 177, Vol. II., was drawn, I thought chiefly of the most convenient height of handle, doing away with slip, and getting the advantage of a rapid revolution of fly-wheel. If these are obtained, by all means have the other details to suit yourself. I should apply for cog-wheels to Lloyd, Steelhouse Lane, Birmingham, or Barker's Gas Engine Manufactory, Birmingham. If not successful in obtaining the wheels, I should try to get a second-hand mangle and wringer, or the wheels thereof, by Bradford, or Harper Twelvetrees; but without sizes it is impossible to advise. It would be best to get two cog-wheels and two pinions before deciding position of axles, as the exact size does not matter much. You want the saw to turn at least twelve times as often as you turn the crank. —B. A. B.

**Propeller Screws.**—F. M. (*Thornton*).—The area of screw blades should be determined by experience; but for those who have no opportuuity of so determining it the following rules will be useful. I give them for four-, three-, and two-bladed propellers. I H P = indicated horse-power of engines; $c$ = a co-efficient:—

$$\text{Total area of screw blades} = c\sqrt{\frac{\text{I H P}}{\text{revoluts. per min.}}}$$

In which formula—

$c = 15$ for four-bladed propellers;
$c = 13$ for three-bladed propellers;
$c = 10$ for two-bladed propellers.

The pitch of screw for propellers varies very much, and in our columns we have not space to deal with so wide a subject. You will find it all explained in Seaton's "Manual of Marine Engineering." The thrust of screw is also explained in the work referred to.—F. C.

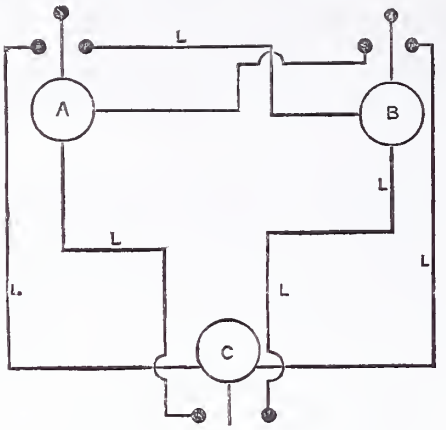
**Steel Hardening.**—A SUBSCRIBER.—No special method beyond the mere immersion of the articles to be hardened. The lead can be melted in any iron vessel; a ladle will do for small articles. The advantage of its use is that the temperature is nearly constant, and that the articles immersed can be left in the lead for an indefinite time without becoming burned. The steel is not oxidised as it is when put into the fire, but retains a clean surface. The lead should be free from corrosive adulterations, and be covered with charcoal while molten. Perhaps the following table, copied from a valuable and now rather rare book—Percy's "Metallurgy of Iron and Steel"—may be of service to you and others:—

TABLE OF THE COMPOSITION OF METALLIC BATHS FOR THE USE OF WORKING CUTLERS.

| *No.* | | *Composition of the Bath.* | | *Temp.* |
|---|---|---|---|---|
| | | *Lead.* | *Tin.* | *Fah.* |
| 1 | Lancets | 7 | 4 | 420° |
| 2 | Other surgical instrumeuts | 7½ | 4 | 430° |
| 3 | Razors, etc. | 8 | 4 | 442° |
| 4 | Penknives, and some implements of surgery | 8½ | 4 | 450° |
| 5 | Larger penknives, scalpels, etc. | 10 | 4 | 470° |
| 6 | Scissors, shears, garden hoes, cold chisels | 14 | 4 | 490° |
| 7 | Axes, firmer chisels, plane irons, pocket-knives | 19 | 4 | 509° |
| 8 | Table-knives, large shears | 30 | 4 | 530° |
| 9 | Swords, watch-springs | 48 | 4 | 550° |
| 10 | Large springs, daggers, augers, fine saws | 50 | 2 | 558° |
| 11 | Pit saws, hand saws, some springs | Boiled linseed oil. | | 600° |
| 12 | Articles which require to be somewhat softer | Melting lead. | | 612° |

Of course, a list of this kind must be taken *cum grano salis*, because of the great difference in qualities of steel. But the lead bath is valuable, nevertheless, and is used to a considerable extent. This ensures uniformity in tempering a number of similar articles; but where the clear fire only is used, the articles are enclosed in a cast-iron box, or a tube of cast or wrought iron, or laid upon a hot plate or bar. For small articles, a cylindrical tube of cast iron is as useful as anything.—J.

**Telephone.**—H. S. (*Stoke Newington*).—This is really a very simple matter when one thinks of it. Having fixed up your instruments in the various rooms, you will require three two-way switches. Carry a wire from station A through the switch to stations B and C. This done, go to station B, and carry the wire to stations A and C through another switch; and, having gone to station C, carry a wire through another switch to stations B and A, thus completing the arrangement. By following this out you will have complete control of the various instruments at the different stations. A simpler plan could not be adopted, although one which would,




Telephone Connections for Three Stations.

perhaps, save a few yards of wire might be devised; but it would lead to complications which would be difficult to get over. You will, of course, require a transmitter and receiver at each station, and also a bell for calling attention. I give above a sketch of the connections, although I think it is not necessary, for the instructions are plain enough, and would be easily carried out. In the sketch, A, B, C represent the three stations, and the heavy dots the switches. The arms of the switches are not shown. The L's represent the line wire. I hope you will be able to get over your troubles, and that your darkness will be illuminated by the above.—W. D.

**Spirit Graining.**—A. W. P. (*Leytonstone*).—Since your query was received, you have, doubtless, had a full answer in the paper devoted to the process which appeared in the Graining series, Vol. II. I should not advise you to try and make the paint mill, as they can be bought so cheaply of any painters' merchant. Crowden & Garrod, Falcon House, London, S.E., sell a very good one for 30s.

Paint Mill.

(I append illustration), which is computed to grind 6½ lbs. per hour. The next price is 40s., and so on up to 180s. To the trade, and for cash, there would probably be a reasonable discount off this. You cannot do better, I believe, than buy of Crowden and Garrod; but grinding one's own paint is poor economy at any time, unless one is situated far from manufacturing centres.—F. P.

**Zither Tuning.**—J. J. (*Belfast*).—You should write to the publishers, Cassell & Co., Limited, London, E.C., and enclose the necessary stamps for any copies of WORK you may require.

**Dynamo Design.**—H. D. H. (*Clevedon*).—If you are satisfied with the "mechanical details" of the design submitted to me, I very much fear you know little of the principles of dynamo designing. In the first place, the F.M.'s are badly designed. The channel is quite ⅛ in. too large, and the cores present an insufficient surface to the armature. The arch of the carcase should not be in one piece, but be slit, and the two pieces connected by a gun-metal bridge. Taking your own statement as being correct, the winding is altogether wrong. In a series wound dynamo, the armature resistance should nearly equal that of the F.M. In your machine the armature resistance is ·0078 ohm, and the F.M. resistance 3·130 ohms. Why have you put the wire on the armature in sixteen sections? Only one of these is effective for E.M.F. of current. You have only one yard of active wire on the armature, and this must be run at 5,000 revolutions per minute to develop an E.M.F. of 1 volt under the most favourable conditions. With a resistance of 3·130 ohms in the F.M. alone, you will get but a fractional amount of current in the outer circuit, even if the terminals are not short-circuited with a thick wire. Your best remedy now is to cut the arch of the carcase in two pieces, and connect the two parts with a non-magnetic bridge of gun metal or brass. Then see that one of the cores has a north polarity, and the other a south polarity. They should be wound in opposite directions to ensure this. You cannot alter the armature channel or tunnel, so must let that remain. Connect the armature in shunt with the F.M.'s and run it as shunt-wound dynamo at a speed of 5,000 revolutions per minute. Even then you will not get a powerful current from such a small and badly designed machine.—G. E. B.

**Electric Light Manager.**—T. (*Port Said*).—Your qualifications, as stated in your letter, should fit you for the duties of manager in an electric light installation. But you cannot expect an electric lighting company to take you on your own recommendation alone. I should therefore advise you to get your qualifications laid down on paper by your officers, and backed with the names of well-known men before you leave the service. Then you will have to make personal application to one or more of the electric lighting companies and ascertain whether they have a vacancy or not. Or advertise in WORK, the *Electrician*, or the *Telegraphic Journal*, for a situation. It is quite possible you may have to show your qualifications in the factory in a lower position, and thus work your way along by giving practical proof of your abilities. —G. E. B.

**Iron Girder.**—J. S. B. (*Poplar*).—The length of chord varies as the radius. We must first find the radius of the bottom chord, which is determined by dividing the square of span by eight times the camber, and adding half the camber: thus with span 75 feet, and camber 1½ inches (=$\frac{1}{8}$th foot)—

75 feet
75 „
375
525
$\frac{1}{8} \times 8 = 1$ ) 5,625 square of span.
5,625
$\frac{1}{16}$ = half of camber.
$5{,}625\frac{1}{16}$ feet = radius of bottom chord.
Add $8\frac{1}{2}$ feet = depth of girder.
$5{,}633\frac{9}{16}$ feet = radius of top chord.
Multiply by 75 feet = length of bottom chord.
28,165
39,431
$42\frac{3}{16} = (75 \times \frac{9}{16})$.
$422{,}517\frac{3}{16}$

This is to be divided by radius of bottom; the fractions may be dropped:—

$\frac{422{,}517}{5{,}625} = 75$ feet $1\frac{9}{16}$ inches, length of top chord.

You ought to allow 1 inch camber for every 40 feet of span. You will find the construction of girders practically treated in a series of articles on "Wrought Iron and Steel Girder Work," commencing page 171, Vol. I. of WORK.—F. C.

**Beer.**—W. G. G. (*London, S.E.*).—I am not aware of any book devoted specially to the after management of beers, but "The Theory and Practice of Modern Brewing," by Frank Faulkner, published at 21s., by F. W. Lyons, will be found to be an exhaustive treatise on the whole subject. The keeping qualities and condition of beers depend mainly on the quality of malt and hops used, and the skill with which the brewings are carried out. If any of these are defective, after management can do little to rectify and preserve. Thick and sour beer cannot be converted into good beer. The best judge of the quantity of finings is, in each case, the brewer who brewed the beer; different beers require different treatment. Warm weather undoubtedly affects beer, but beer can be, and is, brewed to stand such. Inferior qualities suffer most by the high temperatures.—APIS.

**Harmonium Articles.**—H. H. (*Barnsbury*).—No such papers have yet appeared, but some are in preparation.

**Discs for Electric Belts.**—J. W. (*Camberwell*).—I am not favourably inclined towards your proposed method of connecting the discs of copper and zinc. You are right respecting the dimensions of the discs. These may be of the size of pennies, or even larger, up to 1½ in. in diameter. You are also right about having a piece of flannel between the zinc and the copper discs, this flannel partition

acting as a porous diaphragm between the two elements. Now, the two elements should be connected as the plates of a battery are connected, not by a brass eyelet in the centre, passing through the porous diaphragm, but by an insulated conductor conveyed from the outside of the copper discs to the outside or edge of the zinc discs. These should be next the body of the wearer, and coated with thin flannel to prevent actual contact of the metal with the skin, or sores will result from irritation by the metal and its salts. The perspiration from the body will pass through the flannel, excite the zinc, and generate a current of electricity, which will pass through the moist porous diaphragm to the copper and be conveyed by the insulated conductor to the zinc of the next couple, and so on. When the two end discs are connected by the metal clasps of the belt, a current will circulate around the body. For further information I must refer you to "Shop," in Nos. 103, 115, 117, 120, 124, and 129.—G. E. B.

**Electric Gas Lights.**—GAS-L.—The instrument described by you, and illustrated by the sketches sent with your letter, is one of Clarke's patent electric gas lighters. The principles of its construction are similar to those of a Wimshurst frictional electric machine. Inside the outer fixed cylinder of ebonite there should be two quadrants of tinfoil, such as shown in your sketch, and six knobbed wires. Two of these wires should be connected to the tinfoil quadrants, two of them (opposite to each other) be carried up to form conductors for the outer circuit and connected to the insulated wires in the stem of the instrument, and the ends of the other two connected together. The connections may be made above the plate shown in your sketch, and these may be defective. They should be well insulated from each other, and may be improved by pouring melted paraffin on the plate. The inner or revolving cylinder has six strips of tin or copper foil on its inside surface. The spaces between these strips should be varnished with shellac (spirit) varnish, but do not varnish the strips of foil. When the cylinders are in position, the knobbed ends of the six wires must touch the strips of foil in the inner cylinder. The insulation of the outer cylinder may (as you suggest) be impaired. To remedy this, warm it before a fire, and paint it whilst warm with some of the shellac varnish, but do not coat the foils.—G. E. B.

**Bronze Paper.**—THORNHILL.—Write to Berry and Roberts, St. Bride Street, Ludgate Circus, London, E.C.—G. C.

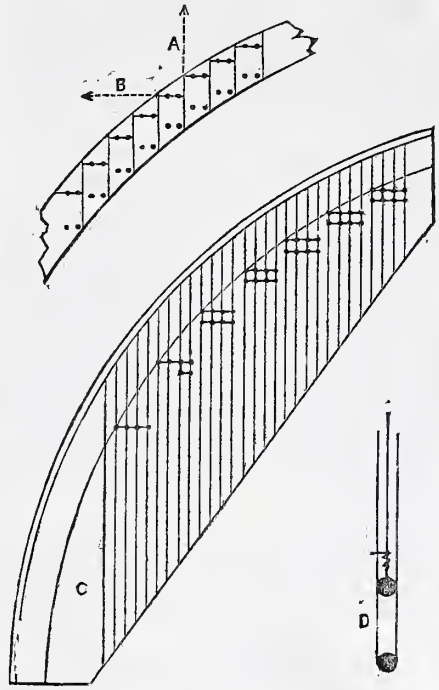
**Small Dynamo.**—H. H. (*Finsbury*).—As you are "only a starter at the game" of dynamo making, I should advise you to attempt something more simple and useful than trying to solve the problem of making "a small dynamo, weight about 1½ lb. complete, to fit in a box 3 in. high, 2½ in. wide, and 2 in. across," to give a light of 4 candle power when driven at about 2,200 revolutions per minute. I give your requirements here in order that some other reader may take up the problem and work it out for you if inclined to do so. As I do not think the "game" worth the candle, I relegate it to some one of those persons who find amusement in working out such problems. The "game" of dynamo making will require a little more study on your part than merely reading casually how to make a dynamo in the back numbers of WORK. I should advise you to read the instructions again, then "start" on one of the small dynamos mentioned on p. 644, Vol. II. of WORK. If you succeed with this, you will understand more about what you call a "game," but which is in reality a most serious study, than you do at present.—G. E. B.

**Safety Bicycle.**—J. J. (*Swansea*).—This subject has been treated in the following numbers of WORK:—107, 111, 115, 119, 124, 127, 132.

**New Invention.**—E. L. (*Netherton, Dudley*).—Our correspondent, as the matter is stated by him, is in no position to treat safely with the matter named; firstly, because there is no *proof* that he has any property to treat for; secondly, because he cannot *safely* treat for the sale of the plan until he has protected his rights, either by lodging a provisional specification or filing a complete. The first thing our correspondent should do is to ascertain clearly whether his invention *is* novel by a careful search and examination of all the published specifications relating to the subject, which may be seen at most of the public libraries—say, Birmingham, Manchester, etc. When he has satisfied himself that there has been no prior specification for his plan recorded at the Patent Office, he should then have prepared by competent parties, either a provisional or complete specification of his invention—properly illustrated with drawings in the latter case—and send them to the Patent Office, and when he receives the official notice of their acceptance, he may *then* proceed to negotiate for the sale or introduction of the matter. It would be the height of folly on his part to attempt to treat with anyone whilst his rights are unprotected, as it is too well known that what are called "trade" principles are not particularly noted for their abilities to distinguish the difference between *meum* and *tuum*, more particularly when the *meum* is most likely to be benefited by the operation.—C. E.

**Boot Studs.**—BARKIS.—E. Penton & Son, Mortimer Street, London, W., will supply you with Ellis's patent hoot studs. There are three sizes, large, medium, and small—price, sevenpence per doz.; per gross, 5s. 6d.; keys, with awls, for same, 3d. each. I should think any large grindery warehouse near you would keep or get them for you.—W. G.

**Piano Bent Side Plates.**—W. H. M. (*Burgess Hill*).—It is quite correct what you have read. You make a line on the bent side 2 in. from the sound-board edge. You start your first parallel line where your 2 in. line crosses the vertical lines. Perhaps the accompanying sketch makes it more plain for you. If you read the paper on "Stringing,"




**Sketch of Bridge—A, showing where cut with Saw; B, where cut with Chisel; C, how Hitch Pins are arranged on Bent Side; D, how Trichord Notes are formed.**

in No. 41 of WORK, you will see why two rows of pins are needed for the trichord. If you cut a small piece of wood, and make the lines on it as described, you would soon see how the bridge is carved. The bridge is cut away on the bevel towards the sound-board, to free the string up to the bridge pin-holes. The string must be free between the bridges, from pin to pin.—T. E.

**Charcoal Furnace.**—T. J. W. (*Stoke Newington*).—According to your sketch the charcoal *ought* to burn. There are two things that might hinder it: one is that the whole thing is too small to burn, as you can only get a small quantity in—scarcely enough to keep alight; the next thing is that a solid bottom would be better than bars in this case, and cut a little off the bottom of the door for draught, or punch some holes in it. You ought to use very small pieces of charcoal, and light it before putting in; but if I were you I should use a spirit-lamp. You would get more heat from it, and it would be constant as long as the spirit lasted.

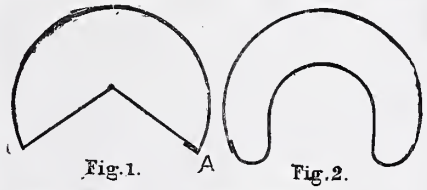



Fig. 1. Fig. 2.

**End Sections of Boiler for Model Steamboat.**

Your boiler is wrongly constructed. You have got most of the water at the bottom, where there is no heat. I send you sections of two boilers, either of which I have found to answer well. Fig. 1 is very simply made of copper, double-seamed and soldered at A, and an edge thrown off at the ends, the ends put on, hammered down, and well soldered. They will stand any amount of pressure that you are likely to want for model engines of any kind, and there is no fear of them leaking while there is any water in them. Fig. 2 can be made in the same way, but the working is a little more difficult. I hope that these few hints may get you out of your difficulty. If any further information is required, I shall be pleased to give it.—R. A.

**Pattern Cutting.**—A. M. W. (*Dublin*).—There is a book called "Last Fitting and Pattern Cutting," a modern (1885) treatise on boot and shoe manufacturing, by A. Hannibal, St. Bride's Avenue, Fleet Street, E.C.; post free, 3s. But I should think the one to suit you best would be (if you will allow me to judge for you) "A Manual of Boot and Shoe Manufacture," designed for the use of technical teachers and students, by Hill & Yeoman, and published as above; post free, 4s. I recommend this book because you also ask for a hook on the "technical terms" of the trade, and this one embraces not only pattern cutting, but subjects from the anatomy of the foot to prime costing; it also gives a good description of terms used in about fifteen subjects connected with the hoot and shoe trade.—W. G.

**Hand-sewn Boots.**—A. B. (*Manchester*).—Your first question is one that concerns almost everybody, for through want of knowledge in being able to judge a hand-sewn hoot from a machine-sewn, the public, by unscrupulous tradesmen and salesmen, are often greatly defrauded by the misrepresentation of goods. To answer this question to your, and my own, satisfaction, I should have to give one or two diagrams of sectional parts of boots of both makes, which would, with a proper description (which the subject deserves), make it too long for the "Shop" column. I will, therefore, as soon as time will permit, submit a short article on this subject for the Editor's kind approval. But, in the meantime, I will give you one or two hints that will help you in the matter. First take the sock out, and if you can see the stitches all round the inside, on the inner sole, you can be sure they are machine-sewn; if they are SMOOTH, they are either hand-sewn, standard-screw, or a combination. If they are standard-screw, you will find the marks on the inner sole of a small round disc. The screw wire is put in to such nicety that they seldom show on the inside, but if the centre of this impression is scraped away with the point of a knife, the brass screw wire will soon he brought to light and prove the make. Or they may be a machine-sewn welt (the nearest approach to hand-sewn), but in either case you may he ahle to see a real and good stitch all round the outside. Machine-sewn hoots or shoes are much heavier than hand-sewn. But another pretty sure guide is the inside of the heel, for as most all machine-sewn work has heels that are put on generally by a heeling machine, you can either see the heads of nails, or where they are clenched, on the inner sole of the seat, and if they are not machine heels they are nailed on by hand, and can be told in the same way: for this reason they often have a whole or half inner sole in them, hut if taken out it can soon be replaced. Hand-sewn men do not huild theirs in this way, for if not sewn they are pegged. Your second query, with regard to sewing the patch, see from A to B (Fig. 4), p. 201, No. 117, Vol. III. of WORK. You must not scrape kid, as that is a leather that has the grain side for the face. Calf you can, as the grain side is the wrong side, and the flesh the face. In answer to your third, I am pleased to tell you that my sixth paper, on Repairing, deals with welting and soling hand-sewn boots, which appeared on page 515 (No. 137).—W. G.

**Carriage Alarm Clock.**—ANSONIA.—I am afraid you will he unable to get the parts which you have broken and lost, as I have never been ahle to get exactly the same. The only thing I can advise you is to write to Grimshaw & Co., Goswell Road, Clerkenwell, London, and if they cannot supply you, then you can only put the remains aside as useless, or to come in for repairs, etc., to others of the same make; or you can write to the wholesale house of the company, or to the company themselves direct, and ask them to supply you with 'scape wheel, pallets and staff complete. I am sorry I cannot assist further, but they are made so cheap that it does not pay to stock parts.—A. B. C.

**Grandfather's Clock.**—P. R. (*Edinburgh*).—I am of opinion that you have either forgotten to put on the gathering pallet—that is, the little part that picks up the rack when it falls at the hour—or if you got that on (which fits on the end of a squared pivot of the wheel next ahove the wheel with the pins in it, and whieh lifts the hammer), you have not got the rack hook on—that is, the part that holds up the rack, or if on, it may not be working as it should; or, again, you may have it on all right, but, perhaps, the rack arm that rests on the snail, or should do so, may he hent out and falls ahove and over the snail, and so falls too far, and the gathering pallet cannot reach it to pick it up. See that all the ahove are right, that the rack does not fall beyond the reach of the pallet, and that the rack hook holds the rack up when it is gathered at the same time. Put the pallet on so that the hammer shall be free or off the pins when the tail of the pallet is resting on the pin in the end of the rack.—A. B. C.

**Chapel and Class-room.**—G. S. (*Glasgow*).—We cannot give contrihutors' addresses, but any stamped and sealed communication can be forwarded. Why not ask your questions through "Shop" for the good of the readers?

**Tar Stains.**—X. W. I. (*Portsmouth*).—The simplest remedy I can advise you to try would be to well wash the stains with spirits of salts well diluted with water. If this does not move them, try some quicklime spread over them thickly, like a paste, and left for twenty-four hours, the lime having been previously slaked with water to the consistency of cream. Whichever remedy you adopt, it must he *very thoroughly* rinsed off with water.—E. D.

**Core Box.**—G. B. E. (*Coseley, near Bilston*).—A paper on Helical Wheels is being prepared, and will be published shortly.

### III.—Questions Submitted to Correspondents.

**Brass Castings.**—Brass Finisher asks:—"Can any reader of Work tell me where I can buy a set of castings for a good brass fender and fire brasses?"

**Cement.**—Repairer writes:—"Will A. S. P. or others give a receipt for bicycle cement with proportions? I hear that old tires are used with other mixtures; what are the other things? I have some old rubbers."

**Wheat Mill.**—P. E. (*Cupar, Fife*) writes:—"Can any reader of Work give me a sketch of the cutters used for grinding coarse oatmeal? I have got a mill for grinding fine oatmeal, but find the same will not do for coarse oatmeal."

**Restoring Leather Chair Seats.**—Incrédule writes:—"Will A. J. (*Faversham*), who in p. 462, No. 133 of Work, recommends Jackson's varnish stains for above-named purpose, let your readers know where that material may be procured, as I would like to try it?"

**Banjo.**—Constant Reader writes:—"I am making a German-silver banjo; can anyone inform me how the edge is spun over the steel wires, also the easiest way of riveting it? I also want to engrave it. If any one of your readers can inform me the simplest way, he will oblige."

**Upholstery.**—W. W. (*Notting Hill*) writes:—"Will any reader give me some information how to stuff dining-room chairs, for I find when I make the roll and have stitched it, it is very uneven all the way round?"

**Whip Stand—Spring.**—Flagellum writes:—"Could any reader kindly give me an idea for a combination riding and driving whip stand? I should like it to be about 6 ft. high by 2 ft. 6 in. broad, standing on the floor against a wall, and containing a drawer for gloves, and so arranged that the riding whips might lie horizontally on hooks, and the driving whips might be upright. I should be glad to know, also, if there is any invention existing which is an improvement on the ordinary springs which are used for holding billiard cues, etc., in a vertical position in a stand, and which I find to scratch the cues, even if provided with rollers."

**Rope Door Mats.**—J. A. (*Southwark*) writes:—"Would any correspondent inform me how to make rope door mats? I have seen them oval shape, which I am told are made from old rope. I have pricked a hole through canvas and put the rope through, but it is not satisfactory. A rough drawing would greatly oblige."

**Wooden Horse.**—Old Chip writes:—"Could any reader tell me where I could get a wooden horse for a tricycle for a boy—a horse something like the hobby-horses we see going about?"

**Frames, Mounts, etc.**—T. B. (*Rochdale*) writes:—"Will any of our brother readers kindly give me the names and addresses of one or two wholesale houses in Manchester dealing in picture frames, mounts, etc?"

**Transfer Drawings.**—Draughtsman writes:—"Can any of your numerous readers give me any advice as to the making of transfer drawings for zincography? I use a crow-quill pen and Winstone and Sons' ink (litho transfer in sticks), but I do not know what consistency to make the latter. To get it a nice black I have to make it so thick that it will not work easily, and if I make it work easily the lines are faint in places. The crow-quills, too, seem to scratch up the surface of the prepared paper and blob the pen, making thick, smudgy lines where I want fine ones. The process is not photo-zincography, but the drawings are transferred direct from the prepared paper to zinc. I should be glad to know if there are any remedies for the defects I have mentioned, the best materials to use, etc., or if it is my own clumsiness."

**Exotics.**—Ajax writes:—"Can any reader of Work kindly inform me where to obtain any manual on the manufacture of artificial exotics?"

**Engine.**—Young Engineer writes:—"Will some reader give me a hint as to the colours to paint an eight-horse horizontal engine—such as cylinders, fly-wheel, and other parts? also colour for lining to match? Which kind of paint, too, ought I use to a ten-horse vertical boiler, or would gas tar do?"

**Fret Machine.**—N. R. (*Yeovil*) writes to W. R. S. (see No. 133, page 461):—"Kindly tell me how to make a fret-machine saw, to fix to a table or bench."

**Monogram for Fretwork.**—N. R. (*Yeovil*) writes:—"Will some kind correspondent give me a NR monogram for fretwork?"

**Chuck.**—Young Turner writes:—"Would any kind reader tell me how to make chuck, for oval turning out of wood? If Mr. Blackett could give me any information I should be very much obliged."

**Cement or Glue.**—J. H. P. (*Blackpool*) writes:—"I want to make a flexible waterproof cement, suitable for applying to leather. The cement must stand 130 deg. Fahr. of heat without softening. Can any readers of Work assist one in a fix?"

**Paraffin Oil Stove.**—Solder-Pot writes:—"Can any brother reader inform me if a plumber's metal-pot and solder can be heated by paraffin oil?"

**Spirit Stand.**—Carr Dyke writes:—"Can any reader of Work give me a design, or particulars as to where I can get fittings for spirit stand?"

### IV.—Questions Answered by Correspondents.

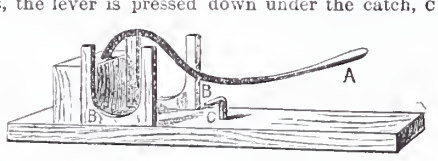
**Locks.**—Brass writes that if J. G. (*Bloomsbury*) (see No. 134, page 478) will apply to the undermentioned, he will in all probability get what he requires:—Mr. Wakeman, St. John's Square, E.C.; W. Taylor, Tower Street, E.C.; Thos. Ray, Waterloo Road North; all of Wolverhampton.

**Model Steam Launch.**—R. R. (*Liverpool*) writes, in reply to A. M. C. (*Holywood*) (see No. 135, page 494):—"I should advise you to write to the engineering firm, Leop. Tolch, of Liverpool, who will give you every information about launches. The above firm are supplying also petroleum launches (pat. captain), which have met with general approbation, and have been considered even better than steam launches."

**Wood Mole Traps.**—J. T. and Sons (*Ulverston*) write, in answer to J. J. (*Cumberland*) (see No. 135, page 492), that they "make them one of their leading lines."

**Heating Room.**—H. J. L. J. M. (*Ealing*) writes, in reply to C. J. P. (*Derby*) (see No. 133, page 462):—"I should think that for a room of the size you name (8 ft. by 5 ft. by 9 ft.) the duplex burner, if lighted an hour or an hour and a half before you require to use the room, would give out quite sufficient heat. I saw a lamp the other day called 'Lampe Veritas,' which gave out, according to size, twenty-five or fifty candle power. It was so arranged that the lamp could be placed in a radiator of cast iron for warming purposes, or put on a table for lighting purposes. This lamp is extensively used in country places for warming and lighting purposes. I should avoid the quicklime plan: it is used by workmen in the open air, but I should not like to try it in a room so small as described by C. J. P. It may be well to advise C. J. P. to see carefully that his room is suitably ventilated, or his studies may suffer and himself too."

**Firewood.**—F. H. (*Streatham*) writes, in reply to F. B. (*Rochdale*) (see No. 134, page 478): "I have sent a sketch of a simple firewood bundling machine, which I hope will be plain to F. B. A is an iron lever; when the wood is put into the round bars, B, the lever is pressed down under the catch, C;




Machine for Bundling Firewood.

a counter weight or a spring will bring the lever up again when the bundle is tied. In Vol. I., No. 11, page 171 of Work, under the heading, 'Our Guide to Good Things,' there are illustrations and description of 'Machinery for Splitting and Bundling Firewood,' which I am sure will be useful and interesting to F. B."

**Paper for Stencil Plates.**—G. P. (*Elgin*) writes:—"In Work, page 459, Vol. III., I see a reply under the above heading by S. W. I do not think S. W. will resent my sending the following: I have no wish to contradict him in what he says, for the simple reason that I couldn't, but I believe that the substance I am about to name is better than either of those which he suggests. This material is Willesden 1-ply paper. It is a thin substance, although it possesses good body, and is by no means easily torn; it is easily cut, and it does not absorb much moisture. It is to be had from the Willesden Paper and Canvas Works, in various colours at various prices."

**Coating for Damp Walls.**—G. P. (*Elgin*) writes:—"Under the above heading The Author of 'Every Man his Own Mechanic' recommends R. A. P. to use a solution of naphtha and shellac (see No. 133, page 462). Now, without going to contradict such a high authority, allow me to suggest a material which may be used without the unpleasant smell of the naphtha solution. That material is Willesden paper. All substances which have been used as lining papers for walls where damp would be likely to injure the paper have been superseded by this paper, which is made by the Willesden Paper and Canvas Company, and is much cheaper. These papers may even be used by themselves, being supplied in certain colours, besides admitting of being coloured. For lining damp walls, either the 2-ply 54 in. wide, at 1s. per yard run for brown, 1s. 4d. for neutral green, and 1s. 6d. for extra brown; or the 1-ply 56 in. wide, at 6d. per yard run for brown, 9d. for extra stout, and 8d. for neutral green, is recommended. I derive no benefit whatever from thus bringing the paper under notice, except the satisfaction I feel from letting others know of a good thing."

### V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—J. H. (*Manchester*); R. T. (*Paisley*); W. G. S. (*Manchester*); Cycles; A Reader; J. T. (*London*); H. S. G. (*Fulham, S.W.*); R. H. H. (*Merriols*); M. D. C. (*Liverpool*); Lux in Tenebris; F. W. (*Kingsland, N.*); Markwell; J. J. M. (*Liverpool*); Centre Board Canoe; Bellows on Three Legs; R. M. B. (*Glasgow*); G. W. (*Chelsea*); W. J. (*Heaton*); W. P. (*Withington*); Gum; A. B. G. (*Ascot*); A. T. L. (*Gloucester*); A. M. L. (*Nuneaton*); J. E. (*Cardiff*); Leghorn; H. B. S. (*Liverpool*); A. H. (*Hyde*); A. N. (*Bexhill*); Grindingstone; New Reader; Stonemason; J. C. F. (*Coalbrookdale*); J. C. K. (*Lisson Grove*); Lance Jack; H. B. (*Accrington*); G. H. (*Leith*); R. T. (*Oldham*); W. R. W. (*Fulham*); W. J. H. (*Reading*); One in a Fix; W. H. S. (*Birmingham*); Knarf.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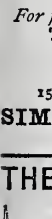


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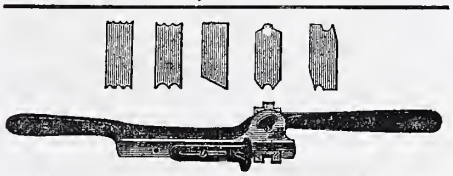

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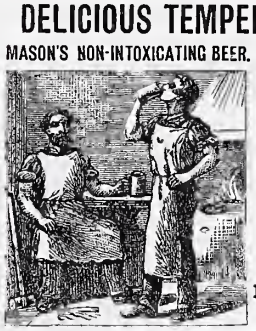

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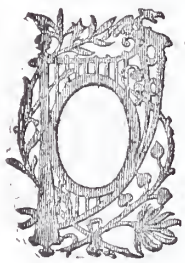

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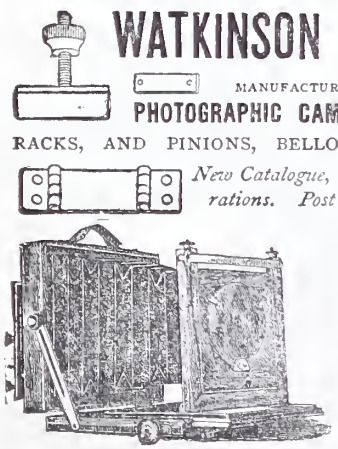

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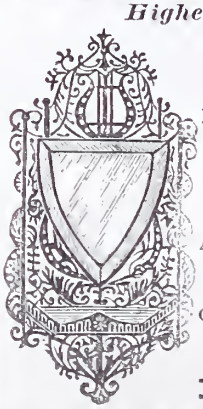

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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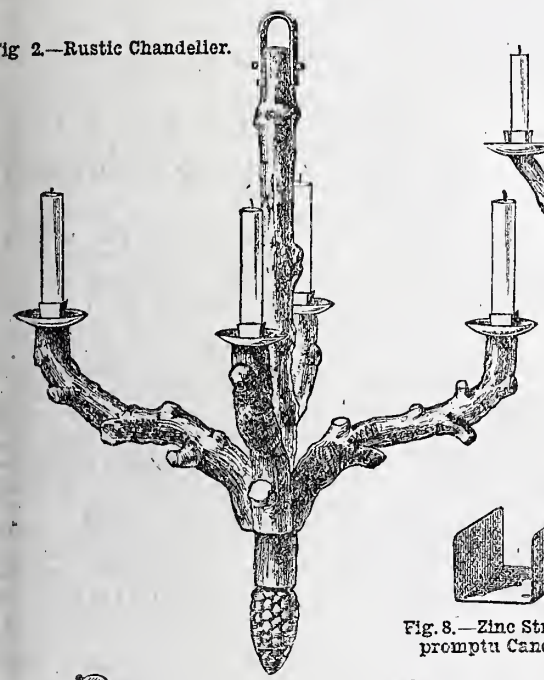


Fig 2.—Rustic Chandelier.

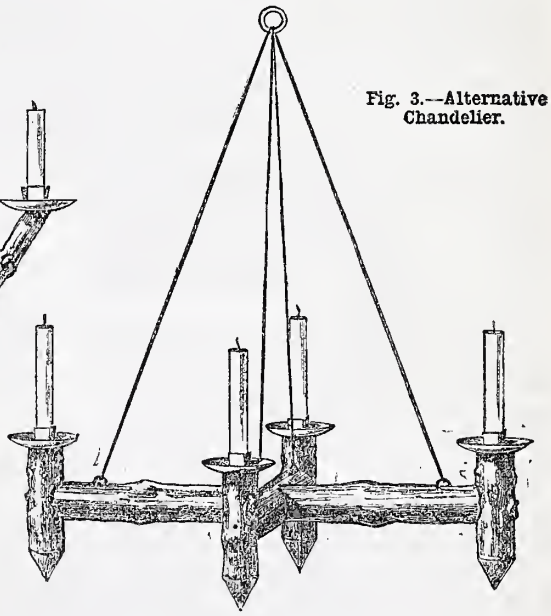


Fig. 3.—Alternative Chandelier.

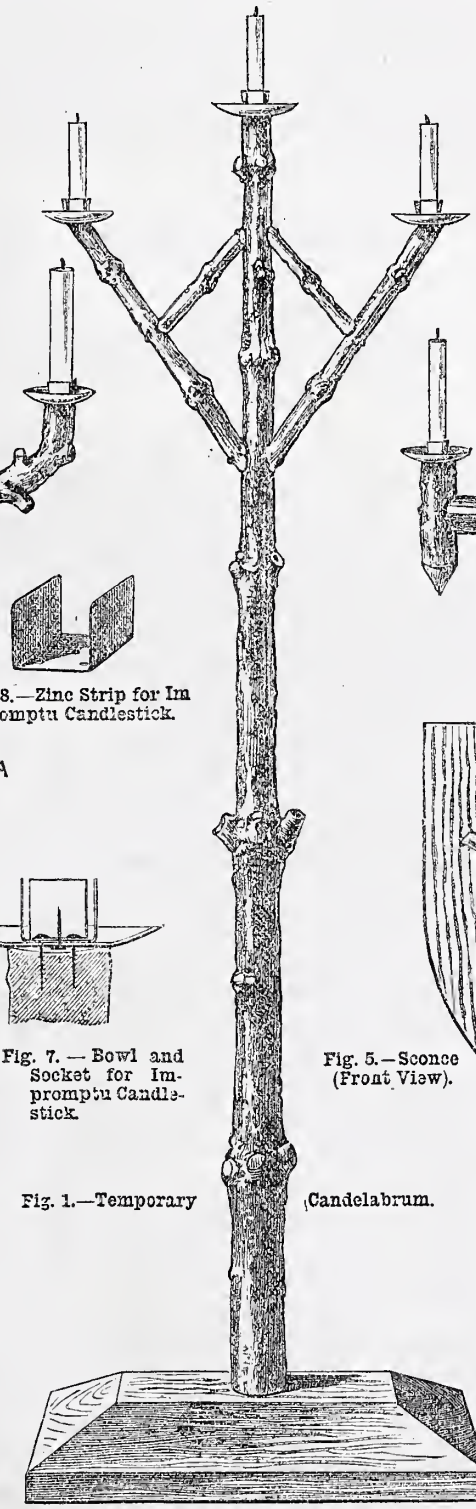


Fig. 1.—Temporary Candelabrum.



Fig. 8.—Zinc Strip for Impromptu Candlestick.

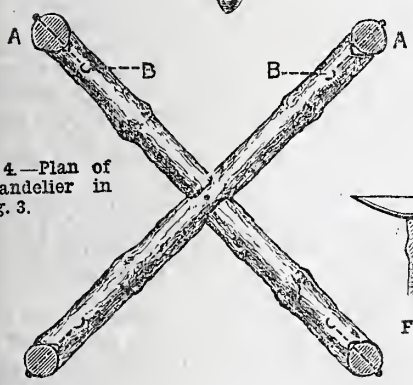



Fig. 4.—Plan of Chandelier in Fig. 3.

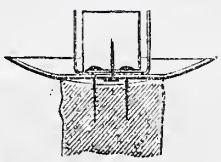


Fig. 7.—Bowl and Socket for Impromptu Candlestick.

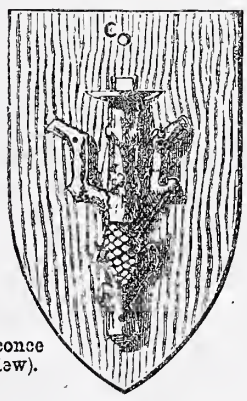


Fig. 5.—Sconce (Front View).

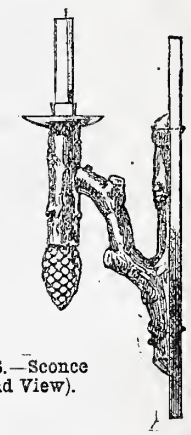


Fig. 6.—Sconce (End View).

## LIGHTING ARRANGEMENTS IN TEMPORARY DECORATION.

BY ARTHUR YORKE.

PRELIMINARY REMARKS — A CANDELABRUM — CHANDELIERS — A SCONCE — IMPROMPTU CANDLESTICKS.

*Preliminary Remarks.*—When, on festive occasions, some ordinary building is under conversion to the uses of a temporary ballroom, concert-room, etc., there is among the resources of the decorator one which might well be more freely employed than it is. The resource alluded to is rustic carpentry, for the production of frames to be afterwards dressed with evergreens and flowers. Such dressings, when judiciously disposed on wood-work covered by its natural bark, have a most happy naturalistic effect, which can scarcely be imagined by those who have not seen it.

For mere temporary uses frames of this kind can be quickly knocked together, and in country places, where natural wood is to be procured readily, these things may be made at trifling cost. The purposes to which they can be applied in such decorations are various, but in the present paper it is proposed to deal only with their application to lighting.

The examples given in the illustrations may perhaps be thought to be less ornamental than they might be, but it must be remembered that they are only skeletons

depending for their full effect upon the flowers and greenery with which they will be clothed.

*A Candelabrum.*—The candelabrum shown in Fig. 1 is an arrangement which may be found useful when the main room is approached by a tolerably wide passage or ante-room. Such candelabra should, of course, be arranged in pairs. The example given shows only three lights, but if there is width sufficient, and it is desired, one or two more branches may be added. The stem is made from the trunk of a young fir or from the top of a larger tree; and to secure a firm base, its bottom is mortised into a heavy slab of wood. The appearance of this slab is of little moment, as it is intended to be covered with evergreens, from which sprays of the small tree ivy should spring and twine spirally round the stem. In decorating the branches above, flowers should be used with the greenery; dried everlasting flowers of various colours are best for the purpose, as warmth will not fade them, and a thin wire run up their stalks will facilitate arranging and keeping them in the positions desired. In this merely temporary wood-work no hesitation need be felt about driving a tack wherever it may be desirable to hold the wreaths, etc., in place, which is a decided advantage to the decorator.

*Chandeliers.*—Figs. 2 and 3 are chandeliers; Fig. 2—which appears in plan in Fig. 4—is of most simple construction. It consists of two straight sticks (fir by preference) cut half through to cross each other in the centre, and with their ends sawn V-shaped to receive the upright pieces (A, A, Fig. 4), which are nailed to them, and which support the candlesticks. It is suspended by four cords or chains attached to staples driven into the cross-pieces (B, B, Fig. 4). When decorated, a considerable bunch of evergreens—holly, perhaps—will look well hung beneath the middle, whilst small and delicate sprays should be made to twine up the cords.

Fig. 3 is somewhat more ornate. The four pieces which form its branches are such as in general shape it is easy to find among a lot of crooked wood—oak, say, or apple-tree. It is recommended that these should rather be screwed to the upright than nailed in the usual way. At bottom, a fir cone is introduced as a pendant, and will best be fixed on with a couple of wire nails. The branches in this should not be heavily decorated—a little green only, with some flowers—but more evergreens will look well up the central stem; in particular, they may be made to branch out round the ring at top.

*A Sconce.*—The shield of the sconce given in Fig. 5, and in profile in Fig. 6, is of rough board, and has a hole bored through it at C, by which to hang it up. How rough the board may be matters little, as laurel or other large evergreen leaves should be tacked over the whole of it. The projecting branch should be decorated with a sparing hand.

*Impromptu Candlesticks.* — The candlesticks which will suffice for use in these temporary arrangements are of a kind which any handy person can readily improvise with no further tools than a bradawl and a pair of zinc shears: which are tools that no handy person is or ought to be without. As material, old meat tins will be found sufficient. Fig. 7 is a section of one of these candlesticks. A disc of tin 3 in. or 4 in. in diameter is cut, and bent to something of a saucer shape; two strips of the same, about ¾ in. broad and 2 in. long, are also prepared, and bent as in Fig. 8. These are then placed crossing each other, and laid on the middle of the disc, and a hole is punched through the three thicknesses. Through this hole a ½ in. tack is thrust, point upwards, as shown in Fig. 7. This forms a spike, which, entering the bottom of the candle, helps to steady it; for it must be remembered that the upturned pieces of tin, though they act as springs and grip the candle tightly, are less strong than a circular socket. The candlestick is fixed down to the wooden support by other tacks round the central one, as shown.

In these arrangements only the simplest and prettiest mode of lighting — that by candles—has been considered; but if space permitted, it would be easy to show how, by the same means, we might provide for the use of paraffin lamps, either to hang or stand. For standing lamps, rustic brackets would have to be arranged instead of sconces. These and other necessary modifications will, however, readily suggest themselves to the ingenious reader.

## PLUSH-COVERED FRAMES.

BY D. DENNING.

ADVANTAGES OF PLUSH—MATERIAL—MOULDINGS—ADHESIVES—MODE OF APPLICATION—FOLDING AT CORNERS—DECORATION OF CORNERS—COMBINATIONS OF PLUSH—STUDS—HINTS ON COLOUR — PLUSH-COVERED CHIMNEY-GLASS FRAMES.

To make an ordinary frame for a picture is by no means a difficult matter, though great neatness is required at the mitred joints. To cut these correctly, however, requires some experience, and more skill than the amateur, with often only a very limited amount of time at his disposal, can always acquire. No doubt, therefore, a few suggestions as to the way in which the difficulty may to some extent be surmounted, or perhaps I should rather say, evaded, and a good-looking frame be made—even though the joinery be anything but neat and clean—will be welcomed by many readers.

As the head-line indicates, the unsightliness of a badly-made joint may be hidden by covering it with some textile fabric, and the one the following remarks have special application to is plush. I hope it will not be understood that there is any special advantage in having the mitres for these frames badly made, for, on the contrary, it will be to the worker's benefit to make them as carefully and neatly as he can. The frame, when finished, may not look any better than it otherwise would if the joint were a rough one; but the fact of trying to make it as well as possible will give experience which may come in useful later on. To attempt to work valuable mouldings without any preliminary practice in frame-making would almost certainly lead to waste, and possibly to discouraging disappointments. By beginning with cheap mouldings, and covering them afterwards either with plush or other suitable materials, not only need there be no waste in tentative efforts, but the knowledge gained will pave the way for more advanced work.

I do not, of course, advise that large frames should be made for covering with plush, but small ones for photographs, engravings, etc., may be made in almost endless variety. Even a plain rectangular frame looks well, and great variety can be got by using coverings of different colours.

The plush best adapted for the purpose is the ordinary silk velvet, which is sold by drapers for ladies' dresses, etc., and by upholsterers for draperies, chair-seats, etc. Remnants can occasionally be purchased at a very much lower price than when cut from the piece specially, and, unless the pieces are very small, they do just as well. The coarser velvets—such as mohair—are not suitable for small frames, but if silk plush is asked for there will be no difficulty in getting the right kind. When of the best qualities, it is rather expensive stuff, so care should be taken to cut it to the best advantage, and keep the waste as trifling as possible. On this point, however, it is impossible to say anything definite; but it may be suggested that it is rarely considered necessary to use the best quality for such frames as are referred to.

The foundation or wood-work of the frame being hidden, there is no necessity for wasting much time in carefully finishing it or in having it the best of its kind. Plain beads or flats even do very well, and should they be a trifle rough it will hardly matter, as, unless very pronounced, the inequalities will not be visible under the plush. If a more elaborate moulding is desired, those made and sold at a very cheap rate for builders' purposes do as well as anything. It is not necessary to clean them down with glass-paper. They can be covered just as they are received. Many mouldings which may look very well when uncovered do not show to the best advantage when covered with plush, and when selecting them, some discretion should be used to get those which will look best when finished. Perhaps my meaning may best be explained by supposing a moulding formed of a number of small members. This would look richer than, say, an ogee or a plain bold moulding while uncovered, but the small details in which its beauty consists would be almost, if not entirely, hidden by the velvet. This, though on the back it might adhere to them closely—not at all a likely case with such a moulding as is supposed—would on the front or plush side only partially reveal the shaping below. The chances, therefore, are that a plain moulding will look equally as well as one of a more elaborate character.

About the actual construction of the frame little need be said, as for present purposes it may be supposed that the intending worker has some knowledge of this part of the work. In most cases plain mitred joints will be the natural ones to use, and where any others are preferable, the worker may be safely left to use his own discretion. If he makes them strong enough for their purpose, and does not overlook the fact that they are covered over afterwards, he will hardly be likely to err.

As plush is a delicate material, care must be taken, when handling it, not to get the surface matted or injured with glue or paste. If any of this gets on the front, it will be difficult, if not impossible, to remove the blemish. Care, therefore, should be taken in this respect. For the rest, plush will bear any reasonable treatment. Some of the lighter and more delicate tints are very easily soiled, but by taking the precaution to have the hands clean, there is no risk on this score. The chief danger the novice should be on his guard against is that of getting the plush matted anywhere by allowing the glue to soak through from the back. If he will do as directed, he need have no fear of this happening.

The glue should, in all cases, be applied to the wood, and never to the velvet. Good ordinary glue can be used, and I know of nothing better, though a mixture of flour,

paste, and glue, or any strong paste—such as used by bookbinders, shoemakers, etc.—is preferred by some. Any good strong adhesive which has not too much moisture, and which does not set so rapidly as to prevent the velvet being laid properly, may, in fact, be used. There is thus plenty of choice; but, as stated, I think there is nothing better than plain glue. It should be of good quality originally, be prepared in the usual way, and be applied, while hot, thinly and evenly to the wood. While it is still sticky—*i.e.*, as soon as convenient without either undue hurry or waste of time—the velvet should be put on.

This is really the only part of the work which requires any unusual amount of care, for if any glue gets on the fingers, and from thence to the plush, a blemish will be caused, which will look anything but nice when the frame is finished. Great pressure is not necessary to cause sufficient adherence. If it were, the plush would be spoiled through the glue being squeezed through the woven backing. A light gentle pressure is all that is required, though possibly the velvet may require a little humouring to get it to fit into angles. When these occur, it is sometimes easier to use a paper-knife or something of the kind to press the velvet neatly into them. Of course, the pile will be somewhat laid or flattened by this treatment, but unless the glue has been forced through, it will be only temporarily so, and can easily be restored to its original condition by brushing lightly with a soft brush.

At the mitres and outer corners of the frame a slight difficulty may occur to the novice in connection with folding the plush over the edges. Special care is necessary—or perhaps I ought to say neatness and deftness—in manipulation at the angles if, on the one hand, a vacant uncovered portion of the wood is to be avoided, and on the other, a wrinkle in the velvet. Both these effects may easily be prevented by cutting the material as far as the front surface of the frame, and cutting away as much as may be necessary to allow of a neat join being effected. As I was on one occasion asked if the velvet was to be sewn at the joints, I may as well say that glue alone is necessary. The velvet is simply stuck to this, and when neatly done, the join is almost invisible, except on the closest examination.

On the inner edges of the frame, if they are only thin, no difficulty will arise, as after cutting the velvet up to the mitre, it easily folds over to the back, when, of course, it can be fastened with glue. The outer edges should also be covered, and the plush be secured behind in the same way.

So far it has been assumed that the frame has been covered with one piece of velvet, from which a portion in the centre has been cut out to correspond with the frame opening. This is all very well for small frames, but if these are of any considerable size, there must obviously be a waste of plush, which would not occur if the frame were covered by pieces cut to fit each portion. This can easily be done by cutting the plush to strips of sufficient width to cover the front of the moulding, and having enough margin to turn over and secure behind. One strip will, of course, be used for each side, top, and bottom of the frame, for a join anywhere, except at the corners, is out of the question.

At the corners the velvet must be cut to correspond with the mitres, and if this be neatly done, the join will hardly be more perceptible and not more unsightly than a properly made joint in the wood. To cut the pieces of velvet so that they join with such accuracy as is implied may not, however, always prove an easy task, but if they do not meet, there is always a simple way out of the difficulty, and the means used, instead of being a disfigurement, may often, with a little taste, be rendered a further source of ornamentation to the frame.

The simplest means of covering the join is using a piece of fancy cord, such as is used by upholsterers for trimming purposes. Its ends are fastened behind, and if the moulding is a plain one, it is merely carried over the joint, which of course it covers. If the moulding is a large one, and has any decided hollows, there will be a little more difficulty, but not much. Sufficient adherence can be given to the cord by touching it here and there with a little strong glue, or if this is not sufficient, by means of a few gimp pins driven through it into the wood. The heads of the gimp pins, being small, can be concealed by a strand of the cord.

In a similar manner the joints can be covered with narrow bands of plush or any material which will look well with it. The ends, as before, are fastened on behind, and the edges, being turned under the band, can be fastened down with glue. It is not necessary to have these small covering pieces of the same colour as the other plush, or, as has been hinted, even of this material, but care should be taken that they are harmonious.

Instead of a plain band to cover, if the moulding is a large one, much taste may be displayed in the arrangement of the pleats which can be given to them. Though it is obviously impossible to do more than hint at this additional method of adornment, there is an immense field open for the worker to display his taste.

Very handsome frames may also be made by the judicious use of plush in a more elaborate style than that which has been referred to. The possibilities comprehended by it as a material for frames are much greater than is commonly supposed for them, for there is no reason, beyond custom, why it should not be used in the construction of frames of an elaborate character much more extensively than it is. We may, for example, suppose a wide frame of the simplest kind—merely a wide flat. This, covered with velvet, would look well enough, and I have nothing to urge against it. Something more elaborate, however, may be wanted than the plain flat surface; and how easily it can be managed! We take a narrow piece of half-round moulding, cover it with velvet of another colour and a suitable one, glue it down on the flat, and there is already the germ of an idea which can be worked on to an almost unlimited extent.

Starting again with the flat, another piece covered with velvet can be fastened to the outer edge, an inner flat can be made to fit within the other, and so on. An almost endless variety of combinations might be suggested, and no doubt will occur to the novice as his experience widens.

Another very simple means of decorating velvet-covered frames is by means of the plain brass or copper studs now so extensively used by upholsterers round chair-seats, etc. The studs can be either driven in close together in straight lines or arranged so as to form simple patterns—such as diamonds, circles, etc.—on the flat surface, and on a velvet of suitable colour look remarkably rich.

Perhaps it may be expected that something should be said about the colouring or combinations of colouring which have been suggested, but if so, I am sorry readers must be disappointed, for the subject of harmonious blending of colour is altogether too vast to be undertaken in the compass of a short article like the present. All that can be done is to throw out a hint or two for the guidance of the frame-maker.

Primarily, a frame is intended to hold something. If this is a coloured picture, take care that the colours of the velvet are not such as to kill the colouring of the picture. If the frame is more striking to the eye than the picture is, there is something wrong. Strong powerful colours in the frame may overpower those in the picture, and if so, the decoration of the frame fails in its purpose.

In the case of monochrome pictures, such as photographs, engravings, sepia drawings, and such like, the same rule holds good. Those who have paid little or no attention to colour from a scientific or artistic point of view may easily try a few variations for themselves on the lines suggested. Black and white placed in juxtaposition, everyone, it may be assumed, knows intensify each other. In a similar manner, other colours may be arranged to "show each other up." This should be the object of the velvet frame maker. Let him select colours which will show up whatever is in the frame.

Due attention should also be paid to the colour of the wall on which the frame is hung, to that of the draperies of the room, and so on. When selected with skill, charming bits of colour may be got without much effort; and by converse, the appearance of a room may be almost spoiled by inharmonious colourings. Whether these be bright or low in tone, the rules which govern them are the same; but, as I have said, the subject cannot be treated of at length here.

In conclusion, it may be suggested that many a chimney-glass frame of the gilt and gaudy kind may be vastly improved by covering it with velvet in a similar manner to that alluded to for small frames.

## THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

FINAL RE-FITTING UP—ADJUSTING THE BEARINGS—HANDLE-BAR—FIXING ON THE HANDLES—REAR-WHEEL, MUD-GUARDS, ETC.—ADJUSTING THE CHAIN—ADJUSTING THE SEAT—ADJUSTING HANDLE-BAR AND BRAKE—ADJUSTING FOOT-RESTS—ACCESSORIES—HINTS TO CYCLISTS—CARE OF MACHINE.

EVERYTHING being ready for the final fitting up of our machine, a piece of carpet or canvas should be spread on the floor, so that the enamel or nickel-plating may not suffer damage.

The first thing to do is to fit the spoon on the front fork, then spring in the wheel. Some front fork ends are slotted through, so that the axle drops into its place without springing the forks at all. If the forks are to be sprung in order to admit the axle, see that the latter is no longer than just to come through the outside nuts, because it is quite possible to overstrain the forks trying to enter a long axle. See, also, that the loose or running cone is on the left-hand side. Before springing in the wheel, this cone should be screwed up till it jams the balls—in other words, till it stops against the balls; then it should be turned back, say, one-fourth of a turn, or as much as will allow the wheel to run perfectly free without side shake. While in this position,

put it into the fork, put the mud-guard stay ends on the axle, and screw up the nuts. The wheel, if it has been properly fitted the first time, should run exactly in the middle of the fork space, and directly under the brake-spoon.

The handle-bar comes next: but we have got to fix the handles to it. The handles may be horn, rubber, or cork; in either case they are fixed on with a little of the cement used for the tires. Our handle-bar is $\frac{3}{4}$ in. tube throughout, so that the handles have $\frac{3}{4}$ in. holes quite through them. Heat the handle-bar end in a gas-jet, and having melted a little of the cement, give the hot end a thin coat for about two inches of its length, then slip on the handle, pushing it up till the bar just appears at the outer end. When this is hard it will be impossible to take the handle off again without heating. It sometimes occurs, however, that a handle is wanted off; to do this, heat a bit of flat iron to red, and place the handle-bar on it nearly close up to the handle; when the bar is heated the cement will dissolve, and the handle may be easily slipped off.

Leaving the handles to cool, put the two parts of the frame together by passing the steering-tube up through the steering-head, then slip on the adjusting cone; after this, the lamp-bracket. Now the handle-bar is put into the steering-tube; see in setting it that it is square across the wheel, and pinch it, meantime, with the set-screw. The brake-lever and other parts of brake-work are now fitted; then turn the machine over with the handle-bar on the ground, and put the rear wheel in its place, the V part of the frame having previously been fitted to the central part, the upper bolts of the lower tubes put in, and the mud-guard fixed behind the bent tube. Now push the wheel to the inner ends of the slots, put on the four stay ends, and screw up the outside nuts. The bottom bracket bearings being mounted and adjusted on the pedal-shaft, the whole is fixed in the bracket-fork by the two long bolts.

Now the chain is put on, see that the head of the small chain-bolt, or the nut, as it may happen, is quite clear of the spokes, as in some makes of hubs it is not. Now slacken the outside nuts of the rear axle, and push the axle back with the two adjusting screws, taking care that both sides are pushed equally, so that the tire of the wheel may be in the centre of the space allotted to it; continue the adjustment till the chain is almost tight. It should hang curved about half an inch or more. If it were adjusted to tightness a good deal of friction would exist, and the grand object in a cycle is to get rid of friction by all possible means. Having fitted up the L-pin, saddle and spring, and the pedals, you are now in a position to adjust the seat and handles to your requirements as a rider. If you are a cyclist, you will know that when mounted you should be able just to place your foot on the pedal at its lowest point with the leg quite straight.

The saddle-clamp should be midway in the length of the three-coil spring, and the lower plate should be clamped also at its centre by the bracket (Fig. 37, page 436), then the whole is free to move on the L-pin for adjustment to fit the rider. The saddle being placed to proper height, the handle-bar may be raised or lowered till the handles are about three inches higher than the top of saddle, when it is fixed in the steering-tube, and the brake-rod at the same time fixed with the gripping end of the brake lever at its lowest, and the spoon half an inch clear of the tire. The brake-lever requires a spring of some sort to lift the spoon clear of the wheel; steel springs between the lever and the handle-bar are sometimes used, but they are seldom effective for any length of time. A spiral spring is often put on the brake-rod; in our case it can be put on the rod in the space between the lamp-bracket and the top of the rod, at D (Fig. 35, page 436). This spring should be plated. The simplest and always effective spring is a rubber band encircling the handle-bar and brake-lever just at the end above the brake-rod; when one is too weak, two can be put on. If adjustable foot-rests are used, they are put on at a convenient height for the feet to rest without outstretching.

Now we may say our machine is completed, and after it is furnished with a lamp, a bell, and a tool-bag, it will appear as represented in the illustration accompanying this—the closing paper on this subject. The latest style of lamp is known as the "swing-back," the aim of its construction being that it will have a certain amount of spring while the machine may be passing over rough road, so as not to jolt the wick down. These lamps may be bought from 4s. or 5s. up to 15s. Cyclists are compelled to carry lamps after dark by law. The bell is a necessity as an accessory. There are several kinds. The double dome, at 5s., is very good; single dome may be bought for 2s. 6d. The horn is about the latest fad; I can recommend it for ugliness, but for nothing else.

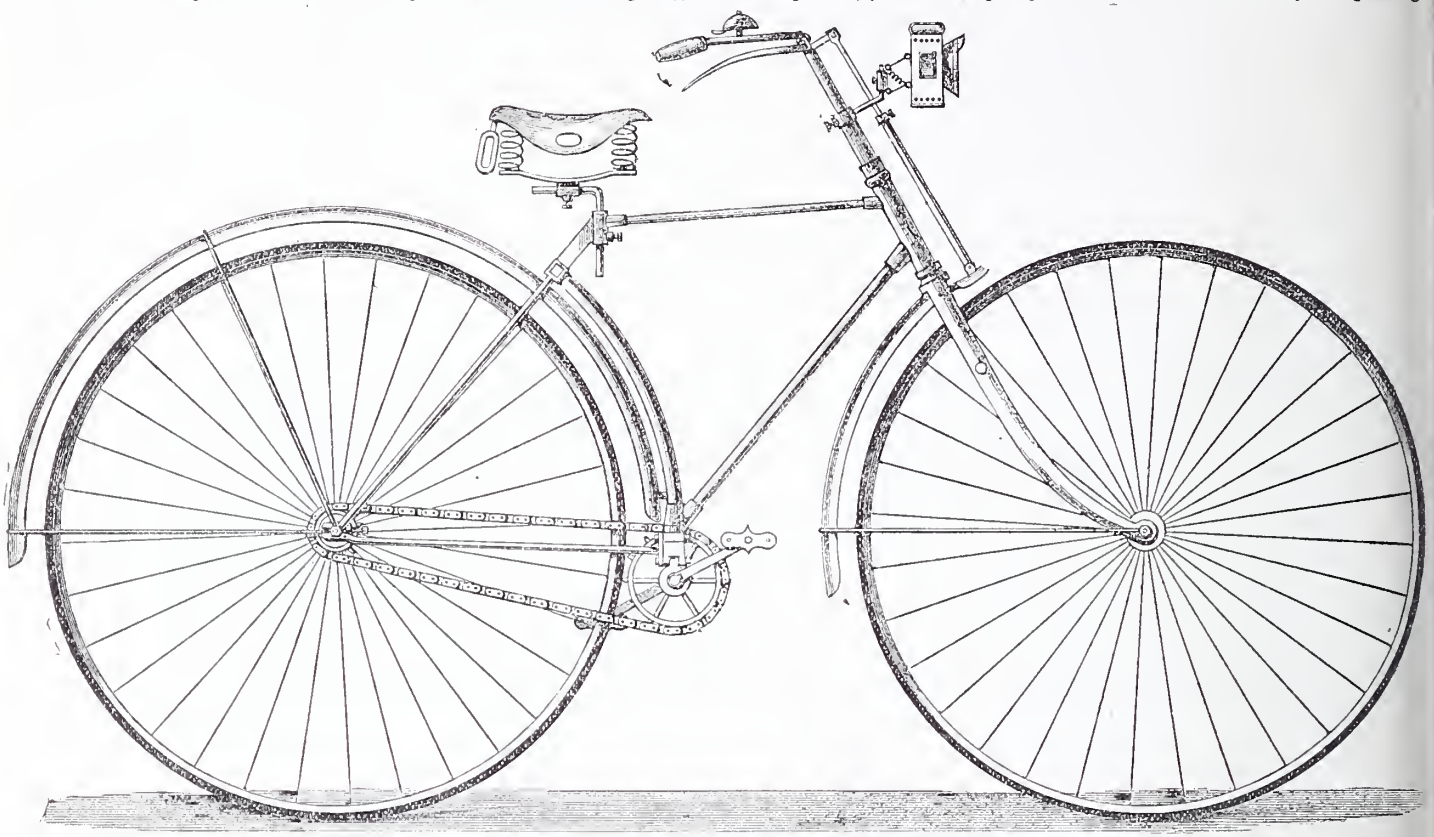


Fig. 44.—The Safety Bicycle, complete and fully fitted for the Road. (Scale, $\frac{1}{10}$ full size.)

The tool-bag is usually strapped on behind the saddle. It may be had from 2s. upwards. It is furnished with a spanner and oil-can.

We have now to offer a few hints to cyclists in general with regard to the care and keep of their machines; for it is a fact that many are the possessors of safety bicycles, costing from £15 to £20, who are almost totally ignorant of the nature of their mechanism.

The vital parts of a safety bicycle of the first class are the ball bearings. These are entirely concealed, and in many cases the possessor of the machine knows absolutely

nothing of their properties, or of the means to get the best results of their use: whereas if they knew but a little how to adjust their bearings—which is usually a very simple matter—they would be saved many a trip to the repairing shop. To all such I would say, invest a penny weekly on WORK, and read these papers carefully, and you will know all that need be known about the matter, as well as most other matters connected with the machine. I have tried all through to state things clearly, and wherever it is found I have failed, I will be glad to know of it through "Shop."

With regard to the keep of the machine, any mud should be washed off after using. To keep the plating bright, by all means keep it dry, drying it carefully after being out in rain. It may be made to shine by using jeweller's rouge made into a paste with water, and applied with a bit of chamois-leather, then wiped off and polished with a larger leather. If the machine is to be laid by for the winter, or even for a short time, where there is danger of damp, all plated parts, including pins, bolts, and nuts, should be well coated with vaseline. This may be wiped off when the machine is to be used, and the plating will be found to be bright and good.

To clean the bearings of the wheels and pedal-shaft after the machine has been used, the best plan is to take down the bearing, keep the balls in paraffin, and clean out the cases with the same oil. If you do not care to take down the bearings (which means taking the wheels out of the frame), turn the machine on its side and run plenty of paraffin through the bearings, revolving the wheels rapidly. This will wash out most of the dirt. After this, wipe the machine clean, and oil up with good cycle oil. About as good as is going is six parts of best sperm to one of paraffin; the paraffin thins it and prevents clogging.

To clean the chain, remove it from the wheels, and placing it in a shallow flat-bottomed pan, cover it with paraffin; let it remain an hour or two, then wipe with cloths. All chains should be lubricated along with the wheel teeth. Oil is very good if the roads are free of dust; on dusty roads, however, the chain is soon coated with it. A preparation of blacklead is used instead of oil for chains, and does not lick up the dust as oil does, and is, therefore, preferable on dusty roads.

Cyclists while on tour should always be provided against tires coming loose. Pieces of string or wire are useful; but there are several sorts of tire binders or fasteners in the market that the cyclist should not set out without.

It is no uncommon thing for a nut to drop off a machine and get lost, and sometimes a single missing nut will disable the machine for the time being. Every owner of a machine should find out the size and thread of all nuts on his machine that are at all likely to work loose and get lost, and provide himself with at least one of each size. They are easily carried in the pocket or tool-bag, and as he always has (or always should have) a spanner—one that will adjust to fit every nut—on finding a nut gone, he has nothing to do but broach his store, replace the nut, and go on his way rejoicing; whereas the fellow unprovided with nuts has, in like circumstances, to trundle his machine, perhaps miles, to the nearest wayside smithy.

Spokes often work loose, especially if they have been rather easily tapped when made. When this takes place the wheel begins to wobble. If cyclists would, therefore, learn the use of the spoke-grip, they would often save their pockets by doing themselves what they have to get done by a repairer. The spokes, in such a case, have simply to be screwed home to their former position. Ample directions are given in their proper place in this series: "How to True a Wobbling Wheel," so they need not be repeated here.

With these remarks on the care and keep of machines, which are meant for all cyclists who may read them, and to whom they may be information, I bring my present task to a close, in the sincere hope that the information sought to be conveyed will be found useful to many readers of this Journal, whether they put it to practical use or not; and I would respectfully ask readers who may find them interesting to draw the attention of their friends and acquaintances to their existence in our excellent weekly, WORK, thereby increasing the usefulness of that already useful publication.

## A LAMP FOR A MAGIC LANTERN.

BY THOMASO.

I AM warned that answers in "Shop" must of necessity be brief, and as brevity to meet the needs of "Shop" is not to be achieved in giving the information that "Pedagogue" seeks, I am compelled to put it in the form of a short article.

The querist says his lantern does not give a sharply defined picture using a duplex lamp. Is he sure the light and reflector are in their right places, and that the diaphragm in the front lens is properly placed, and the aperture of the right size? This latter is probably the cause if he made the lantern himself. The lamp might cause an unevenly lighted or dull picture, but I do not see how it could cause a blurred picture—for it is thus I read his letter. However, I assume that he is satisfied it is the lamp in fault, and accordingly give a description of a three-wick lamp. Two wicks are used placed thus: V, with the point of the V towards the picture. Four and, I believe, five wicks are used, but they do not give much more light than three, and the extra heat is a serious matter. "Shop" space is limited, so must my instructions be. Take great pains to get everything true and square, or the lamp, if it burns at all, will either stink or smoke—perhaps both. Cut all holes in sheet-metal with fret-saw, to prevent buckling. Use the "Russian" sheet-iron (ask for best charcoal-iron) and the best tin plates (not "wasters"). Get some $\frac{1}{8}$ in. tinned iron wire, and some a full $\frac{1}{16}$ in.; brass plate, $\frac{1}{16}$ in. and $\frac{1}{8}$ in. Flat brass wire can be got these thicknesses, $\frac{1}{2}$ in. and $\frac{3}{4}$ in. wide respectively. Fig. 1 gives view of lamp complete, with dome raised exposing wicks. Make the dome of sheet-iron, 6 in. long from end to end, and of the other dimensions shown in Fig. 2, which is half full size. Wire ends with the thin wire, bend dome to shape, and then run a wire round bottom and across ends, allowing wire to project $\frac{1}{2}$ in. in front. A hole, $3\frac{1}{4}$ in. by $1\frac{5}{8}$ in., having been previously cut in top, a piece like Fig. 3, $1\frac{1}{4}$ in. high, is riveted in. Upper edges of this are turned inwards and flattened down for strength. Bend another wire same shape and size as that on bottom of dome, and on each side fix a strip of tin of shape shown in Fig. 1 by bending top edge of tin round the wire. The holes in the strips are necessary for ventilation.

Now make burner. Wick tubes $2\frac{1}{2}$ in. long ($1\frac{1}{2}$ in. wick should fit easy), made in two pieces (Fig. 4 is section; observe how ends lap). Cut two holes in one side of each tube, $\frac{5}{8}$ in. apart, and $\frac{1}{4}$ in. by $\frac{1}{8}$ in. for the wheels to wind up wick. Make a piece of tin for each wick tube of shape shown (A, Figs. 2 and 5, complete arrangement). Cut out little wheels in the $\frac{1}{16}$ in. brass like Fig. 6. (*Nil desperandum;* I once made a dozen by hand.) Drill the central hole first, and then file teeth. Cut piece of thick wire any

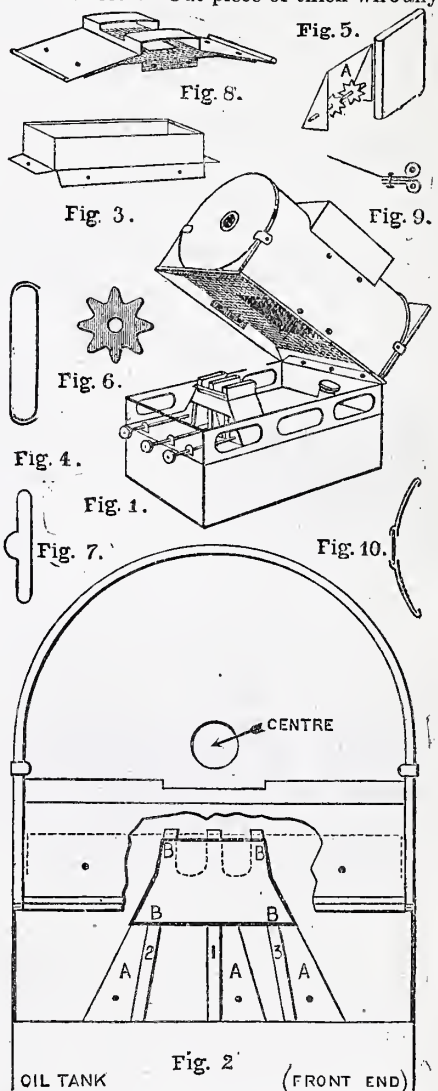



Fig. 2

Fig. 1.—Lamp complete. Fig. 2.—Front View of Lamp (half size). Fig. 3.—Support for Chimney. Fig. 4.—Section of Wick Tube. Fig. 5.—Wick Tube complete, separated to show Arrangement of Parts. Fig. 6.—Wheel for Winder (full size). Fig. 7.—Shape of Hole in Top of Tank for Wick Tube. Fig. 8.—Wick Cover to fit in Dome. Fig. 9.—Section of Hinge. Fig. 10.—Section of Reflector in Frame.

convenient length, and thread it through A (Fig. 5) and two little wheels. Solder wheels in place, and the whole thing on to the wick tube, after trying it. Oil tank $6\frac{1}{2}$ in. by $4\frac{1}{4}$ in., and high enough to bring "centre" (Fig. 2) to level of centre of condenser, usually made by cutting square pieces out of corners of oblong piece of tin, bending up sides, soldering corners, and finally the bottom in. A brass screw bottle top is put in front to fill the lamp—1 in. at least. The holes for wick tubes are to be made the shape of Fig. 7, and the wick tubes soldered in on the under side, at proper

angle, etc. ; nearest side 2 in. from back of tank. A (Fig. 5) is then soldered on to the tube, it having been left long to allow of trimming the bottom to the proper angle. Solder the tubes in the order indicated in Fig. 2, finishing each one before going to the next. Solder strip of tin (B B B B, Fig. 2) across the ends of wick tubes, and a U-shaped pieee of perforated tin (zine might melt) between the tubes, as shown by dots in Fig. 2. Make Fig. 8 of iron, to fit in dome ; length of hole in it, $1\frac{7}{8}$ in. The two ends are turned round the wire which goes round bottom of dome. When properly fixed, the ends of wicks should come exactly in eentre of the hole in it. Rivet a piece of perforated tin to Fig. 8, as shown in that figure and in Fig. 2 by the dots, previously making a hole to freely clear the wicks ; bend down a part of the sides of the perforated tin, and rivet to the sides of the dome as shown. Hinge the dome on as shown in Fig. 1, and in seetion in Fig. 9, and solder the strips of tin supporting dome to the reservoir. Make milled edge winders of the $\frac{1}{8}$ in. brass, notching the edge with a file, and drill and solder on to the winding wires, previously having soldered in place little pieces of metal, as shown (Fig. 1), for rigidity. Get square of thin glass, $4\frac{1}{2}$ in. by $4\frac{1}{2}$ in., to close up front of lamp ; lay it on pieee of iron or copper (latter easiest), turn up edges over glass on three sides, and cut circle out of the centre, $3\frac{1}{4}$ in. (or as much of the circle as you can) ; centre of circle cut out when all is in position, to coincide with centre of reflector. Rivet little elips each side of dome to hold the glass and frame in position. The reflector is an awkward job. Make a frame for it like the one for the front glass, but with the following variations :—It is to be a square with a semi-circular top (there's a bull !), and the middle is not to be cut out, but hammered concave to fit the reflector. Cut $\frac{1}{2}$ in. hole in centre of reflector and frame, and bulge $\frac{1}{8}$ in. of the metal round the hole in the latter outwards enough to lay a small circle of violet or red glass in (see Fig. 10). Put reflector into place, and close in by bending the metal frame over the edge of the reflector round the top and straight down the sides and across the bottom. A piece of the bottom of reflector may have to be eut away. Fasten to back of dome by clips, as shown ; or it can be hinged on to the same wire as the back end of Fig. 8, a part of the latter being cut off the wire to admit of the hinging. The clips method is the easiest. Make chimney telescopic in two or three draws ; total height when drawn out about 10 in. Smallest draw at the bottom, and to fit tight on Fig. 3. In best work there are no sharp edges, and no rivets except in the top, where the piece is riveted on to keep the light from shining on the eeiling. To prevent it slipping down when in use, make a little bulge near the bottom edge of one draw to fit into a corresponding bulge in the top edge of another draw. There will be sufficient spring in the metal to allow of telescoping the draws if the bulge is not too great.

To wind up briefly I may say : Chimney made ; lamp finished. Further particulars to order. That is to say, if any further particulars are wanted, I hope myself that there may be no asking for more, as such requests will indicate either that I have not carried out my explanation to the fullest possible extent, or that I have not succeeded in making myself intelligible—two horns of a dilemma in which I should be sorry to find myself, and from whieh I would fain escape.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### The Saw.

Saws are a difficulty to the beginner, and no small part of his trouble arises from the apparent ease with which a practised hand can divide the stuff. In the first volume of Work there is an excellent description of saws and the form of their teeth, which all beginners should read.

But the use of the saw cannot be aequired by a knowledge of the form of teeth alone. Let me, then, try to give practical advice. Always mark a line for sawing, and, in cross-cutting, let the line be made on two adjacent surfaces, for there are many who can saw a board at right angles as far as breadth is eoncerned, but if the square is applied to test the edge it will be found that the angle is not that desired. In all probability the first attempt to use a saw results in a quantity of saw-dust, an inereased temperature in the operator, and some roughly divided wood. It seems almost absurd, but it is necessary to advise the proper saw to be chosen at first, and to persevere with it, not taking all the saws in stock one after the other to try which is the best, neither try all sorts of positions for the material or for the operator, for if there is anything in which an unstable or vacillating policy is injurious it is in learning to saw. The operator should, as soon as possible, form a habit (of course, if possible, a correct one) and stick to it.

The choice of saws depends on the work to be done. An amateur may need a "half-rip" saw ; that is the coarsest he will need. If he works in hard wood a "hand saw" will do instead ; a panel saw is indispensable. These saws, which have no backs to stiffen them, form a group which may be said to be generally used on the stools, while the tenon and dovetail saws, which are furnished with a back, are for smaller work, and are used on the bench.

The advice given to square the lines on two adjacent surfaces will be more effective on wood of considerable thickness, say upon one of the pieces of $4\frac{1}{2}$ in. by 3 in. advised for a planing lesson. Let the sawyer stand so that he can see the lines appear as one line, or, in other words, let him stand so that his eye is in the same plane as the lines ruled for the guidance of the saw. In such a position he can, with slight alteration of position, glance at either side of the blade of saw, and can exercise watchfulness to check the slightest tendency to depart from the line. If this care is not exercised quite at the beginning of the cut, it will soon be too late to return to the line at all, and the temptation to try again from the other end of the stuff will become almost irresistible. If possible, however, try to avoid this, and master the use of the saw by means of perseverance and careful practice.

One of the most important items to remember is the position of the elbow. Without wishing to dogmatise, seeing that an expert ean do good work in almost any position and with his elbow moving in almost any direction, a beginner ought to make his elbow move in the plane in whieh the saw moves. Just try an experiment : mark a line on a board, then, with a strip of wood held in the hand, try to move the strip so that it constantly agrees with the line, with various positions of the elbow, close to the side and more extended from it, and then apply the result to the use of the saw.

## A FOUR-DRAW TELESCOPE.

BY O. B.

A correspondent, who has adopted the *nom-de-plume* of "Yarmouth," having asked for particulars with reference to the constructing of a small telescope, I purpose in the following paper giving such details as shall enable anyone who has a fair acquaintance with the use of a few tools to eonstruct such an instrument. But here I would say that it is an instrument which requires some skill to make—if finished as it ought to be—and a lathe is indispensable ; yet anyone who can use a lathe and chase a screw will find no difficulty.

The eonditions specified were as follows : A telescope with 1 in. O.G., and to extend to about 16 in. when drawn out. Whilst for the present I shall work to these dimensions, my instructions will be such that they may be adapted to any size of O.G. or length of focus.

*Tubes.*—It will be understood that brass tubing may be procured either stout or light. For a telescope of large dimensions—such as for astronomical purposes—a stout tube is required, but for a light hand instrument, the less weight the better. The tubing we require is known as mandrel drawn ; it is thin, hard, and smooth on the inside, and may be had in all sizes for about 2s. 6d. per pound from any instrument maker, such as Lancaster, Birmingham ; or metal merchants, as Stanton, in Shoe Lane, Fleet Street, London. I have found no difficulty in getting what I wanted from the latter plaee.

It is possible that small dents or pits from blows may be in the tubing. These must be removed, as, to say the least, they would appear very unsightly in the finished instrument. To remove them, lay the tube with the dents on a piece of hard level wood, and, either with a burnisher or a round piece of hard wood, rub the inside of the tube over the indentations, which will quickly bring up the surface level.

*Quantities.*—The sizes and lengths of tubes needed are as follows : body, $5\frac{1}{4}$ in. by $1\frac{1}{4}$ in. diameter ; first draw, $4\frac{1}{4}$ in. by $\frac{1}{20}$ in. diameter ; second draw, $4\frac{3}{4}$ in. by $\frac{17}{20}$ in. diameter ; tube to carry eye-piece, 5 in. by $\frac{3}{4}$ in. diameter ; for the eye-piece, 2 in. of a size to slip into the last-mentioned tube, and 2 in. of a size smaller still for the erector.

In addition to these, we shall require tubing for collars, which may be made out of the same tubing as the next size larger, thus : the collar B may be made of the same size tube as the body A, and so for the other two collars. In addition to the tubes, we shall require a piece of sheet brass $\frac{1}{8}$ in. thick and about 6 in. square, out of which we shall have to cut rings for the ends of tubes and eollars. This, in the main, will eomprise all the brass required.

Chuck a piece of hard wood in the lathe, and turn it down as a mandrel 4 in. long to receive the tube A. True off the ends of the tube at $5\frac{1}{4}$ in. long, and chase an internal thread at each end. The mandrel may now be turned down to receive the tube B, which must be cut off $4\frac{3}{4}$ in. An internal thread must be chased on one end, as shown. Tube C must be treated in the same way.

At one end of D a ring must be soldered on, as at *a* ; this ean be cut off a thiek tube—not mandrel tube. Supposing it is not convenient to get a piece the exact size, then one a little too large can be made to fit by cutting a small portion out of it. Place it on the tube, and bring the edges to meet, and bind it in its place with a pieee

of wire. Run soldering fluid between the tube and ring, and then with a hot bit cause solder to flow into the joint until the ring and the tube are solid. Chuck the tube as the others, and cut it off to 5 in.; on the collar chase a thread, as shown at *a*, and also chase an inside thread on the other end.

*Collars.*—We now require three collars, as B, C, D. Fig. 5 shows one in detail, and to describe one is to describe each. Procure or make a tube, $1\frac{1}{2}$ in. long, to fit tightly the draw on which it is to work. If a piece the exact size is not to hand, then, as before described, take a tube slightly larger, and cut a piece out and solder the joint. On one end sweat a ring of thick tubing $\frac{1}{2}$ in. wide, as at *b*. Chuck it in the lathe, and cut off the end of the ring down to the collar, leaving the collar to project $\frac{1}{8}$ in. Out of sheet brass cut a ring to fit the end of the collar, and wide enough to project $\frac{1}{8}$ in. beyond *b*. This must be now soldered in its place. If due care has been taken, it will be perfectly solid. Replace the whole in the lathe, and turn down the collar as thin as possible consistent with strength. Chase a thread on *b* so as to screw into A, turn down C, and mill the edge. This milled edge must project beyond the tube A about $\frac{1}{16}$ in. The other two collars must be made in the same way—C must screw into B, and D into C. At *a* on B and C, a ring must be soldered as shown, so as to prevent the tubes being separated when drawn out. In each collar four slits are made, as shown (*d*, *d*, in Fig. 5). These are made in a slightly diagonal manner at the diameter of the collar. A slight tap must be given to these two free strips, causing them to spring slightly inwards, so as to press more fully on the tube which slides in them. Thus all shake will be avoided. We can now screw our tubes together, and if our work has been properly done, we shall have a tube perfectly rigid.

*Cell for O.G.*—This cell may be cast or built up. The latter plan I have adopted myself, and have not found it difficult. It is taken for granted that we have procured our O.G. of 1 in. diameter and 10 in. focus. A ring must be made out of stout tubing of 1 in. internal diameter. Chuck it on the lathe, and turn down the ends true. Cut a ring out of sheet brass, the inside diameter, say, $\frac{1}{32}$ in. smaller than the O.G., and the outer diameter $\frac{1}{4}$ in. larger than the tube A. This needs only to be done approximately at first. When soldered together, place it in the lathe and turn it up to the size mentioned, chamfering off the outside of the inner diameter as shown, and milling the outer edge. A thread must be chased on it, so as to screw it into the tube A; and on the inside a thread must be chased to receive the collar to retain the O.G. in position (as *b*, Fig. 1). Care must be taken that the inside of the cell is turned true, so that the O.G. beds perfectly. The stop collar, *b*, may be turned out of the solid, or may be built up like the cell into which it screws. The edge must be milled. The cell, when made, should hold the lens without any shake, and yet without pinching it, so as not to set up a strain.

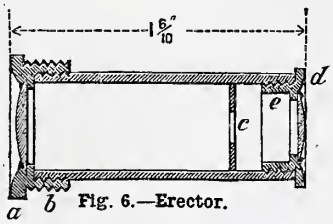


Fig. 6.—Erector.

*Eye-piece.*—For this we shall require a field lens $\frac{6}{10}$ in. diameter and, say, 2 in. focus; eye-lens $\frac{4}{10}$ in., and the focal length one-third that of the field lens. Add the combined focal lengths together, and divide by 2; this will be the distance which must separate them. They must be plano-convex, with their plano sides towards the eye. The better plan for a novice to adopt is, when purchasing them from such an optician as, say, Lancaster, to say what they are for, and ask the distance they are to be separated.

Procure a piece of tubing that will fit nicely into the tube D; cut off, say, $\frac{3}{8}$ in.; turn out one end to the extent of $\frac{1}{16}$ in., so that the field lens will bed on it. The other end must be turned down, and a thread chased on it, as shown. Now place this cell in a chuck, with the end to receive the lens at the right. Place the lens in its position, keeping it steady with a finger of the left hand, and with a burnisher press the bezel over the lens, which will hold it securely. For the cell of the eye-piece turn away the metal on the outside to form a bed for the lens, as shown, and then pierce the centre, leaving a narrow flange. Now cut away the metal at an angle, as in Fig. 7, leaving a bezel around the hole which has to be turned over on the lens, as in the other case. A thread has to be chased on the cell, as shown. A tube must now be cut, of such a length that when the two cells are screwed in their places the lenses shall be separated the required distance. A stop must be placed, as at *b*, to cut off marginal rays. If we were constructing an astronomical telescope, our work would be practically complete; but the youngest tyro in optics will know that the instrument, as it now stands, will invert the objects seen, and thus, for all terrestrial observation, is practically useless.

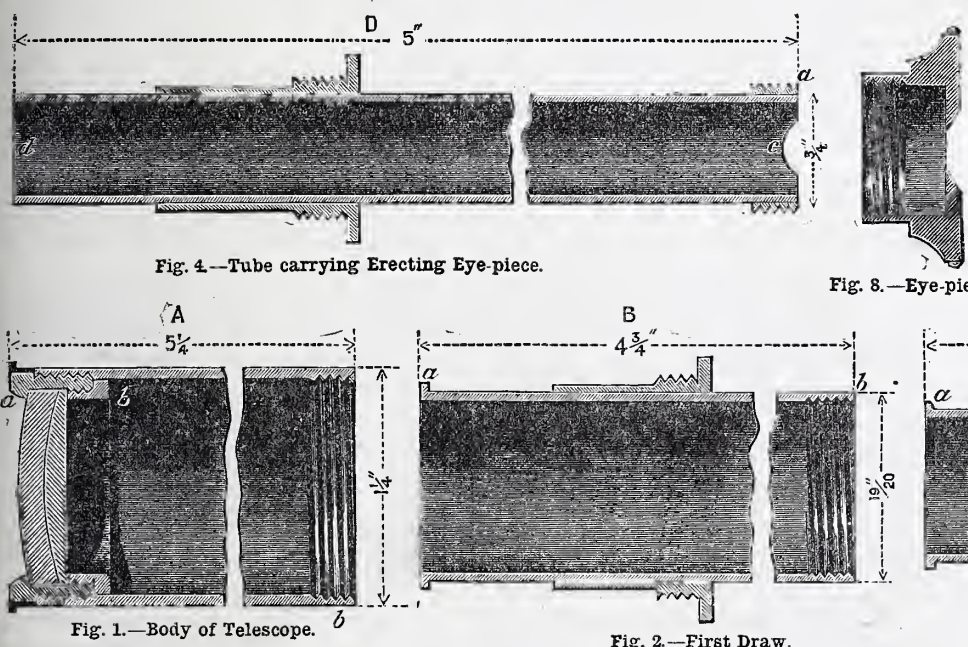


Fig. 4.—Tube carrying Erecting Eye-piece.

Fig. 1.—Body of Telescope.

Fig. 2.—First Draw.

Fig. 3.—Second Draw.

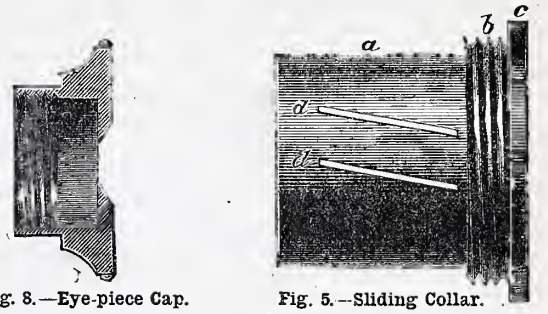


Fig. 8.—Eye-piece Cap.



Fig. 5.—Sliding Collar.

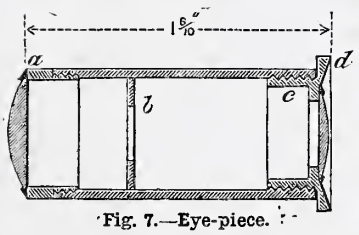


Fig. 7.—Eye-piece.

*Erector.*—For this we shall require two lenses. The one nearest the O.G. may be either plano-convex or double-convex; but if the latter, the greatest convexity must be nearest the O.G. This should be $\frac{1}{2}$ in. diameter and $1\frac{1}{4}$ in. focus. The other is a plano-convex, with the plano side nearest the eye; this may be $\frac{3}{8}$ in. diameter and $1\frac{1}{2}$ in. focus. They must be separated one-half of their combined focus.

After what has been said on cell-making, the diagram (Fig. 7) will be sufficient to show how they are mounted. A stop with a small hole must be placed as shown. The milled edge at *a* must project a little beyond the diameter of the tube D, so that the collar shall prevent the tube from being pulled out.

We now need to make the eye-cap (as Fig. 8); this needs no further description.

A thumb-piece must be taken out of tube D, as shown at *c*, to afford facility to remove

the eye-piece when needed, seeing the flange, *d*, of the eye-piece is flush with the tube.

*Sunshade.*—It is usual to have a sunshade to draw over the O.G., with a cap to prevent damage. If this be desired, then a ring, say, 1 in. wide, must be soldered to body tube at *b*; then a collar must be made to slide over the tube, and the sunshade screwed to this, and a cap or cover fitted to the end. These arrangements will be so simple, that anyone who can master the foregoing details will find no difficulty in working them out. When all is so far finished, the inside of all tubes must be made a dead black, and all the exposed parts of the tubes burnished and lacquered.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

FIRE-GUARDS—BODGING—THE BODGE—THE BODGING-RING—STAY-BARS—EYE-WIRES—HOOKS.

I HAVE no hesitation in saying that the manufacture of a fire-guard such as I show in Fig. 119 must be numbered among the most difficult tasks a wire-worker is called upon at different times to perform. My earnest advice to my amateur friends is that they should leave fire-guards alone until they thoroughly understand details in other directions, and have become comparatively efficient in handling wire in a practical manner.

I have tendered this counsel because I am aware that a fire-guard is an extremely useful adjunct to a household, and that the fact might induce some of our amateur friends to try their hands at such articles before they had thoroughly grasped the instructions previously given. However, if any are determined to endeavour to accomplish making one, they will find these notes accurate and "plain sailing;" for I have dotted them down roughly while observing the process through which a fire-guard passes, and have, just before penning these lines, experimented personally.

These articles are not separately made and finished complete, nor, indeed, are many things so made, but a quantity are put through one stage previously to passing through another. However, it will serve no useful purpose for me to name the different processes. I will begin and end with a single guard.

They are made in various sizes, and are usually proportioned to the height; but I shall not give *all* the dimensions, as there are so many, and I do not see the need of my doing so. Should any reader, however, desire fuller particulars, I shall be pleased to give them to him, although I have endeavoured to obviate the necessity of any such action on his part in the course of my following remarks.

Supposing a certain height is agreed upon, the first proceeding will be to bend a wire as in Fig. 127, the top being half-circular. There will be a bottom wire (indicated as A B in Figs. 119, 122, and 123), which will finally be nearly half-circular in shape, but will be used in the straight until a point is reached of which I shall say more later on.

A little extra should be allowed upon this for the purpose of twisting the corners where the wire, A B, comes in contact with the upright arch.

A piece of work should now be laid out on the bench, of a mesh previously decided upon, the width of it exceeding by a trifle the length of the bottom wire, A B. The upright arch should now be placed upon the work, one corner of the former touching one end of the bottom wire, A B (Fig. 126), and the length marked off, giving a very considerable excess over the length of the upright arch, for the reason that sufficient must remain to be bent dome-shaped, as in Fig. 119.

When the piece of work is cut out, should it be found correct in size to fit on to the frame (which I have designated upright arch and bottom wire, A B, for convenience' sake), if more than one guard of these dimensions is required, it will be preferable to cut all the necessary pieces of work ready according to the first piece.

When this stage is reached, the work is ready to be turned over on to the bottom wire, A B (before that wire is bent arc-shaped, bear in mind), and will then be as in Fig. 122. Parallel to the bottom wire, A B, at a certain distance from it (which distance will depend upon the height of the guard), will be another wire (C D), temporarily secured in position by being tied at odd intervals. Between these two stay-bars will be a pair of eye-wires (Fig. 125), one towards each side of the work, in order that the movable hooks (Fig. 132) may be fastened to them in such a manner that sufficient space is afforded for them (the hooks) to work freely and be attached to the bars of a grate to hold the guard in proper position. The wire, C D, will then be laced to the work.

What requires to be done when the work is thus far ready is to bend the bottom wire, A B, and the wire, C D, to their requisite arc shape, which is done by means of the bodging-ring shown in Fig. 120 (of which more anon). The appearance of the job will now be as a piece of netting bent, being really an arch whose both openings are the same size as each other.

When this point is attained, the upright arch wire should fit properly in between the wires along the part which forms the bottom edges of the arch of bent work. The latter wires must be temporarily tied to the arch wire, preparatory to being turned over it. It will be found that the wires can only be turned over on to the arch wire along the straight sides of it, thus leaving loose ends all round what will afterwards be the arc-shaped portion.

The all-important work of bodging takes place at this period, but before describing it I must return for a short time to the eye-wires. As before said, one is shown in Fig. 125. A straight wire has its ends bent as shown, either by means of fingers, pliers, or something as convenient, and is then again bent, at a short distance from each end, round pegs, the holes or eyes being thus formed (Fig. 124). When fixed in position, by placing one end over the bottom wire, A B, and the other end over the bar, C D, they are there squeezed down as tightly as possible by the aid of the nippers. Of course, these eye-wires will be upon the inside of the job, as also will be the wires, A B and C D.

Now for the bodging—by the way, a peculiar but appropriate term. First, there must be a bodge. This is shown in Fig. 121, and will be turned from hard wood. An idea of its most suitable proportions can be gleaned when I say that the narrowest part shown in my sketch is intended to serve as a handle. The next accessory will be a metal hoop about four or five inches deep, and about the same diameter as the width of the guards. The work is placed upon it in such a manner that that end which is to be dome-shaped partly covers the orifice of the bodging-ring. A few gentle taps are given with the bodge, the work meanwhile being shifted regularly with the left hand, but never having any other part over the bodging-ring than that which is to be dome-shaped. The consequence of these actions is a depression of the wires so tapped or bodged, and if these operations are continued systematically, a dome top will be the result. Many more words concerning the bodging will be superfluous, for I am certain that neither myself or anyone else could possibly describe the details clearer if confined, as I am naturally compelled to be, to pen and pencil. To give more diagrams would be useless, as wire is such open work to represent that an idea of it cannot always be conveyed in drawings, and my only fear is that those I do give, although drawn correctly, may not be instantly intelligible in every case. The wires will then be turned over the half-circular portion of the upright arch.

Another difficult part in connection with fire-guards is the accomplishment of a pair of hooks for purposes previously mentioned. To me the task of describing the routine through which a piece of wire passes before it can be called by the name under consideration, is indeed a difficult performance; but to show that I have at heart most earnest wishes that the knowledge which I have gleaned from my practical friend should be imparted to all who feel desirous of becoming properly acquainted with it, I have decided upon a scheme by which I consider I shall benefit my readers and also satisfy myself, of which I must postpone explanations until I have completed a few more descriptive paragraphs.

These hooks are bent by means of pegs driven into the bench at stated distances apart, the distances depending upon the size of the hooks required. There will be six pegs, placed in relative positions shown by Fig. 128. In that diagram the whole lot are shown complete, and I have lettered them—the letters in the companion diagrams illustrating a correspondence of parts.

First, a straight wire has a hook formed at one end, which is held to the left in beginning the after-bending. This end hook is fixed on the extreme left-hand peg, A, and the wire is bent round the extreme right-hand peg, F (Fig. 128). In this state it is taken off the bench. In the next bending it will not lay flat, as it unavoidably appears to do in the sketch (Fig. 129), but one bent half will be exactly above the other, as I have endeavoured to explain in Fig. 133. In that diagram it is intended that only what is the lower half in the drawing shall touch the bench. This being understood, then, I will proceed.

The wire is, in this position, placed by the sides of pegs D and F, in such a manner that the bend, G, does not project beyond the peg D, and is then bent round as in Fig. 129. Then at point G each half is squeezed close together. It is again taken from the pegs and replaced against them, as in Fig. 131, the longer portion being exactly above the shorter, and the *longer portion only* bent as in that diagram. In the next bending, the hook (so far finished) must be turned upside down and fixed in contact with the pegs, as in Fig. 130, and the longer portion again bent round peg F. The hook will be finished when the remaining straight end is formed into a bend similar to that at the other end, and will then present an appearance similar to that represented in Fig. 132.

An examination of the arrangement of the pegs will show that any number of hooks may be made of all exactly the same size as

each other. The pegs form a gauge for them. When the first piece of wire is formed into a hook, it will naturally be desirable to know what its length is if any more than a few pairs are required. To arrive at this conclusion, it would seem that it would be necessary to straighten out the hook again in order to measure it; but if my following hints are accepted, no such toilsome course need be resorted to.

Have a length of wire a few inches in excess of what it may be roughly estimated will be required. Measure it, and then make the hook. It will be seen that by subtracting the length of the surplus piece from the whole, the remainder will give the proper length occupied by the hook. I believe this explanation is clear enough, and my readers who properly understand must not think I am doubting their intelligence by an example—which I give for the benefit of those of my younger readers who may not quite understand what I mean by what I have said above. Supposing the original piece of wire is ten inches long, when the hook is formed there will remain a portion at the end which will have to be cut off. If this latter measures two inches, then the remainder, eight inches, will be the length of the piece of wire necessary to form the hook.

Each hook will be secured to the guard by having its ends passed through the holes in the eye-wires and squeezed down so that it may swing to and fro. The corners, where the upright arch wire comes in contact with the bottom wire, A B, should be slightly twisted. A handle will be required. This is simply a piece of bent wire squeezed down upon the dome part of the guard.

Sometimes these articles are mounted with brass. This is done by having a brass tube, which is slit its whole length along one side, and then bent round to the shape of the guard, and, finally, hammered down over the frame of the guard. Another tube will be necessary for the bottom.

Now I will speak further of what I proposed doing, so that myself and my readers might be satisfied. Should any of the latter not quite grasp the purport of my previous remarks, I will be pleased to supply him with a card upon which I would draw in plan the exact relative positions, full size, of hooks of any dimensions he desires. He must tell me the length and width he wishes it to be *when finished*. The one thing that I stipulate for on his part is, that, when writing to me, he shall enclose sufficient of the requisites to cover postage, of which any balance remaining would be returned. I shall be glad to assist my readers in this way in any direction in which they may require enlightenment.

I have said that articles with brass or other mountings would be dealt with in future papers; but such an enormous number of fire-guards are made quite plain, that I consider their description rightly belongs to this section, and I have included them in this section accordingly.

## MEANS, MODES, AND METHODS.

### Black Stain.

A splendid black stain for wood-work can be made and used in the following way:—Take out the burner of a gas-jet and suspend a piece of iron or tin above it, and allow it to smoke on the tin; in a few minutes a fine black powder will accumulate. This should be collected by scraping it off with a knife. If a piece of wadding or flannel, moistened with French polish, be dipped in the black powder, and rubbed on the article to be stained, it will be found to stain (and polish at the same time) a beautiful jet black.—H.H.

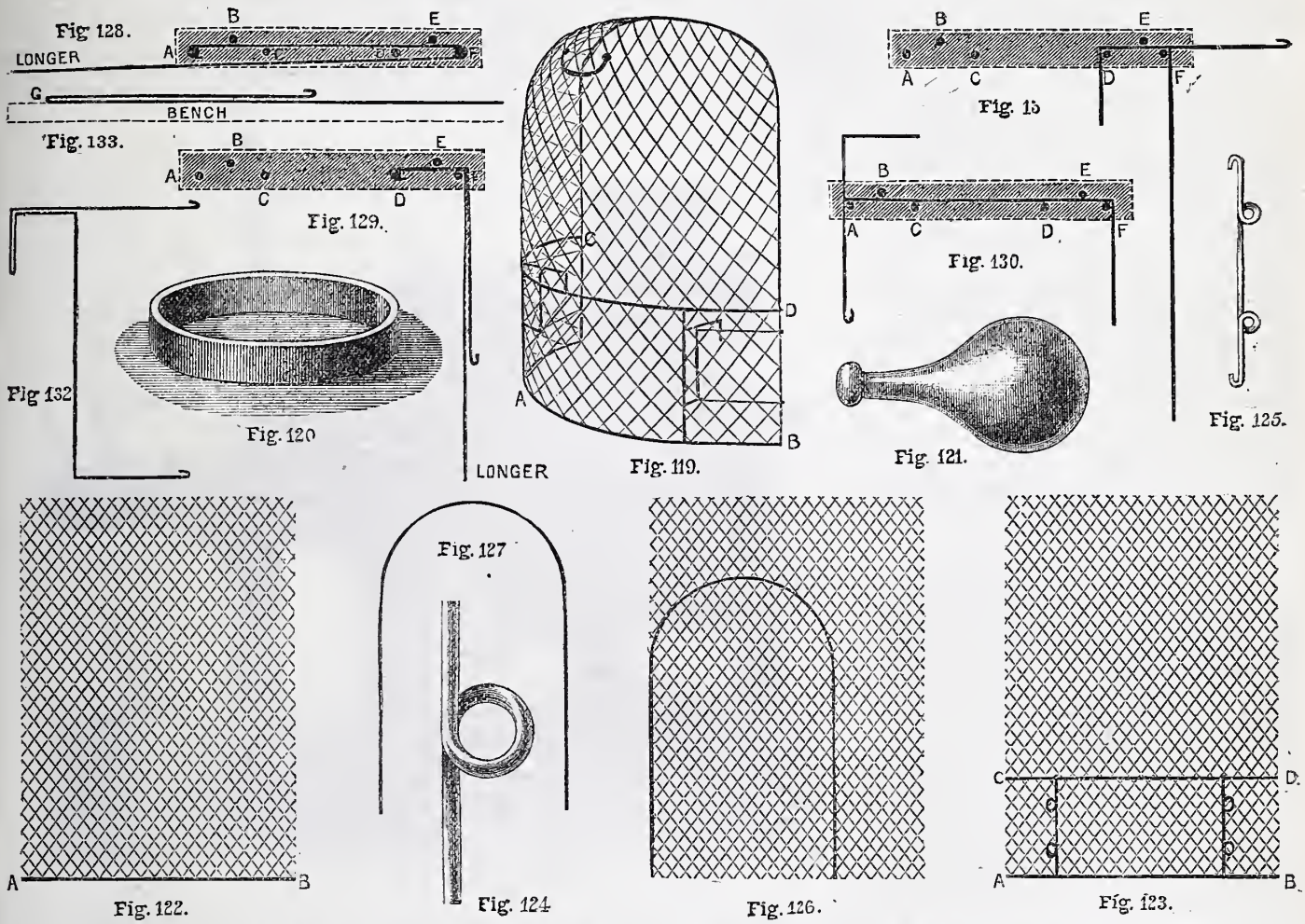



Fig. 119.—Fire-guard complete. Fig. 120.—The Bodging-ring. Fig. 121.—The Bodge. Figs. 122, 123, 126.—Progressive Diagrams illustrating the laying out and fitting of Various Wires. Fig. 124.—Eye-hole (see Fig. 125). Fig. 125.—Eye-wire (see Fig. 124). Fig. 127.—Upright and Wire. Figs. 128, 129, 130, 131.—Progressive Diagrams showing how Hook (Fig. 132) is formed. Fig. 132.—Hook. Fig. 133.—Diagram in further Explanation of Figs. 129, 131.

### A Cheap and Useful "Graph."

The following directions for making a cheap and useful "graph," or copying materials, are based on a recipe given in the *Papier Zeitung*:—Soak four parts of best clear glue, preferably Scotch, in a mixture of five parts pure water and three parts liquor ammonia until the glue is thoroughly softened. Subject it to gentle heat until the glue is dissolved, and then add three parts of granulated sugar and eight parts of glycerine, stirring well and letting it come to the boiling point. While hot, spread the mixture upon clean white blotting-paper with a broad brush until the blotting-paper is thoroughly soaked and a thin coating remains on the surface. Then put it aside to dry for two or three days, when it will be ready for use. The writing or drawing to be

copied is done with the usual aniline ink upon writing-paper. Before transferring writing to be reproduced to the blotting-paper, wet the latter with a sponge or brush and clean water, and allow it to stand one or two minutes. Place the written side down, apply gentle pressure to get rid of any air bubbles, and submit the whole to gentle pressure for a few moments. The written paper must then be removed, and impressions taken in the ordinary way. When the impressions begin to grow weak, damp the surface of the "graph" a second time. This "graph" does not require the writing to be washed off; all that is necessary is to put it aside for an entire day, or a day and a half; or, in other words, from twenty-four to thirty-six hours, when the surface will be ready for a new impression.

### A Hard and Fast Cement.

The introduction of the following cement, that is said to stick on anything, is attributed to Professor Alexander Winchell:—Take of clear gum arabic, 2 oz., of fine starch, 1½ oz., and of white sugar, ½ oz. Reduce the gum arabic to powder, and dissolve it in as much water as the laundress would use to render 1½ oz. of starch fit for use. Dissolve the starch and sugar in the gum solution. Then place the mixture in a vessel and plunge the vessel itself in boiling water, and let it remain there until the starch becomes clear. The cement should be as thick as tar, and remain so. It can be kept from spoiling by dropping in a lump of camphor, or a little oil of cloves or sassafras. This cement is said to be very strong indeed, and will cause glazed surfaces to adhere perfectly. It is useful for repairing specimens of rocks, minerals, or fossils that may have been accidentally broken.

### How to Imitate Old Bronze.

An excellent method of imitating antique bronze has been lately introduced in some of the art work of that class. It is well known that repeated applications to copper or brass of alternate washes of dilute autic acid, when subsequently exposed to the fumes of ammonia, result in giving to the metal the colour of antique green bronze; but workers have long been on the look-out for a more rapid method of obtaining this appearance. It has been found that the desired result may be obtained by immersing the articles in a solution of one part perchloride of iron to two parts of water, the length of the immersion regulating the depth of the tone. A similar result may also be obtained by boiling the article in a strong solution of nitrate of copper, or by dipping the articles to be coloured in a solution of 2 oz. of nitrate of iron and the same quantity of hyposulphite of soda in a half-pint of water. The article must then be dried and burnished.

### A Wrinkle for Bookbinders.

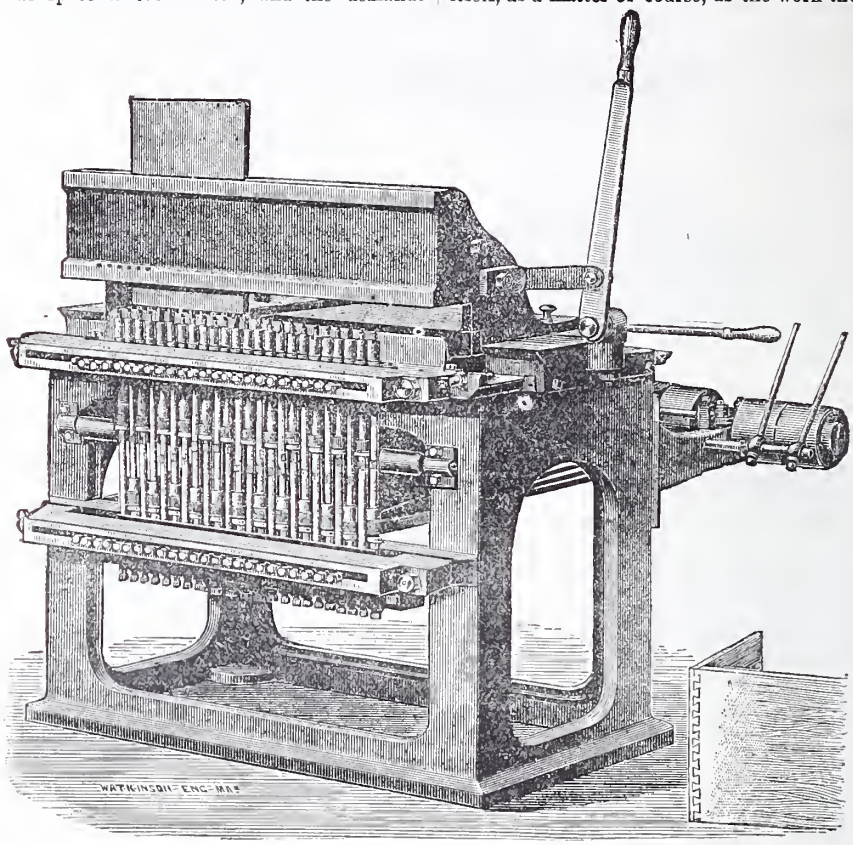
In gilding the edges of books, trouble sometimes presents itself in the gold cracking off and spotting, especially in works of art whose plates have been worked on thick and pulpy paper of a greasy nature. This can be remedied by adopting the following process:—After the edges are well scraped, wash with a solution of about five drops of muriatic acid to 2 oz. of oxalic acid; this will destroy the grease. Then paste, wash, and when dry polish with a round agate burnisher; this will give the edges of the plates a hard surface. Now apply the gold with size in the ordinary way, and the result will be a bright, solid edge.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 90.—Pickles' Improved Dovetailing Machine.

The accompanying engraving is an illustration of a new and improved dovetailing machine recently introduced by Messrs. John Pickles and Son, Saw Mill Engineers and Wood-cutting Machinists. Those who are acquainted with machinery will readily recognise its construction and action from the illustration itself; and as space is too limited, and the demands on it too great, to deal with these points in as complete and satisfactory a manner as I could wish for the instruction of the uninitiated, I will merely take occasion to point out that the machine is of the most modern design, and is specially adapted for dovetailing furniture and all parts of furniture in which dovetailing is desirable, and, indeed, absolutely necessary, as, for example, in all drawers, boxes, etc.; and it is also most useful in packing-cases, and for all kinds of cases in which goods are sent out, whether on a large or small scale, and in which the dovetail joints are for the most part numerous. Messrs. Pickles & Son write to say that they have been led to submit the illustration to the notice of the readers of WORK in consequence of "an admirable paper on dovetail joints" which appeared in page 389 of the current volume, an expression of opinion which is valuable in itself coming from the source from which it does, and which shows that WORK finds its way into the offices of men of experience and sound judgment, who are able to appreciate the information contained in its pages at the proper value. They proceed to say: "We have just made a machine for the largest cabinet factory in London as per illustration enclosed" (that is to say, the illustration that I have been enabled to give here). "This machine will dovetail work up to 30 inches wide, all in one operation, making both pins and tails, and not only that, but rounding the pins off to fit the dovetails. Different pitches of dovetails can be produced on the machine." The rounding off of the pins to fit the dovetails is of the utmost consequence, particularly in all hard woods, as it requires no undue amount of cramping up to get all the pins fairly home. A very important feature in this machine is that the distance between the cutter spindles can be varied so as to produce different pitches of dovetails and pins by having different sizes of cutters. The machine is easily and expeditiously worked, and is made in three sizes—namely, No. 1, to take 30 inches in width; No. 2, 24 inches; and No. 3, 18 inches. It is well worthy the attention of all who are engaged in the furniture trades and packing-case making of every description. To amateur wood-workers it will not commend itself, as a matter of course, as the work they do in dovetailing is by no means so extensive as to induce them to proceed beyond careful work with the tenon or dovetail saw, or such simple machinery as may be devised for home use, in which there is but one cutter, and the work is made to travel laterally until the work of dovetailing is completed. I do not say that such a machine exists and is purchasable, but that by the exercise of a little thought and ingenuity such a machine may be contrived, even as machines for mortising and tenoning have been made for home use, and have proved of considerable assistance to the maker and contriver.




Pickles' Improved Dovetailing Machine.

### 91.—Serial Publications and New Editions.

I have received the current numbers of "The Machinery Mart" for August, September, October, and November; "The Amateur," published by Messrs. Henry Zilles & Co., for September, October, and November; and the fourth and enlarged edition of "Photography in a Nutshell," by the "Kernel." As the merits of these have already been noticed in "Our Guide to Good Things," it is unnecessary to do more on the present occasion than to acknowledge their receipt.

THE EDITOR.

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Testing Accuracy of Framework.**—G. P. (*Elgin*) writes:—"I notice that no figures are attached to the second of the two diagrams which accompanied my communication on 'Testing the Accuracy of Framework' (see Work, p. 523, Vol. III). In Fig. 2 referred to, the top left-hand corner should be marked 'A,' the top right-hand corner, 'B,' the lower right-hand corner, 'C,' and the lower left-hand corner, 'D.'"

**Hand Saws.**—A. R. (*Scorrier*) writes:—"In No. 137 of Work, p. 523, letters appeared from myself and Chopstick criticising M. Powis Bale's article on 'Saw Teeth' (see p. 421). I would like to call the attention of the readers of Work to the criticism on p. 523 by Chopstick, which any practical saw-sharpener will deem absurd. If Chopstick means what he wrote on p. 523, I can only say that his practical experience in saw-sharpening must be very limited. Chopstick said the form of teeth shown in Fig. 1 is the best for cross-cutting. I understand that Figs. 1, 2, and 3 were represented as rip-saw teeth. Chopstick further said that Fig. 2 was the best for ripping, and Fig. 3 the right shape for cross-cutting logs. If the readers of Work will refer to the article on p. 421 by M. Powis Bale, they will notice that the rake of teeth (Figs. 2 and 3) is much the same, and the angle is about 50°. Now, I ask, what man can work a hand saw with teeth at such an angle? Again, it is well known that the rake of teeth for cross-cutting should not be as much as for ripping. The teeth in Figs. 2 and 3 have too much rake even for ripping, and Chopstick will actually say that Fig. 3 is suitable for cross-cutting logs! Chopstick will please allow me to tell him that for cross-cuttiug logs there should be but very little (in some cases, not any) rake in the teeth. It would be impossible for two of the strongest men I know (and I have had to do with some strong men, especially above the shoulders) to work a two-handle cross-cut saw in cutting logs with rake in teeth as in Fig. 3 (p. 421). Again, in reference to everyone sharpening a saw to cut any kind of wood: I know many men who have tried to sharpen saws, but the saws have been made a deal worse by the so-called sharpening. I would not advise anyone to practise sharpening a good saw, but to follow some of the instructions in Work, practising for some time on an old saw or pieces of saws. In reference to a needle running down the saw teeth, Chopstick may sharpen a saw that a needle may run the whole length of teeth before it falls off, and another saw may be sharpened even better, and the needle will fall off before it runs half-way down the teeth. In fact, a saw may be improperly sharpened and a needle run the whole length; while in another saw, that is properly sharpened, it would not do so. If Chopstick can give no better proof than that of the needle, allow me to tell him, as a practical man, there is more than that required to convince me that his saw is properly sharpened. I might add that from five to seven teeth in a hand saw will be the most suitable for cross-cutting, and for ripping, four teeth or points to the inch will be far better than three points to the inch, and if teeth are properly sharpened, 3 in. deal can be easily ripped with it."

**Splicing a Mast.**—L. L. H. (*Falmouth*). — My reply to Nauticus (see No. 137, p. 523) was not quite explicit enough; I will therefore supplement it. Into the two nicks in the mast to be cut (shown at A and B in the drawing) nail two narrow strips of wood, or battens, perpendicularly—*i.e.*, at right angles to the mast. They must be sufficiently long to stand *well* above the spar as it lies on the ground. If a straight-edge is laid on the mast against these strips and moved up and down like a see-saw, always touching the strips, it will be found to be very easy to scribe a straight line on the mast, which, when sawn upon, will make a true mitre of the end of the spar. This is the method invariably used by mast-makers. A mitre-box as suggested by the Editor would not be practicable for the very large and heavy spars with which a mast-maker has to deal."

**Sheet Metal Work.** — Erratum. — Tinker writes:—"In my letter which appears in page 523, No. 137 of Work, there is a slight misprint. Instead of half a middle plate being 15 in. by 15½ in., it should read 15 in. by 5½ in."

**"Work" Certificate Frame.**—W. W. (*Elswick*) writes:—"I forward this to you as a design for Certificate frame. It gives your readers an idea as to how I intend to frame my certificate, as I am proud to think that I was a successful exhibitor in your late Exhibition. This frame is intended to be turned in the lathe out of two pieces of mahogany, which will be suitable to the dimensions given in the design. The long columns are turned with a ball at each joint, and a ⅜ in. bole put through each ball, with the ends finished as shown. Then they

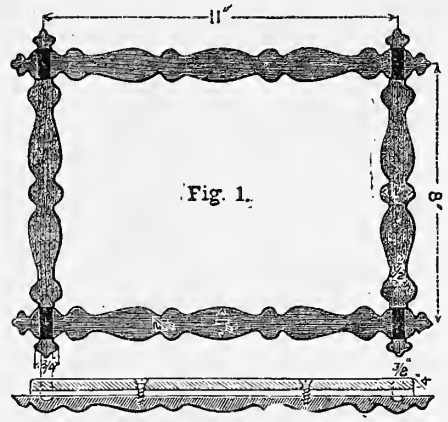


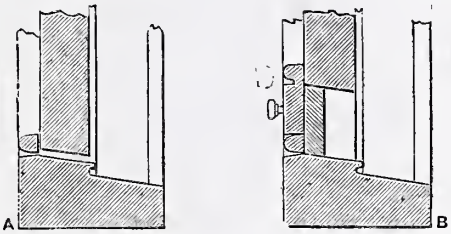

Fig. 2.

"Work" Exhibition Certificate Frame.

are carefully sawn through the centre, and form the two sides of the frame. The short columns are turned with joints made to fit the hole in ball, and ends turned as shown. These sawn through centre as in long columns form top and bottom of frame. Fig. 2 is a section showing edge, and how to fasten backboard to frame."

**Draught Excluder for Doors.**—The Rev. H. H. (*Burton-on-Trent*) writes:—"I found the following simple plan very effective last winter for excluding draught from the bottom of a door: Roll up a sheet of brown paper the length of the door; the roll should not be solid, but hollow, to make it springy. Fasten a piece of elastic to a button, and pass the end of the elastic through the end of the hollow, and then through the thickness of the paper: the button will form a stop; then pass the end of the elastic under the door and neatly tack it to the other side. Treat the other end of the roll in the same manner. The elastic and springy roll work comfortably together over edges of carpets and other inequalities, and always clip the door and floor with an easy but sufficient pressure. The roll can be placed either inside or outside the door, and can be covered with carpet, oilcloth, etc., according to the requirements of taste. Another simple and effective plan is to fasten elastic to the under ends of the door-mat and floor or jamb of such a length as to keep the edge of the mat always gently pressed against the door. Draughts to the feet are not only a nuisance, but dangerous."

**A Ventilator for Windows.**—T. S. (*No Address*) writes:—"It is sometimes rather too cool to have the windows open, and not cold enough for a fire to be necessary, and our rooms are stuffy and unpleasant, so here is a mode of ventilating that perhaps may be useful to some of the readers of Work. Procure two pieces of wood, 2 in. wide by ¾ in. thick (the one before me now is of yellow deal, varnished); the length of one of the pieces is about ½ in. less than the distance between the pulley stiles of the window, or the length of the bottom rail of the sash; the other piece should be cut to fit loosely in between the beads of the sash-frame, or about 1½ in. less than the first piece, and should be beaded




Ventilator for Windows.—A, Section of Window without Ventilator; B, Section of Window with Ventilator.

or chamfered on one edge. Now put the first piece on edge on the sill of window, and shut the sash down on it, and put the second piece against the sash, to hide the first piece. If the two could be screwed, nailed, or otherwise fixed together as they are so placed, the ventilator is complete. Of course, as one side shows in the room, screws and nails should be put in from the outside, so you had better mark where they should be fixed together, and take them out and complete. The advantage of this construction is that there is in no place a straight joint. There is a rebate all round top, bottom, and both ends. No bolts or other fastenings are required. A small knob is perhaps useful to hold it in position while shutting the sash, or without the knob you may pinch your fingers."

**Lamp Explosions.**—W. G. (*Sherborne*) writes:—"After what we have heard about the death by burning of Lord Romilly and the fearful lamp accidents at Liverpool and in Wiltshire, people would do well to use the Maguay electric lamps, which cannot explode even in a coal mine. They are made complete with batteries for hanging on a wall, or the battery can be placed under the dinner-table and light a table lamp; they can also be used to drive motors. A few days ago a single firm is known to have ordered £260 worth of these electric bicycle lamps, which cannot be blown out in the storms."

### II.—Questions Answered by Editor and Staff.

**Cocoa Fibre.** — Don. — I cannot give full particulars to describe the process of preparing fibre for weaving into mats; and, if I could, Don would have to see it done, and ask numerous questions on the subject to be enabled to do it himself. I recommend him to get an order to view some prison where this sort of labour is carried on, when, no doubt, he could pick up many "wrinkles."—J. W. H.

**Burnishing Machine.**—W. A. H. (*Haworth*).—A machine for this purpose consists of two iron cylinders, the upper one polished, geared together with tooth-wheels working in headstocks, just like one of the ordinary clothes-wringing machines, which you may take as a model, with a top bar, strong coach-spring, and screw to put on the pressure, as in the wringer. Now plane a piece of iron about ¼ in. thick, the width of your rollers and rather longer, polishing the upper surface; and on your side frames cast a rib on which the end may slide, exactly on a level with the top of the lower roller. Have a small atmospheric gas-burner fixed under the plate, so that when it is drawn out to the full extent it may be heated. You may have a stop, to prevent its going too far, if you like. This plate, when between the two rollers, will move when they are turned, like the box of a mangle; but it is, of course, better to fix a rack and pinion of the same pitch as the wheels under the plate or table, and gear a small pinion on the same shaft into the tooth-wheel of the bottom roller; and having outside that a handle keyed upon it to turn the machine with. This table must be oiled when not in use, and all oil and rust polished off with dry whiting when about to be used. Lay your photos, face down, on the table, which should be heated just so that you can bear to lay your hand upon it; and adjust the pressure gradually, putting a little more on as the mount and paper get thinner with the rolling, until the gloss is satisfactory. If you have no gas, a paraffin lamp will answer, if you do not put it too near the table; as, if you do, it will cover the underside of the table with thick layers of lamp-black. If you cannot work to this description, we will, if you write again, give working drawings and dimensions, size and pitch of wheels, rack, pinions, etc.—J. W. H.

**Medical Coil.** — Achlum. — From your rough sketch of the apparatus, I gather that you have made a medical coil of two powers, although in your letter you describe it as an "electric battery." A coil and an electric battery are two separate things. The right way to connect the wires is as here directed if you have two secondary coils: Connect one end of the primary wire to one of the terminals, marked on your sketch "to battery;" connect the other end of the primary wire to one end of the electro-magnet wires; then connect the other magnet wire to the contact screw pillar, and run a wire from the contact to the other terminal, marked on your sketch "to battery." This will complete the primary circuit. Now for the secondary circuit: First, connect the commencing end of the first secondary to one of the studs marked "to handles;" connect the other end of this wire to the stud of the switch marked "No. 1," the other stud of this being connected to the opposite "handle terminal." This will complete the first power. The second coil of wire will start from the same stud as the first, and will finish off at a stud on No. 2 switch, thus forming the second power. All connections made beneath the base.—G. E. B.

**Unanswered Letters.**—E. D. R. (*Camberwell*).—A reply to your first letter was prepared in due course, and was awaiting space for publication in "Shop," when your second letter came to hand. There is great pressure upon "Shop."—G. E. B.

**Battery for Electric Light.** — Ignoramus. —The cheap electric light battery described on page 428, Vol. III. of Work, in reply to F. G. (*Paddington*), will furnish enough current for two 2½ candle-power 8-volt lamps. The charge will run for about six hours, and then will have to be thrown away, the battery plates cleaned, the zincs re-amalgamated, and the cells charged with a fresh solution just before starting the battery again. This must be done every evening, if the light is required for a period of from four to six hours. In any case, the plates should be lifted out of the solution when the battery is not at work. If this is not done, the zincs will waste away. For these reasons the battery is not suitable for electric bells.—G. E. B.

**Electrical Engineering.**—A. T. (*Horwich*).—I do not know of a "Guide to Electric Engineering, Mechanical Engineering, and all other Engineering Trades;" nor do I know of a book containing the Board of Trade examination questions on these subjects. Several good books on electrical engineering and mechanical engineering have been published, among the best being "Electrical Engineering for Electric Light Artisans and Students," by Messrs. Slinger & Brooker, price 10s. 6d. "Questions on Magnetism and Electricity," by F. W. Lavender, price 3s. 6d., and "Exercises in Electrical and Magnetic Measurement," price 3s. 6d., are books which may be useful to you. By writing to the secretary of the City of London Guilds Central Institute, South Kensington, S.W., you may get information respecting the latest examination papers of this Institute. Copies of such papers are sometimes on sale.—G. E. B.

**Battery for Lamp and Coil.**—T. S. (*Caledonian Road*).—The small lamps mentioned by you (under the name of "Aladdin Electric Watch Stand") may be worked with current from a small ebonite accumulator, a small lithanode battery, a chloride of silver cell, or a small battery, with zinc and carbon elements; the cells being charged with bichromate of potash, or chromic acid solution. If you had described your battery, I would have told you how to make a suitable solution. Bichromate or chromic acid solutions are made by dissolving 3 oz. of either salt in 1 pint of warm water, allowing this to cool, and adding a large wineglassful of sulphuric acid in drops at a time. This is the most lasting solution for a small cell with carbon and zinc plates, whether used for small electric lamps or for working street coils; but even this will only last for a six hours' run with lamp or coil. A 25-volt 16-candle power lamp will require a battery of thirteen half-gallon bichromate of potash or chromic acid cells, connected in series, to light it properly; and this battery will have to be cleaned and re-charged after a run of from five to six hours.—G. E. B.

**Gas Engine.**—AMATEUR.—What I should advise you to do is to decide what kind of engine you want to make, and then an advertisement in WORK would bring forward some reader who had a set of drawings. These I should advise you to study thoroughly, making yourself as complete a master as possible of all the details, meanwhile making notes of what you do not grasp; then write again, stating definitely what it is that you do not understand, when, I have no doubt, someone will be able to help you, and that willingly.—P. B. H.

**Indiarubber.**—OLLGARTNY.—The arrangement sent us by our correspondent is not new, having been used by the Fabers some years since, and was, we believe, introduced by them. There is no doubt that it is an improvement on the plan named by our correspondent; but any patent would have to be confined to the exact thing shown, and this modification would most probably have been covered in some prior patent. But this could only be satisfactorily ascertained by a search for and examination of such patents as have been already taken for this object.—C. E.

**Picture-Frame Gilding.**—EUSTACE.—It is impossible to re-gild picture frames without experience, being a trade in itself. If the frames are really English gilt—*i.e.*, not lacquer, or German gilt—they can be cleaned by being delicately sponged with lukewarm water, to remove the dirty size, and, when dry, re-sized. Black-stained frames are best polished, egg-shell finish.—F. B.

**Lantern Lens.**—F. J. K. (*London, W.*) has a set of lenses from wet plate camera, and wants to know if he can use them to an ordinary lantern to show photographs and paintings on glass, which he has been trying his hand on, and says:—"Of course, if I have to add another lens I don't mind;" and, further, that the lenses he has are 1½ in. diameter. It is hardly clear what F. J. K. means, but he must know that in a lantern, in addition to the front lenses, for which, no doubt, his present lens would be available, he will require a pair of condensers, from 3½ in. to 4 in. in diameter, and of about 6 in. focus. These elementary facts must be grasped before a lantern can either be made or used. And then as to the photographs, etc., referred to, it is not clear whether he means ordinary photographs or transparencies made purposely for the lantern. The former can certainly be shown, but not by an ordinary lantern. I should advise F. J. K., in the absence of a more instructive manual on the subject, to get a catalogue from some optician who makes lanterns a speciality—and there are many—where he will find much useful information. At present it seems he does not know the elementary optical conditions required. If he can state his wants more definitely I shall be glad to help him.—O. B.

**Tin Can Ear.**—APPRENTICE.—The ear which you send as a sample is called a canteen ear, and you can obtain them from Messrs. Hopkins & Sons, Granville Works, Birmingham; Perry, Son & Co., Temple Street Works, Wolverhampton; T. Paul Lomax, Moor Street, Birmingham; or any other maker of tinmens' mountings.—R. A.

**Sheet Metal Work.**—I. J. W. (*Farnworth*).—You will find articles on the above as follows: Vol. I., Nos. 17, 23, 32, 42; Vol. II., Nos. 67, 71, 78, 93; Vol. III., Nos. 127, 134. There are several more to follow.—R. A.

**Oval Chuck.**—A. W. D. (*No Address*).—The sketches show an alternative guiding ring which may suit A. W. D.'s lathe, though it is very difficult to prescribe for an unseen patient. The principle of the oval chuck is, of course, rotation, combined with a definite reciprocating motion. Any means which will secure this end may be adopted. If the tool could be made to advance and withdraw twice in a revolution, no complicated chuck would be necessary, though the arrangement would be very difficult to obtain. Yet A. W. D. will see, on consideration, that it would be possible. One great difficulty would be to turn various diameters with travel of tool thus fettered. The alternative to this travel of the tool is the travel of the work, and the oval chuck secures this. A. W. D. is aware of the fact that this oval chuck is suited for work which is *wholly* supported by it, without any help from the

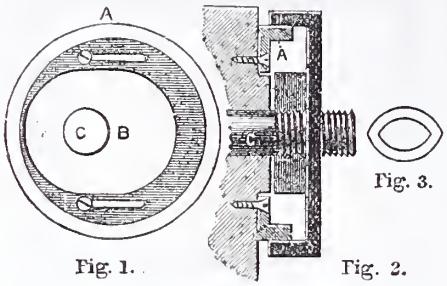
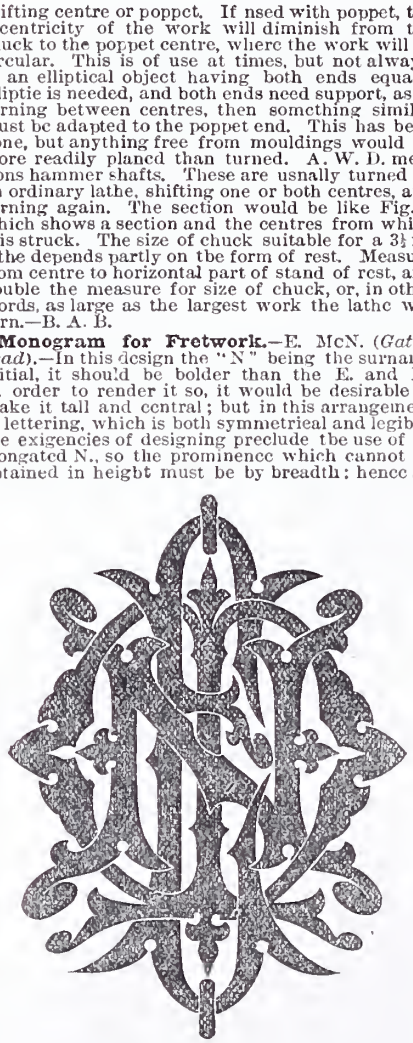



Fig. 1. Fig. 2. Fig. 3.

**Suggested Form of Guiding Ring for Oval Chuck. Fig. 1.—Front View—A, Guide Ring; B, Centre, cut away to allow it to be set eccentrically; C, Centre of Mandrel, to be fixed with Screws in the Slots marked. Fig. 2.—Section. Fig. 3.—Section of Hammer Handle, showing Centres.**

shifting centre or poppet. If used with poppet, the eccentricity of the work will diminish from the chuck to the poppet centre, where the work will be circular. This is of use at times, but not always. If an elliptical object having both ends equally elliptic is needed, and both ends need support, as in turning between centres, then something similar must be adapted to the poppet end. This has been done, but anything free from mouldings would be more readily planed than turned. A. W. D. mentions hammer shafts. These are usually turned in an ordinary lathe, shifting one or both centres, and turning again. The section would be like Fig. 3, which shows a section and the centres from which it is struck. The size of chuck suitable for a 3½ in. lathe depends partly on the form of rest. Measure from centre to horizontal part of stand of rest, and double the measure for size of chuck, or, in other words, as large as the largest work the lathe will turn.—B. A. B.

**Monogram for Fretwork.**—E. MCN. (*Gateshead*).—In this design the "N" being the surname initial, it should be bolder than the E. and M. In order to render it so, it would be desirable to make it tall and central; but in this arrangement of lettering, which is both symmetrical and legible, the exigencies of designing preclude the use of an elongated N., so the prominence which cannot be obtained in height must be by breadth; hence an



**E. M. N. Monogram for Fretwork.**

expanded "N." becomes indispensable. Our correspondent would do well to devote a little extra time and attention when piercing this particular letter, and by keeping the saw clear of the edges, leave the face of it as broad as possible, thereby making it stand out just as bold in wood as it does in the pattern. With careful handling (which no doubt it will receive) the result will be highly successful and pleasing.—A. C.

**Magic Lantern.**—FOCUS CRIBUS asks two definite questions—first, where he can buy a magic lantern suitable for conducting a good Mission during the winter. To give a full answer would be to waste space, and a limited one seems invidious, the number is legion. If FOCUS CRIBUS can get a copy of the *English Mechanic*, he will find many advertised. One or two must suffice. Lancaster, Colemore Row, Birmingham; Riley Brothers, Bradford; Hughes, Brewster House, Mortimer Road, Kingsland Road, London; Noakes, South London Optical Works, Greenwich. From any of these he can get what he requires. Secondly, is it necessary to wet the screen when showing the lantern behind it, or what is the purpose of wetting the sheet? By wetting the sheet it becomes more transparent, the reason being the interstices between the fibres being filled, it becomes more homogeneous, so that less light is absorbed and more transmitted. When shown in front of the sheet it must not be wetted. A hard, even surface is required, which shall reflect as much light as possible, and transmit as little as possible. This latter plan is best, and is now generally adopted. Space is also utilised, which in a small room is always of importance.—O. B.

**Ink.**—S. W. (*Blackburn*).—Ink is theoretically tannate of iron dissolved or suspended in water thickened with gum. Inks, as now made, vary very much in their composition, and the gum generally used is dextrin, or "British gum," but for this sugar or glycerine is sometimes substituted. To test for the latter proceed as follows: Take a fair quantity of the ink, dilute it with water, and add basic acetate of lead solution, when a copious precipitate will fall, and must be filtered off. The filtrate will be yellow or nearly colourless, and contains the sugar or glycerine, if present; whilst the dextrin, tannin, and most of the other bodies are left in the precipitate. To the filtrate add a few more drops of basic lead acetate, and if there be no further precipitate, add carbonate of soda, which will precipitate the excess of lead used, which must be filtered off. The filtrate will contain the sugar and glycerine if either or both be present. Evaporate nearly to dryness, then shake up well with a mixture of two volumes of absolute alcohol and one volume of ether, and filter. Any sugar present will be left undissolved on the filter, which stand aside for a while. Any glycerine present will be in the filtrate, from which evaporate off all the ether and alcohol, when the glycerine will be left as a dense viscous liquid of intensely sweet taste. If a few drops be kindled they will burn with a blue flame and leave no residue; or, if a few drops be heated with acid sulphate of potash (bisulphate of potassium, or potassium hydrogen sulphate), vapours of acrolein will be given off, and can be recognised by their penetrating odour like that of burning fat, and their property of causing a flow of tears. Now return to your residue containing sugar, if present. Dissolve it in water, filter from any insoluble matter, and call the filtrate "Solution A." Put a few drops of an alkaline solution of copper sulphate into a test-tube, dilute with water, boil, and, when boiling, add a few drops of "Solution A." If there be any yellow or red precipitate of cupreous oxide on heating again, then sugar, in either of the forms called "glucose" or "invert sugar," is present; but if there be no precipitate, test for cane sugar as follows: Boil for a few minutes some of "Solution A" with one or two drops of hydrochloric (muriatic) or sulphuric acid, which will turn any "cane-sugar" present into "invert sugar," cool and neutralise the acid with carbonate of soda, and, as before, add a little of the solution thus prepared to some boiling dilute alkaline solution of copper sulphate. A yellow or red precipitate will prove that cane sugar was originally present. To make basic acetate of lead solution: Grind up in a mortar 1 oz. of litharge and 2 oz. lead acetate, with sufficient water to make the whole pasty. Now well boil the mixture with half a pint of water, filter, and keep the solution in a well-stoppered bottle. To make an alkaline solution of copper sulphate: Add an excess of potash to a few drops of copper sulphate solution, and then add a solution of tartaric acid until all the precipitate formed has re-dissolved. A little of this solution, diluted and boiled, should give no precipitate; if it does so, add more tartaric acid and potash, but take care to leave the resulting liquid considerably alkaline. Write again if you are not successful with your testing.—F. B. C.

**Makers of Bicycles.**—NIL DESPERANDUM.—There is no *best* maker of bicycles. Some of the best are: Singer & Co., Coventry; Premier Cycle Co., Coventry; St. George's Foundry Co., Birmingham; Humber & Co., Coventry and Wolverhampton. Any one of the above will supply a machine than which no better need be desired.—A. S. P.

**Ticket-Writer's Ink and Sable Pencils.**—G. R. (*Camberwell, S.E.*).—You can get all you require from Brodie & Middleton, Artists' Colourmen, Long Acre, W.C., who will procure you anything they may not have in stock, especially if you mention WORK.—H. L. B.

**Clincher Tires.**—G. A. P. (*Birmingham*).—The address of the makers of the Clincher Tire is Edinburgh. They can be had through any cycle maker or agent. Try St. George's Cycle Co., Upper Street, Islington, London.—A. S. P.

**Paper.**—W. H. (*Birmingham*).—Neither heavy or light carburetted hydrogen, nor hydrogen, which are the chief constituents of coal-gas, will affect prepared papers hung up in your offices sufficiently

for your purpose; but coal-gas generally contains a little sulphuretted hydrogen and carbon disulphide, which would turn black paper which has been soaked in an alkaline solution of oxide of lead. Boil up some litharge with potash, dip some blotting-paper in it, and hold it over a gas-jet to see if the gas supplied to you contains sulphuretted hydrogen or carbon disulphide. If it turns black, it will do for you; but always keep it moist.—F. B. C.

**Dutch Clock.**—AMATEUR.—After you filed up the 'scape teeth, the escapement was made shallower, and so you are unable to regulate it. Take out the 'scape wheel and put it in the "turns" or lathe, and file the teeth all the same length by holding the file steady while the wheel is revolving. Then make them all the same thickness at the tops, and replace the 'scape wheel. Now you will see the front hole of the pallets is in a strip of brass; move this round so as to put the pallets working deeper in the 'scape wheel. Have it as deep as it will go without catching on the tops of the 'scape wheel. You will then be able to regulate it with the ball and nut in the usual way.—A. B. C.

**Match-Lighting Clock.**—CLOCK.—I think I should try the old-fashioned lucifer matches. Have an arm to hold one, and fix up a piece of glass-paper, so that when the arm falls with the match on the end, it shall drag on the sand-paper, and so light it. Put a small weight so as to bring the arm and match down sharp. As regards the chemicals, I cannot help you, being very ignorant in that line. As to who would make them, I should advise you to try any of your local clock-makers, as, unless you wanted a quantity, it would not pay a big maker to make them. As it is, I have found making these curious clocks, etc., does not pay anyone. I have made several "fads" for amateurs, but find it neither pays them nor me.—A. B. C.

**Scene Painting.**—E. F. (*Hereford*).—I know of no instruction books on the art of scene painting. The only work I ever have known is one published about eighteen or twenty years ago by Mr. Lloyd, with coloured plates, price half-a-guinea; but I believe the edition is long since run out. If you have any taste for the art, you have only to follow out the simple instructions laid down in WORK. Study them well; you will soon overcome all difficulties. Should you require any aid to do anything you cannot master, if you will write, I will do my best to assist you.—W. C.

**De-magnetising Watches.**—DYNAMO.—Neither my friends nor myself know of the method mentioned by your friend. From your description of the process, I cannot understand how it was done. There may have been a small electro-motor in the box. One of my friends undertook to clean a lady's gold watch, and wore it for a few days to see how it would keep time. In attending to a strong magnetic machine, he got the watch magnetised, and came to me in a troubled state of mind about it. I advised him to place the watch on a rug and spin a powerful permanent magnet over it for a few minutes. This he did, and de-magnetised the watch. Watches may be de-magnetised by spinning them rapidly near a powerful dynamo, and withdrawing them gradually from its influence. Mr. Bottone undertakes to de-magnetise watches at a charge.—G. E. B.

**Connections of Electric Bells.**—ELECTRO.—Your sketch of connections for an electric bell and a three-hole indicator is quite right. One return wire will do for all of them; but a separate wire must go from each push to each indicator. Whenever in doubt, always sketch each circuit on paper, as you have done now, before you put up the bells. Our rules do not allow of a reply by post.—G. E. B.

**Hot-Water Fittings.**—R. J. (*Gainsboro'*).—The best books on hot-water fittings that I know of are published by Messrs. E. & F. N. Spon, 125, Strand, London. They will send you a list of them on application.—T. W.

**Electro-Magnet.**—STUDENT.—To ascertain the best magnetic results obtainable from your twenty half-pint Leclanché cells, connect them in series, and find the total internal resistance of the battery. Select a wire for the magnet which shall have a resistance equal to the resistance of the battery, and yet be long enough to place a large number of turns around the magnet core. By dividing the total E.M.F. of the battery by the total resistance of the battery and magnet circuit, you will find the ampèrage of the current flowing in the magnet coils; and, if you multiply the strength of the current by the number of turns of wire wound on the core, you will get at the magnetic strength of the current. You will, probably, get the best results from a pound of No. 26 silk-covered wire, wound on a ¾ in. core of iron, 8 in. in length, bent to the form of a horseshoe, having limbs 2½ in. in length, half a pound of wire on each limb. You will get very poor effects with this on a solenoid having an internal diameter of 3 in. Such a solenoid will require a very powerful current from a large Bunsen or Grove battery through many turns of No. 18 wire. To get alternating currents from a battery, you will need an automatic current reverser, worked by an electro-magnet.—G. E. B.

**Spoon- and Salt-Boxes.**—A GLASGOW BOY.—As a rule, I am particularly fond of receiving queries of such a nature as will tax my ingenuity to a noticeable degree, and would relish questions asking for anything short of perpetual motion and the philosopher's stone. Spoon- and salt-boxes certainly do not leave much scope for the display of talent; but as these articles are what you require, I must try and please you. The mention of spoons and salt brings up before my mental vision basins of porridge, disappearing as quickly as motion will allow down an accompanying throat. Do not think I am poking a bit of fun at you; for I am told that Scotch blood—of course, partly manufactured from porridge—runs in my veins. Indeed, the dearest relation I possess will try to convince me that I am related to the great Sir Walter! That troubles me little, for I trace my pedigree further back, and start with Adam; and thus claim relationship with the greatest men and women, dead or alive. Now to business. As you say you wish there were more designs of fretwork (although I am sure those given are numerous), I intend this article to be fret-cut. Now, it requires very little intelligence to see that salt would hardly contain itself within merely fret-cut boards; so (one way) rebate your side boards to a certain depth, leaving a narrow margin all round, and into this rebate sink your fretwork. A bottom board will complete the salt-box. The spoon-box will consist of four narrow boards, treated similarly

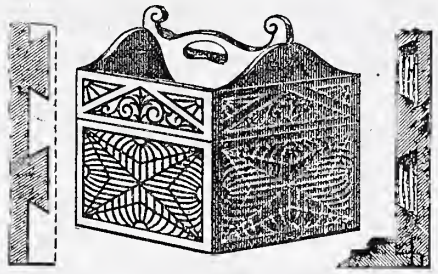


Fig. 4. Fig. 1. Fig. 5.

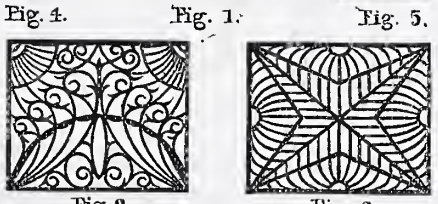


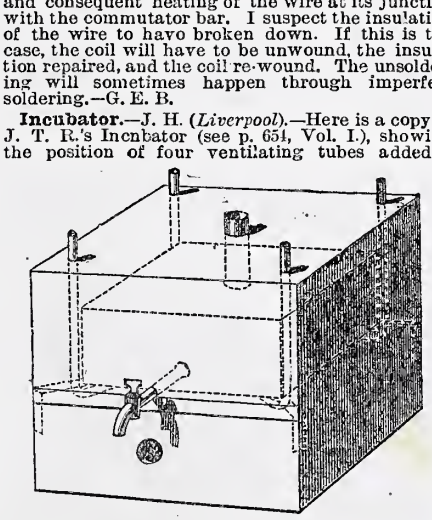
Fig. 2. Fig. 3.

**Fig. 1.—Spoon- and Salt-Box. Figs. 2 and 3.—Designs of Fretwork for Box. Figs. 4 and 5.—Method of Dovetailing.**

to those of the salt-box, and a bottom board, with a division across the middle, shaped to serve as a handle. The spoon-box will be hinged on one side to the salt box, both being secured by a lock or a hook. If you wish for a strong box, dovetail sides together, as in Figs. 4 and 5, and join bottom board, as in Fig. 5. Concerning sizes I can say nothing, as I know not whether you wish to stock sufficient salt for a day or a year. I have given you two or three designs for fretwork, but I make no pretence of their being anything nice, as other pencils can manipulate this branch of art better than mine can. If either suit you, however, and you wish to enlarge them, as you have all the past numbers of WORK, you will find how to do so by reading the Music-Stand articles by O. B. and myself. I cannot reply definitely to your other question, but must advise you, as I have just advised another correspondent on another subject—be patient.—J. S.

**Unsoldering of Dynamo Wires.**—DYNAMO.—If the wire becomes unsoldered from the segment of the commutator only, there is some fault in that coil which leads to an excess of current through it, and consequent heating of the wire at its junction with the commutator bar. I suspect the insulation of the wire to have broken down. If this is the case, the coil will have to be unwound, the insulation repaired, and the coil re-wound. The unsoldering will sometimes happen through imperfect soldering.—G. E. B.

**Incubator.**—J. H. (*Liverpool*).—Here is a copy of J. T. R.'s Incubator (see p. 651, Vol. I.), showing the position of four ventilating tubes added.—



**Incubator.**

B. A. B.

**Wood-Block Surface.**—ENGRAVER.—The finely polished surface must be removed by the application of Bath-brick, finely powdered and well wetted. This should be vigorously rubbed over the block until the shiny appearance is got rid of. Then clean the surface, and apply, as evenly as possible, with a broad sable brush, a thin wash of white—at first it will be found difficult to apply the paint equally and evenly, but practice will soon obviate this. It may be necessary to pass the now empty brush two or three times over the block, in alternate directions, to distribute the white more equally.—W.

**Book on Electric Lights and Electric Bells.**—IGNORAMUS.—I do not know where you can get a cheap book, combining information on "electric lights, electric bells, and the fitting up of the same, and explaining the meaning of the technical terms, ohms, volts, watts, ampères, etc." The cheapest source of information on these subjects is this little paper, which you can get for one penny per week. In Nos. 12, 18, 20, 27, 31, and 33, you will find information on electric bells; in Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104, you will find information on electric lights. The meaning of technical terms has been given several times in "Shop."—G. E. B.

**Unbrazing.**—T. B. (*Islington*).—It is impracticable to unbraze many articles, as it would certainly spoil them; but you can manage it in the case you mention. You must heat the handle to the melting point of the spelter again, assisting it with a little powdered borax. You can then take it apart. If it is pinned or riveted in any way, the pins or rivets must be drilled or punched out first. The brazing in of a new handle is not a very difficult matter. Get the socket and the handle perfectly bright and clean before attempting to braze, and you will be sure to succeed; especially if you will take the trouble to refer to the indices of Vols. I. and II. of WORK, where you will find that there has been considerable information given on brazing both by myself and others.—R. A.

**Drawing.**—P. B. (*London, S.W.*).—I do not know of the existence of classes held specially in mediæval ironwork; but if you master freehand, you can easily practise the drawing of ironwork. "Metal Work and Its Artistic Design," by M. Digby Wyatt, is a good book, published by Day & Son, Lincoln's Inn Fields. You can go to South Kensington and draw from actual work, of which there are some very fine specimens, both ancient and modern, in the Wrought Iron Gallery.—J.

**Conical Bellows.**—R. K. B. (*Woolwich*).—It is not an unknown occurrence for incompetent workmen to find fault with their tools. We cannot be expected to supply brains as well as information. In all cases of merely written directions, much is, perforce, left to the ingenuity of the workman. Those alluded to have been successfully carried out by some of our readers, who were, possibly, more apt workmen than R. K. B. It would occur to most people of average intelligence, before cutting up valuable material, to make a rough pattern in paper in order to practise the folding and the pinching up of the corners, which certainly require a little knack; and which experiments—tried on the leather, etc.—would, in all probability, spoil it. Better try again.—D.

**Instantaneous Camera.**—G. B. (*Stoke*).—If you refer to back numbers of WORK, you will find information that may be of use. A camera of the kind you require can be purchased at such a low price (21s.), that, considering the probable result, it is almost better to purchase one, with lens, shutter, and all complete, than make one yourself. All of our well-known opticians supply lenses suitable for these cameras; and as to dry plates, any photographic material dealer can supply you; also, many chemists and druggists stock them.—D.

**Cold Brazing.**—G. A. M. (*Chorley*).—I have never tried to braze a band saw cold, having but little faith in cold brazing, therefore I cannot say whether it would answer, but am of opinion it will not, the strain being so great, and so much bending and straightening of the saw; but will give you receipt for making cold brazing, etc., so that you may try for yourself. Mix in a lead bottle 1 oz. of fluoric acid and 1 oz. of oxy-muriatic acid. See that the parts to be brazed are perfectly clean and free from grease or oil, and put a chalk mark on each size of braze. The above mixture will keep good in the bottle about six months. If any reader who has had experience in cold brazing will write briefly on the subject, I have no doubt but that the Editor will gladly insert it in the "Shop" corner—stating what he thinks is the best way to proceed, and with what success he has met. Such information may benefit more than one of his fellow-readers. I might add that I am of opinion that there is no simpler method of brazing band saws than with bright, hot and black, or dull red-hot, tongs, as described in back numbers, and feel confident no stronger braze can be made in a band saw.—A. R.

**Toy Manufacturer.**—GAMESTER.—For any new toy, you cannot do better than consult Jacques and Son, Hatton Garden, London, E.C.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Opal Glass Letters.**—RUBRIC writes:—"Would any reader do me the kindness of supplying the information how the above are cut out? Some say they are not cut out at all, as appeared some time ago in your paper. Others say they are cut out by emery powder and iron wheels. As there seems

to be such various opinions, any reliable authority would be gladly welcomed."

**Ventr loquism.**—DOWLAIS will be glad to know of a good, cheap book on Ventriloquism.

**Wooden Monogram.**—MUGGINS writes:—"Will any wood-worker show me how to put the initials E. M. C. on a box?"

**Panel Gauge.**—APPRENTICE writes:—"Will any reader oblige by letting me have, through 'Shop,' a drawing and size of a handy and also a nice-looking panel-gauge?"

**Pottery and Porcelain.**—T. H. L. (*Dublin*) writes:—"Will any reader inform me what are the best books pointing out general characteristics of the various kinds of china, etc., such as Oriental, Dresden, Spode, Crown Derby, Wedgwood, Worcester, and showing marks and stamps which distinguish same?"

**French Medal Glue.**—CONSTANT READER writes:—"Will any reader of WORK kindly inform me as to the best methods of: (1) Preparing French glue to use for gluing wood together. (2) Keeping a quantity ready for immediate use where about 28 lbs. are used per day. (3) Also, does glue lose any of its intrinsic qualities by being kept boiling hour after hour?"

**Magic-Lantern Oil.**—J. D. (*North Wales*) writes:—"Will any reader of WORK tell me the name of the best paraffin oil suitable for magic-lantern use, or if, by the addition of any chemical, a most brilliant light may be had? I should also like to know if there is any other oil better than paraffin for same use."

**Gilt Frames.**—EDWARD writes:—"I shall be glad of views as to the best thing for cleaning gilt frames that are slightly soiled."

**Saw-Hammering.**—J. S. (*Keighley*) writes:—"Will any reader say which is the proper pattern for an anvil for saw-hammering? Should the face be perfectly flat or round? Also as to gulleting saws: which is the best method, using emery wheels or stones, or the fly-press, for punching-out? Give advantages of each system."

**Launch Screw.**—W. L. H. (*Swindon*) writes:—"Will some kind reader answer the following questions in 'Shop?': (1) What is the best size for a screw to drive a small launch at a maximum speed with economy (launch, 22 ft. long and 45 ft. beam)? I should like to know the width and breadth of blades for three-bladed and two-bladed propeller. (2) Where is the best place to buy a small injector, and probable cost thereof, for a 2-horse power vertical boiler?"

**Sledge.**—W. B. S. (*London, N.W.*) writes:—"Will any reader please tell me how to make a sledge?"

**Perfumery.**—A. H. K. (*Pendleton*) writes:—"I should be glad if any reader could tell me through 'Shop' whether there is a practical book on perfumery, and where obtainable."

**Mandoline.**—H. D. (*London, S.W.*) writes:—"I wish to know whether any of your readers could send me a complete sketch and description for making a canoe- or pear-shaped mandoline."

**Open Sailing Boat.**—G. A. (*Hornsey, N.*) writes:—"Will anyone tell me the proper proportions for a 19-ft. boat—that is to say, the width at the widest part, the depth at the stern, midships, and the stem? I propose to make the skin of pitch pine; the stem, transom timbers, and keel, of American oak. Can I do better?"

**Fire Engine.**—W. L. (*Dalston*).—If you want to know how to load the L'Extineteur Fire Engine No. 4, you cannot do better than write to W. B. Dicks & Co., London, S.E.

**Water Motor.**—WATER MOTOR writes:—"Not having seen anything of the sort in the pages of WORK, I should be greatly obliged if any correspondent would tell me through 'Shop' the particulars and dimensions of a water motor to be driven by water from town main to give about ¼-horse power—to use as little water as possible. There is a good pressure of water from main, and I want to drive a small 50 c.-p. dynamo."

**Bar Bullion.**—G. C. (*Brighton*) writes:—"Can any reader kindly inform me where the 'bullion dealers' buy their silver, or where it can be bought, in bar, at the quoted market price? It is of no use going to the bullion dealers themselves, as, of course, they must have a profit. Is there not a bullion office at the Bank of England?"

**Glass Painting.**—J. A. B. (*Camberwell*) writes: "I wish to ask any experienced reader who understands glass painting which are the principal transparent colours connected with this art."

**Illuminating.**—G. S. (*Gateshead on-Tyne*) writes:—"I have lately been attempting some illuminating of letters, but have not been very successful—especially with my monograms. Would it be asking too much of any reader to give me a monogram for illumination of the letters E, H, S? I got a very good E in one of the back numbers of WORK, but I have not made E, H, S, to my satisfaction."

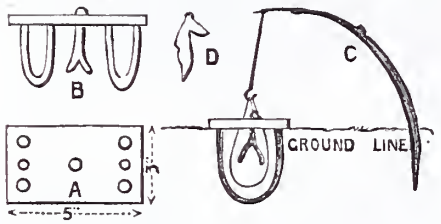
**Vacuum Pans.**—VACUUM PAN writes:—"Will any so well-informed give me the names of any good English works on Vacuum Pans, and their usage?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Inlaying.**—C. W. S. (*Sydenham*) writes, in reply to A. E. (*Wandsworth*) (see p. 446, No. 132):—"If A. E., or any other reader of WORK, will call at 33, Stanton Square, Lower Sydenham, I shall be pleased to show him my method of inlaying, with specimens of materials used. Call before twelve noon."

**Paraffin Barrels.**—J. M. C. & Co. (*Nottingham*) write:—"In reply to PARAFFIN (see p. 526, No. 137), *re* 'Measurement of Paraffin Barrels,' the gross weight is taken, the tare of the cask deducted, and the remainder divided by 8, shows the number of gallons—as, for example, 3 cwt. 2 qrs. 26 lbs. gross; 2 qrs. 21 lbs. tare. Now the gross weight equals 418 lbs. Deducting the tare, 77 lbs., from 418 lbs. leaves 341 lbs. This divided by 8 (the number of lbs. in a gallon) gives 42 gallons and 5 pints. The mark, '120 test,' refers simply to the flashing point of the oil, which may be subjected to 120 degrees of heat before it will take fire, and is the degree of safety prescribed by Parliament. Any oil firing at a lower temperature would not be passed as 'paraffin,' but would come under the term 'explosive,' and be classed with benzoline and such inflammable substances."

**Wooden Mole Traps.**—E. R. D. (*Sherborne*) sends the following method of making mole traps in reply to J. J. (*Cumberland*) (see p. 492, No. 135):—"Cut out as many pieces of wood, ½ in. thick, with eireular saw as at A; bore five ½-in. holes with drill in the lathe, and two ½ in. holes for the wire; drive




Wooden Mole Trap.

in a wooden staple at each end, made of green hazel or other suitable wood, split flat side inwards; fit a Y piece at B for the mole to push out with his nose, which lets the end of a piece of string attached to the spring stick, C, fly up, and draws the two fine wires tight, and the mole dies. Two hook sticks, D, should be placed on each side to hold the trap down in the tunnel."

**Screwing Tackle.**—T. B. B., JR. (*Manchester*) writes:—"In reply to the letters of AN ADMIRER, T. S., and other correspondents, I may say that the article in question on 'Taps and Reamers' was intended as the first of a series on screwing tackle generally. Failing health, however, prevented me from continuing them; but I will resume them as soon as possible. I think if T. S. examines his screw-plate closely he will find that the thread on one side has been reduced by slightly enlarging the hole. This side is the proper one with which to start cutting a thread. The threads, too, at all events in the larger sizes, are backed off for clearance, so that they will only cut one way. This will settle which is the starting side of the plate. I cannot tell what all the holes in his screw plate are for without having seen it. Probably there are two holes for the smaller sizes and three for the larger. One hole of each size will cut a full thread. The other hole or holes of each set may have been enlarged, so that they do not cut the full depth, and so are easier to start, and are not so liable to twist the pin, being screwed. Some of the remaining holes may be duplicates of the commoner sizes. I cannot say exactly, but I have made them that way. As for his difficulty in tapping shallow holes (or rather, comparatively shallow), I know it is rather awkward; but if the taper tap will not start the thread, the second one (on which the thread is only backed off a little) should do so. The holes, too, may be opened out a little at the top, unless it is necessary for the thread to come to the top. This would materially assist the starting of the tap."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. E. W. (*Wolverhampton*); L. J. G. (*London, W.C.*); A ZINCWORKER; JACK FROST; T. F. (*London, S.W.*); AMATEUR; W. J. (*Newcastle-on-Tyne*); LLEWELLYN; W. L. (*Wolverhampton*); DULCIMER; C. F. C. (*Oldham*); J. M. (*Derby*); T. R. B. (*Newcastle-on-Tyne*); E. C. S. (*Bickington*); A. C. R. (*Cardiff*); G. A. S. (*Edinburgh*); S. W. N. (*Lonsfield*); A SUBSCRIBER; S. C. W. (*Bristol*); CAB; ANXIOUS ENQUIRER; W. P. (*Dundee*); M. S. (*Bristol*); B. A. (*Scarborough*); G. T. (*Hollinwood*); E. F. B. (*Liverpool*); APPRENTICED LOCKER; T. P. (*St. Leonard's*); G. A. W. (*Holloway*); R. Y. (*Burdett Road*); D. M. S. (*Glasgow*); J. L. (*Wimborne*); H. B. (*Brunscliffe*); F. M. (*Preston*); FRETWORK; B. H. H. (*New Cross*); A. B. (*Salford*); H. R. (*Blackpool*); MRS. S.; H. B. H. (*Leicester*); A. S. (*Lavender Hill*); E. R. S. (*Gloucester*); M. (*Malta*); E. S. (*South Norwood*); AMATEUR; A. P. (*Shepherd's Bush*); A. B. (*Aberdeen*); E. F. B. (*Whitehaven*); G. C. H. (*New Kent Road*); J. T. P. (*Bow*); J. W. (*London*); G. H. A. (*London, S.W.*); J. B. T. (*Manchester*); INDIA-RUBBER; B. B. (*No Address*); J. R. H. (*Oldham*); RUFUS; A CONSTANT READER; SPIRAL; A. B. (*Glasgow*); APPRENTICE WHITESMITH; FRISKY; J. G. (*Glasgow*); F. G. (*Plymouth*); W. H. B. (*Southsea*); G. G. (*Deptford*); W. D. (*Lynthwaite*); R. J. B. (*Whitby*); DOUBTFUL; W. H. (*Bromwich*); A. M. M. (*Salisbury*); E. W. (*Cupar, Fife*); A. W. (*Caterham*); J. J. K. (*Manchester*); G. N. (*Acton*); G. R. (*Camberwell*); S. B. (*Chelmsford*); A. H. (*Woolwich*); M. T. (*London, W.C.*); F. W. G. (*Glasgow*); F. B. (*Staffordshire*); E. S. (*Upper Clapham*); J. D. (*Glasgow*); R. H. E. (*Blackburn*); WOODPECKER; J. P. (*Sheffield*); R. M. (*Chingford*).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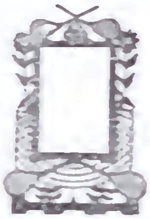

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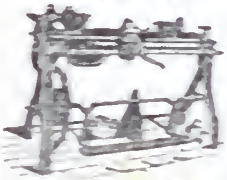

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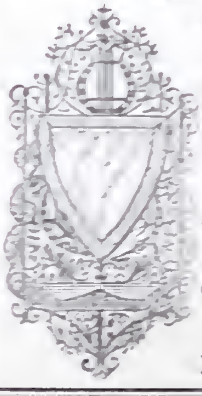

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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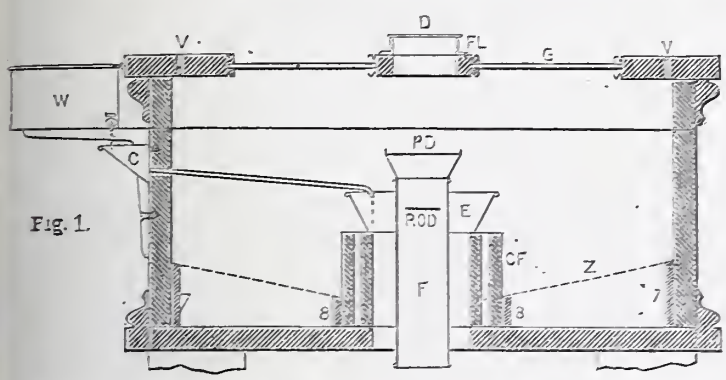



Fig. 1.

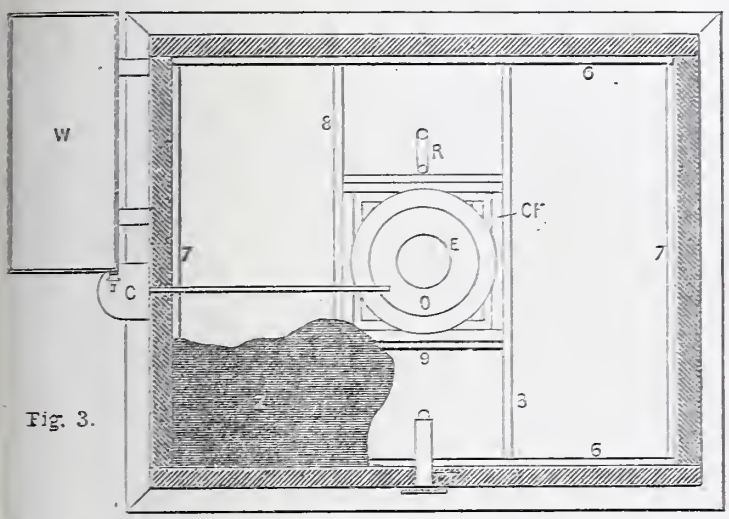



Fig. 3.

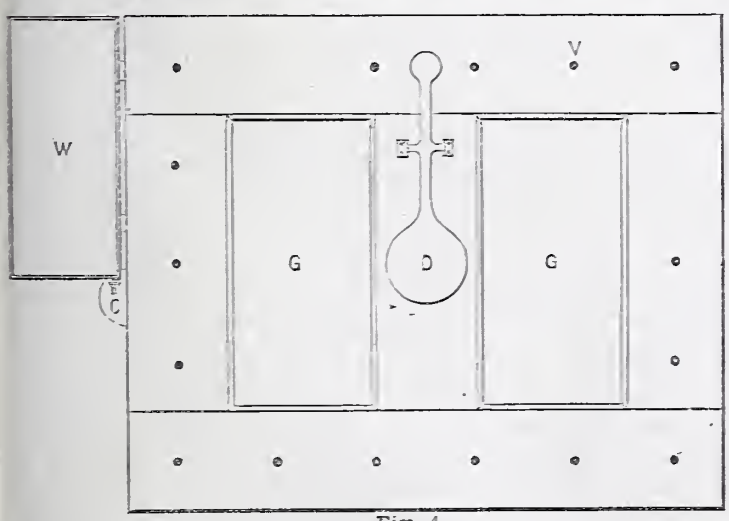



Fig. 4.

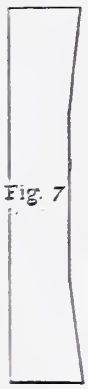


Fig. 7

Fig. 8.



Fig. 9.

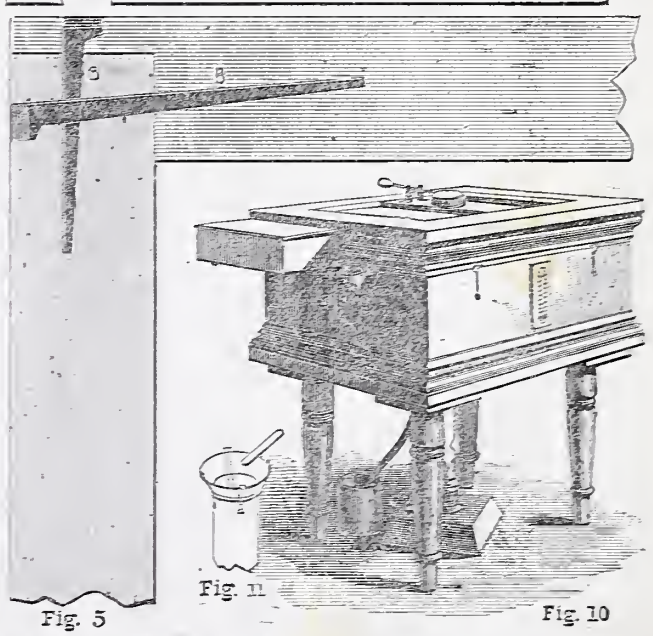



Fig. 5

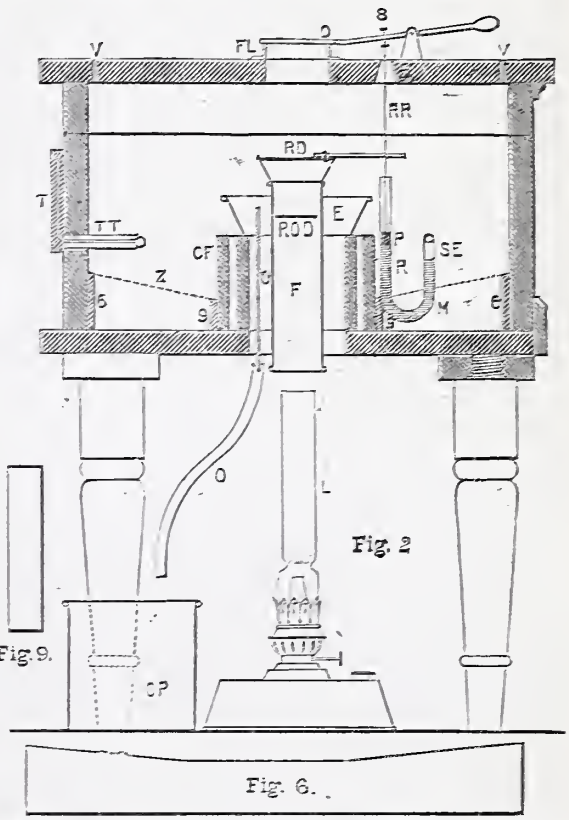



Fig. 2

Fig. 6.



Fig. 11

Fig. 10

AN ATMOSPHERIC INCUBATOR: HOW TO MAKE AND WORK IT.

Fig. 1.—Longitudinal Section. Fig. 2.—Cross Section. Fig. 3.—Plan. Fig. 4.—Plan of Top. Fig. 5.—Alternative Method of Jointing Corners. Figs. 6, 7, 8, 9.—Fillets for Egg Trays. Fig. 10.—Machine complete, from Photograph. Fig. 11.—Top of Lamp Flue, with Tripod and Regulator Rod Guide. Scale, 2 in. to 1 ft., except Figs. 5, 10, and 11.

## AN ATMOSPHERIC INCUBATOR: HOW TO MAKE AND WORK IT.

BY LEGHORN.

INTRODUCTION — GENERAL PRINCIPLES — ADVANTAGES — CASE — FITTINGS — REGULATOR — LAMP — WORKING — CONCLUSION.

*Introduction.*—My object in writing this paper (in fulfilment of my promise in No. 99, Vol. II., to describe a simple and reliable atmospheric incubator) is to help those who help themselves.

The ancient Egyptians, we are told, hatched chickens artificially, so that we may presume incubating machinery is no new thing; but the varying success following its use, together with its somewhat prohibitive price, has not had the effect of bringing the artificial method into general use until quite recently. Since, however, the introduction of the "hot-air" variety, an impetus has been given to poultry raising generally, and machines are now to be had, the results from which make "poor Biddy" take quite a back seat.

Whatever your object in poultry keeping—eggs or table birds—the grand secret of success is to hatch your chickens at the right time, so as to ensure a steady and constant supply all the year round. Those who keep only non-sitting varieties or, having limited accommodation, can keep but few birds, generally have a difficulty in finding a hen willing to undertake maternal duties in the early months of the year—a necessity if winter eggs are wished for—so that, for raising early chicks and ducks for laying purposes, the show pen, or for market, the possession of a reliable incubator must necessarily prove a great boon. Now a good machine with a pedigree costs money, and the average amateur poultry keeper, as well as some of his professional brethren, does not care to lay out much money in the purchase of such, and consequently gets only late-hatched birds, which do not make the return they should. "Poultry don't pay," used to be, and still is with some, a familiar croak; but I am glad to say we are beginning to find out that poultry *does* pay, and pay well, IF—put this in big type, please, Mr. Printer—they have proper attention; in fact, no stock pays better if *intelligently* managed.

In this paper it is my intention to place within the reach of all who possess but a small amount of mechanical skill the outcome of a long period of study of the principles and practice of artificial incubation. From the amount of correspondence I have received, I feel sure the subject will be a pleasing one to many readers of WORK, and if I can help any lame dog over a stile I shall not have put pen to paper in vain.

I purpose giving instructions for a machine nicely made and properly fitted—my motto always being, "What is worth doing at all is worth doing well;" but, of course, details of finish and materials must be left entirely to the individual worker.

*General Principles.*—Josh Billings says: "The principal bizzness for an abel-boddyed hen iz tew lay eggs, and when she haz laid thirty-six ov them, then she iz ordained tew set still on them until they are born; this iz the way young hens fust see life."

This is evidently something of it, but we must look a little farther into the subject. Let us for a moment inquire into the principles of incubation. At first sight it would seem that all a hen does to the eggs is to keep them warm during a certain period. However, this is not all. In the natural order of things, the bird would make her nest on the ground, and the heat of her body would draw moisture from it; also, during her morning ramble, her breast feathers would get saturated with dew, thus providing more moisture: and as a hen selecting her own nest thus, rarely fails to bring off a chick for every egg, it follows that moisture plays a very important part in the process of incubation, natural or artificial. In building a machine to discharge these functions, the nearer we copy nature the better results we may expect. We need, therefore, to have the bottom of our machine in the form of a nest—the reason for this will be seen later on—and to supply a moist heat centrally and from *above* the eggs, kept as near the natural heat of a hen's body as possible.

The simplest method of supplying the necessary heat is by means of a lamp placed under the centre of machine. The heat arising from the combustion of the oil enters the machine by a suitable flue, and is radiated all over the hatching chamber, in its course passing over a tray of water, for which hot air has a great affinity, and finally escaping by a series of holes in the lid. Thus we have a continual flow of hot, moist, fresh air. "But," I hear someone say, "won't the fumes from the lamps kill the germ of the chick?" I answer, "No; if the lamp is kept burning properly, with the wick regularly trimmed, there should be no smell whatever, burning even the cheapest oil, which, however, I do not recommend."

In this variable climate of ours, it is impossible to keep a constant temperature in the egg chamber without some automatic means of regulation, the heat inside fluctuating according to the temperature of the atmosphere. We need, therefore, to arrange for a larger supply than necessary, letting off the surplus heat by a suitably arranged valve, actuated by a sensitive regulator. As the heat, in the course of its passage through the machine, will naturally lose some of its intensity, we need to arrange that the outer layers of eggs are higher in the hatching chamber than those nearest the centre. This is accomplished by means of the dished bottom previously mentioned. This also serves another purpose. If you watch a hen after returning to her nest from her daily feed, etc., you will notice that she is very busy for a few minutes, turning her eggs over and altering their relative positions. The dished bottom enables this to be done easily, for, by simply taking the layer nearest the centre of the machine and placing them at the edge of the nest or egg-tray, the others will naturally roll into their places. The reason for this changing will be discussed later on, when we come to the working. We need also to follow nature by allowing the eggs a periodical airing, which they would naturally get during the hen's daily absence.

Having now discussed the principles of incubation, we will just summarise a few of the advantages, and then proceed to the construction of the machine.

*Advantages.* — The advantages of the machine to be described may be estimated thus: Its portability, no cumbersome and leaky hot-water tank, no heavy egg-drawer with consequent loss by concussion and breakage; it can be started in five minutes after the regulator has once been adjusted; it keeps a perfectly even temperature; the consumption of fuel is small—less than half what a hot-water machine of same capacity would require; and with proper attention—all other things being equal—it will hatch every fertile egg. I hope the work of construction and the after operations may be the source of much pleasure to such of our readers who keep poultry for pleasure, prizes, or profit.

*Construction: The Case.*—On reference to the diagrams on the front page of this number, it will be seen that the apparatus consists essentially of a box with a hinged lid, standing on four legs. Fig. 10 gives a view of the finished machine (from a photograph); Fig. 2, a complete cross section—that is, as if the machine were cut in halves through the centre from back to front; whilst Fig. 1 gives a section of the upper portion only, cut lengthways.

For this incubator, thirty-six egg size, we shall want a box 17 in. long, 14 in. wide, and 9 in. deep, all outside measurements. The wood may be pine, deal, or any harder wood the fancy of the maker may direct; but whatever is used, it *must* be dry and well seasoned, or it will probably shrink and crack under the heat to which it will be subjected. For this reason it will be advisable to select one of the softer woods as being more likely to be well seasoned. The material forming the sides and lid should not be less than $\frac{3}{4}$ in. in thickness, whilst that for the bottom may be $\frac{1}{2}$ in. It would be well, perhaps, if I give here a list of wood required. For the front and back we shall require two pieces 17 in., and for the ends, two pieces 14 in. long by $7\frac{1}{2}$ in. wide; for the bottom, one piece 17 in. by 14 in.; for the top (if framed), two pieces $18\frac{1}{2}$ in., and two pieces $15\frac{1}{2}$ in. long by $3\frac{1}{2}$ in. wide. For the centre frames, one piece 31 in. by 3 in.; for the fillets, one piece $25\frac{1}{2}$ in. by $2\frac{1}{4}$ in.; for the legs, 4 ft. of $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in.; and for the leg blocks, a piece of, say, oak or mahogany, 6 in. by 6 in. These are neat, finished sizes, so, to allow for a little waste, we had better procure, say, 12 ft. of 8 in. or 9 in. by 1 in. (Inch boards really only hold about $\frac{7}{8}$ in. thick, so by the time both sides are planed it will be about the right thickness.) Also get, say, 4 ft. of 7 in. by $\frac{5}{8}$ in., 4 ft. of $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in., and the piece of hard wood $6\frac{1}{2}$ in. by $6\frac{1}{2}$ in. Having procured these, planed and cut them to size, we will now proceed to the joining. The sides should preferably be dovetailed (for description of various dovetail joints, see an article by Fred. Crocker in page 389, Vol. III., or No. 129), but may be merely butted and nailed, or jointed and cross-nailed, as shown in Fig. 5. This makes a fairly strong joint, and the rebates in back and front may be cut with a tenon saw and wide chisel, or a rebate plane will make matters true and square. If, however, nice work is aimed at, dovetailing is by far the best method of jointing, and, if my readers are not carpenters enough to do it themselves, a few shillings expended in getting it done will not be wasted. The sides having been joined, we will now fit the bottom, which should not be permanently secured until the centre frames are fixed (see *Fittings*). Before fixing the bottom, cut a 3 in. square hole exactly in the centre. This is for the lamp flue. Now with a gauge or pencil correctly mark a line all round the box, $1\frac{3}{4}$ in. from the top. The lid now demands our attention. As will be seen from the plan (Fig. 4) and sections (Figs. 1 and 2), it consists of a frame with a centre rail, and contains two glass panels (G). These are very useful, especially during hatching time, to see how matters are progressing without opening the lid. This glass should not be less in substance than what is known in the trade as 32 oz. sheet or pieces of plate glass, which

is about ¼ in. thick, would be still better. The frame should be mortised and tenoned to make a nice strong job, but a simpler plan, though not nearly so good, would be to halve the joints and secure them with brass screws from the under side. It may, of course, be solid, but, if this plan is adopted, it should have a lining of felt and sheet zinc, or it would, in all probability, crack with the heat. The top now being ready, nail it to the sides of the box, and fixing the case, if possible, in the vice of a carpenter's bench, proceed to divide the lid from the body by sawing round the line previously marked. Now take out the saw marks with a smoothing plane, and hang the lid with a pair of 1¼ in. or 1½ in. brass butt hinges, using brass screws (iron would rust).

Now mitre a 2 in. architrave moulding round the bottom, and a 1¼ in. panel moulding of similar section round the lid under the projecting top, or a plain plinth may be affixed to the bottom and a small hollow run round the top, as shown on the right-hand side of Fig. 2, or the top and bottom may be rounded off or left square, as on left-hand side of same figure. In this latter case the bottom should project ¾ in. over the sides instead of being flush, as previously described. Before fixing the top, a hole 2 in. in diameter should be cut in centre of middle rail (see D, Fig. 4, also sections), and round the framing of lid a series of ⅜ in. holes (V) equidistant from each other, and midway between the edge and the glass, should be bored with a centre-bit—boring from both sides in order to cut the holes clean. These are for ventilation. Now procure two squares of glass 9¼ in. by 4¾ in., and fix in place with small beads secured with needle-points or fine brads. Now, having prepared your blocks of hard wood, take them, with the four pieces for the legs, to a wood-turner, and get him to turn the legs to pattern, and cut a thread on the top stud and a corresponding thread to fit in the blocks. This will cost about 1s. or 1s. 6d., according to the conscience of the turner. Now fix the blocks in position as shown, screw in the legs, punch in all nail heads, stop the holes with putty, and give all a good glass-papering. It can now be painted or stained and varnished to taste, when it will be quite an ornament in any room of the house. A pair of brass side hooks fixed to the front for fastenings completes the case, and we will now proceed to the fitting up.

*Fittings.*—On reference to the sectional drawings (Figs. 1 and 2), also to plan (Fig. 3), there will be noticed an arrangement of double frames (C F) fixed in the centre of the machine, to which is affixed the lamp flue and evaporating tray. To be more explicit, the arrangement consists of two lidless and bottomless boxes made of ⅜ in. wood, 3 in. high, the outer one 5 in. square, and the inner one 3¾ in. square—both outside measurements. The smaller of the two is fixed, by means of fine brass screws, exactly over the square hole in the centre of the bottom; the larger one is fixed outside the other, leaving a ¼ in. air space all round. The object of this is to prevent the heat from striking through direct to the eggs nearest the centre of machine. These having been fixed, secure the bottom of case to the sides permanently by means of brass screws. Now take the remainder of the ⅜ in. wood, which we have already planed up, and cut to shape eight fillets, two to each pattern (see Figs. 6, 7, 8, and 9). When prepared, they are to be fixed with brass pins or brads all round the bottom of case and centre frames, and in the positions indicated by the corresponding numbers on plan (Fig. 3). These complete the wood fittings. We now require a sheet of perforated zinc a little larger than the inside measurement of the case). Cut out a portion corresponding in size to the centre frames, and then cut and shape the zinc to fit on the fillets, thereby forming the dished bottom, egg-tray, or nest (Z, Figs. 1, 2, and 3) previously mentioned. Fix this bottom down with brass escutcheon pins to the fillets, first boring the holes with a suitable bradawl, and then forcing the pins home with a piece of wood, so as to be easily withdrawn when required for cleaning purposes. Out of sheet metal—copper recommended—make the lamp flue (F) and the evaporating tray (E). Through the bottom of the latter solder a piece of small brass tube (O, Fig. 2) to act as overflow pipe. Over the bottom of this slip a piece of rubber gas tubing to convey the waste water to a suitable receptacle (O P, Fig. 2). To the top of lamp flue fix, by means of rivets, three narrow strips of copper, forming a tripod, shaped to hold the radiating disc (R D, Figs. 1, 2). In order to make this quite clear, I have, in Fig. 11, sketched the top of flue, showing tripod and disc. This disc should be made of a piece of stout steel metal, and have affixed to it tightly by a single rivet a short arm as shown, with a small hole drilled in its extremity to serve as a guide for the regulator rod (R R), of which more anon. A second disc (R O D), but smaller, should also be provided, and hung by cross straps from the top of flue, in order to throw the heat passing upwards against the sides of evaporating tray, thus heating the water contained therein. A metal cup (C, Figs. 1, 3, and 4) must now be provided, and a piece of brass tube soldered into the bottom at the back to convey the water into the evaporating tray. These two fittings should be made of copper, and it will repay the worker in the end to have them made by a coppersmith, as there must be no soft soldering about them. They are also the parts subjected to the most wear and tear. Tinplate will not do on any account, as sooner or later it would only lead to trouble; therefore avoid it. The next fitting to claim our attention is the water tray (W). This may be made of zinc, and needs no special description beyond saying that it is a rectangular vessel, supported on two brackets of iron or wood secured to the side of case. A small brass tap, costing about 1s., should be soldered near the bottom at the right-hand side of front, and serves to regulate the supply of water dropping into cup (C).

The next item on the programme is the damper (D). This may be built up of sheet metal, but is better as a brass casting. It consists of a bent bar, say, ⅜ in. wide and ⅛ in. thick, with a circular enlargement at one end 2½ in. in diameter, and a smaller but thicker enlargement at the other. This should be hollowed out and filled with lead as required to adjust the balance, so that the widest end is just slightly the heavier of the two. A cross-bar occupies a central position in its length, the ends being reduced and filed to a knife edge. Two brackets, with a round hole in each, are fixed on either side to the top of the case, forming the fulcrum on which the knife edges work. A small flange, ½ in. deep, is now to be fixed over the circular hole in cross-rail of lid, and the damper adjusted until it covers the opening in the flange. After the regulator is fixed, carefully note where the lifting-rod (R R) engages with the bar of damper, and at this point drill a hole and fit a small milled-headed screw (S). When fitted, a small disc should be soldered to its point, in order to catch the end of the lifting-rod of the regulator. By means of this screw the final exact adjustments are to be made. A simpler arrangement, though not nearly so good, would be to make the damper lever of wood. The cross-bar could be of wood also, having a couple of needle-points driven in, one at each end, which might work in the slots of screw heads, screwed in the lid.

*Regulator.*—This, as will be seen by reference to Fig. 2, consists of a bent glass tube (R) of about ½ in. calibre, bent in the form of the letter **J**. The shorter limb is sealed over with the blowpipe, and in the sealed end, imprisoned by a column of mercury (M), is contained a volatile fluid (S E); preferably dilute sulphuric ether in the proportion of 3 parts of ether to 1 of alcohol. (N.B.—Water will not mix with ether, so do not try it). This fluid, boiling at a low temperature, gives off a vapour in proportion to the amount of heat present, and, being imprisoned, forces the mercury column round into the longer limb. This in turn engages with a small float or plunger (P) resting on its surface, carrying a rod (R R), which in its turn actuates the damper (D), impinging on the small disc at the end of adjusting screw (S), and allows a portion of the heat to escape. As the temperature falls, the damper resumes its normal position, rising and falling according to the variations in the temperature. In practice, however, it will be nearly always open, and should be adjusted so that the damper stands about ⅛ in. clear of the flange, thus allowing for decrease as well as increase of heat. Now, to get the ether and mercury into their proper positions is rather a troublesome job to the tyro, but to the initiated it is as easy as "eating pie," and is easier shown than described. However, having procured your tube, pour into it sufficient mercury to fill not quite half its length. By gently tilting the tube thus, \, force out all the air, so that the mercury entirely fills up the short arm. Now pour about three-quarters of an inch of ether on the mercury, and by gently tilting in this direction, ⌐, lodge about half the fluid above mercury at the sealed end. Ether being of lighter specific gravity than mercury, will assume the uppermost position. Bring the tube to an upright position, and with a small piece of rag or sponge soak up the surplus liquid now remaining in the open end. Slip the rod through the hole in the guide-arm attached to radiating disc, and adjust as necessary, so that the plunger slides easily and freely in the tube, and at the same time engages, when rising, with the small disc of adjusting screw. To know the exact temperature the machine is working at a thermometer will be necessary, and should have a bent tube in the form of the letter L (see T, Fig. 2), the bulb being inside on a level with the upper side of eggs, and the scale from about 90° to 120° Fahr., reading outside. To protect the thermometer it must be encased, as shown, with a piece of brass tube fixed in the front.

*Lamp.*—Now we come to the heat supply. It is not absolutely essential that a lamp should be used. Gas may be employed if more convenient, only it needs carefully watching to note when pressure in the main is increased, as it always is towards night, or you may get more heat than the regulator can master. Watch should also be kept

that the supply is not shut off for repair of mains, etc., without being noticed. If a lamp is used, these precautions are unnecessary, and can, after the first day or two, be left to take care of itself for twenty-four hours at a stretch. The best form of lamp to use is one of the round burner variety, known as "kosmos," taking an inch wick. The burner and screw collar can be purchased at most respectable oil shops for about 1s., and should be fitted to a square tin reservoir as shown in Fig. 2, a screw cap being also provided for filling. If made to size, as drawn, it will hold enough oil for two days' supply in the coldest weather.

All the sketches—with the exception of Figs. 5, 10, and 11—are drawn to a scale of 2 in. to the foot, or one-sixth full size, so that if any measurement is multiplied by 6, the exact size will be obtained.

*Working.*—We will now suppose the machine finished, and ready for a trial run. It will be well to run it empty for a few days in order to understand its working and to get the temperature set and regulator adjusted. The machine should stand, if possible, in a room with a fairly even temperature (the bedroom is a capital place, if the lady members of the household do not object), out of the way of draughts, and as far from the reach of loud noises and jarrings as possible. The quieter its surroundings the better. The situation having been selected, fill the lamp with oil of good quality, costing about 1s. per gallon. Avoid cheap oil; for our purpose it will be the dearest in the end, being very deficient and variable in heating power. Trim the wick squarely with the top of the burner, light, and turn up until the flame is about level with, or but slightly above, the constriction in the chimney. Fill the water tray with tap water (warm in cold weather), and turn the tap so that it supplies a full drop per second, remembering that, as the water gets lower in the tray, the slower will it drop from the tap. A piece of muslin placed over the tray and water-cup will keep out dust, etc., which might choke the tap and pipes. Take out the regulator rod, and watch the thermometer until it registers from 104° to 106°. Now note the position of the mercury column in the regulator tube, and cut the rod to its approximate proper length, insert in place, and make final adjustments with adjusting screw (s). As regards the proper heat to work the machine at, a little difference of opinion exists, but it is pretty generally conceded that it lays between 104° and 106°. I have had good results with the latter, but if eggs at various stages of incubation are in the machine together, the former figures will be preferable. Having mastered the details of working, *and not before*, place a few ordinary eggs in the machine, and proceed to business.

One word of caution: Do not put a batch of valuable eggs in for the trial run, as incubators, like everything else, want understanding before the best results can be obtained, and it is considerably within the range of possibilities that the first lot may not prove an unqualified success, although the experience gained should stand you in good stead. Josh Billings says, "The hen is a darn phool;" but this remark does not apply to this "tin hen," as incubators have been called, and any failure should not be rashly laid to its account. The eggs being in, and all working satisfactorily, we shall need to trim the lamp once every twelve hours by carefully removing the charred portion of the wick with a duster, also replenish oil and water as may be necessary. Once a day, morning preferably (when the lamp is trimmed will be a seasonable time), open the lid of machine for a short time according to the state of the weather—say fifteen minutes in cold weather, and twenty in warm—to give the eggs an airing; and also turn them and alter their position as before described. The reason for this is that the germ always floats on the top of the egg, and if kept in one position would probably stick to the shell, and thus cause the death of the embryo chick. No notice need be taken of the temperature in the egg-chamber for an hour after the daily airing, after which time, with the lamp burning properly, it should have resumed its normal temperature. Provided the eggs were fresh—and I may as well say here they *must* be as fresh as possible (if taken direct from the nest to the machine, all the better), as stale eggs cannot but produce unsatisfactory results — we may, towards the end of the twentieth day, look for signs of the eggs chipping, and may possibly hear the chirp of the chicks some hours before the shells are "starred." Avoid opening the lid of machine at all times, any more than is necessary, and especially at hatching times. If no shells are "starred," the eggs may with advantage be placed in a basin of water heated to 100° Fahr., placing them in gently, so that they are not entirely submerged. The live chicks can now be easily distinguished by the capers they cut, the struggles of the chick trying to extricate itself giving the motion. After a few minutes' soaking—being careful not to chill the eggs—replace them, *without wiping*, in the machine, and await developments. Help at hatching time should not be too freely rendered; but, if a shell has been chipped for twenty-four hours, and the chick seems unable to kick its covering off, a little help may be beneficial. Begin at the beak, and gently remove the shell in small portions by the help of warm water, if necessary, but, should blood flow, desist at once, and replace in machine, as the blood-vessels attached to the membrane of the shell are not dried up, and the chick would probably die if removed. Our trial run having proved satisfactory, we may now proceed to business in earnest; but in order to economise space, we will examine the eggs after they have been in a few days, replacing the clear or unfertile ones with fresh. In adding fresh eggs to those in an advanced state of incubation, care must be taken that the cold eggs are not placed in contact with the warm ones. If possible, it will be advisable to thoroughly warm them through, in front of the fire or otherwise, before placing them in the machine.

*Conclusion.*—In finishing this paper, I may say it will be followed by another, in which I shall hope to make clear the testing of eggs at different stages, give instructions for making simple rearers or artificial mothers of two or three different patterns, and conclude with a few remarks on chicken rearing. I hope all who attempt to follow my instructions may be successful. I have endeavoured to make everything clear; but if not, I shall be pleased to help and advise any who may be in difficulty through "Shop." Let me impress upon each worker the necessity of quiet, regular daily attention, patience, fresh eggs, good oil, sufficient water supply, and last, but not least, cleanliness. This is ever and always an important item in the keeping and management of everything that has life, but which, unfortunately, is too often neglected.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### The Saw.

I have, in these lessons, treated on the saw used merely to divide pieces of any size into parts, but before any real progress can be made in the more advanced use of the saw, the learner must know the difference between sawing *on* a line and sawing *up to* a line. In the first case a line may be made, and the saw not only wastes the wood on which the line is drawn, but some wood on each side of the line; but in the second case the saw is to be used so that the line is just glanced by the saw, and the whole of the wood wasted by the saw-cut must be taken from the part not wanted.

In making the various joints in which sawing forms part of the operation there is, of course, waste, and if the lines are accurately drawn, as boundary lines, clearly the saw must be made to move on the waste side of the line, outside the marked boundaries, or the finished work will be too small. Nor is this an unnecessary refinement. For instance, if a tenon is to be cut, both surfaces are generally formed by the saw, and therefore if the saw is allowed to encroach upon the tenon the fit will be materially affected.

The learner must practise with the saw until it is his obedient servant, but some advice may be given tending to that result.

The hint given to keep the eye in a plane with the cut will be slightly modified in favour of any position, differing but *little* from it, in which you can see the line.

In cases where special accuracy is needed, such as cutting shoulders to tenons, a knife-cut instead of a pencil-mark is to be recommended.

In that case, using care, the actual joint is the cut-line, rather than the sawn edge. Very little reflection will convince the worker that the whole of the wood removed by the saw must be on the waste side of the line, and that the blade of the saw should move along the line in *close* contact with it.

I am aware that the word line in this connection scarcely bears its mathematical meaning, although, even in that respect, a line made with a sharp cutting edge is much nearer the ideal line than a pencil-mark.

As to the proper saws to be used for cutting the parts of joinery, there can be no hard-and-fast rules laid down. A tenon may be so large that it may be formed by cutting with the grain with the rip saw, and across the grain with a panel saw, or so small that a dovetail saw is of ample size for both purposes. Again, a dovetail may easily be large enough to warrant the use of a tenon saw, and yet not be as large as dovetails are sometimes required.

It is of importance to learn to use the saw so as to require the aid of chisels to pare the tenons, etc., as little as possible. It is far better and economical of time to cut the work properly at first than to trust to the use of chisels to reduce tenons too stout, dovetails too big, sockets too small, or mortises too narrow.

Of course, this advice is to be applied to sawing for *joinery*; in the use of the saw as an adjunct to wood carving it is a time-saving tool, and these considerations do not apply. It may be as well, however, to add that when I speak of the saw as a tool used in wood carving, it is in the production of wrought forms from the solid in cabinet making and not to wood carving in bas-relief.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### SPLICING.

SHORT SPLICE—MARLINESPIKE—PRICKER—LONG SPLICE—CUT SPLICE—EYE SPLICE—CABLE SPLICE.

SPLICING is a method of joining ropes by interweaving together the strands of which they are composed. When ropes that are required to run through blocks have to be joined it is evident that knotting them together will not serve our purpose, as the knot would prevent their passing through the block. In this case splicing is always used to unite them. The splice most generally used is the short splice.

The ends of the two ropes are unlaid for a sufficient distance; they are then placed together, as shown in Fig. 112, the strands of one rope going alternately between the strands of the other. The two ropes are then jammed closely together. The end of one rope with the strands of the other rope is now held firmly in the left hand. Sometimes a lashing is put round the strands to keep them down to the rope on which they lie. Pass the middle strand, A, over the strand of the other rope, which goes down to the left of it, which is B, then bring it under C, and haul taut. Do the same to each of the other strands in succession, putting them over the next strand to them and under the next beyond. Turn the rope round and do the same to the other set of strands; this may be repeated on both ropes. Care must be taken not to bring two strands up through one interval in the rope. Each strand should come up separately between two strands of the rope they are passed into. If it is desired to taper the splice for the purpose of making it neater after the ends have been interwoven, divide the yarns of which the strands are composed, pass one-half as before, and cut off the other half. For the purpose of bringing the rope into shape again after the splice is finished, it is usual to roll it, if the rope be large, with the foot on the deck; if small cord has been used, a piece of flat wood is substituted. As the strands of a rope are tightly twisted together it requires some force to open a passage for the parts of one rope through the other. For this purpose, in the case of large ropes, a marlinespike (Fig. 113) is used. They are made of iron, copper, and hard wood. I like copper best myself, as it does not rust like iron, or break like wood. With small stuff we use a pricker (Fig. 114), which should be made of steel. Messrs. Thomas Turner & Sons, of Sheffield, make an excellent knife, with one large blade, and a good-sized pricker; the whole is nickel-plated to avoid rust. At the end of the handle is a shackle for a lanyard. It is as useful a tool as any sea-going person could desire. For very large ropes a fid is used, which is merely a wooden pin, tapered, generally made of lignum vitæ.

*Long Splice* (Fig. 115).—This is in some respects a better splice than the short splice. Unlay the ends of two ropes for a much greater distance than for a short splice and put the ends together as before. Unlay one strand (A) for some length, and fill up the space left by its removal with the opposite strand from the other rope, as B. Do the same with two more strands (C, D), C being the one unlaid, and D the one laid up in its place. Now make an overhand knot with the two remaining strands (E and F), taking care that the ends follow the lay of the rope and not across them. Divide both strands in halves and pass one-half over the next strand, and under the following one; do this two or three times and cut all the ends off close. Work the remaining two pairs of strands the same way and the splice is finished. The rope should be well stretched before the ends of the strands are cut off.

Fig. 116 is a cut splice forming an oblong loop in the middle of a rope. It is made by splicing the end of one rope into the standing part of another, as at A, A, Fig. 117, so as to form an eye of any size you wish. The end of the other rope is then spliced into the standing part of the first rope, and the spliced parts served over. A neat way of forming an eye at the end of a rope is by unlaying the strands and placing them on the standing part so as to form an eye, then put one strand under the strand next to it, and pass the next over this strand and under the second; the last strand must go through the third strand on the other side of the rope. Taper them as before by halving the strands and sticking them again. This is called an eye splice (Fig. 118).

*Cable Splice.*—Unlay the ends of the ropes to be joined for some distance, then place them together and make a short splice, leave some length, and from thence reduce each strand to a long taper by gradually cutting away as many yarns as necessary; neatly point over the taper and lay the ends in the intervals of the rope. Clap on a seizing at each end of the splice, an end seizing at the beginning of the pointing and a stop at the end of the tails. This is the best splice for cables, as it may readily be taken asunder.

Another method of making a cable splice is to splice the ends in twice each way, then to pick out the strands, worm part of them round the cable, and taper away the rest, which should be marled close down; then clap on a throat and two end seizings of ratline.

I am now approaching the termination of the subject on which I have been writing, and in two papers more I shall bring my remarks on it to a conclusion. Readers will have noticed that it divides itself into three parts, of which the first, namely knotting, was by far the longest. Splicing, which has been dealt with here, is short, but its importance must not be underrated on that account. Working Cordage now remains for our consideration, and this, as I have said, will be comprised in two papers.

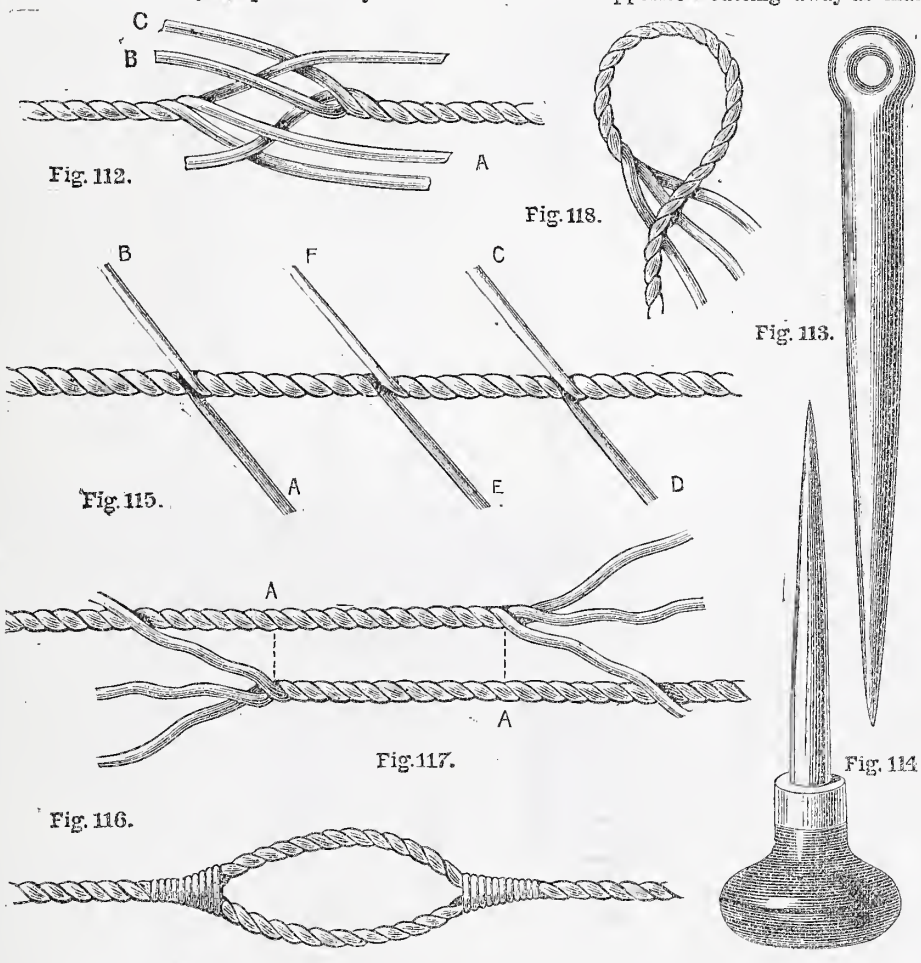



Fig. 112. Fig. 115. Fig. 117. Fig. 116.



Fig. 118.



Fig. 113. Fig. 114.

Fig. 112.—Short Splice commenced. Fig. 113.—Marlinespike. Fig. 114.—Pricker. Fig. 115.—Long Splice. Fig. 116.—Cut Splice. Fig. 117.—Cut Splice commenced. Fig. 118.—Eye Splice.

## AN ARTIST'S SKETCHING EASEL.

BY A. CONWAY.

NECESSARY FEATURES — DIMENSIONS — HINGE-BLOCK—ATTACHMENT OF LEGS—SUPPORTS FOR CANVAS—ENDS OF LEGS—FASTENING EASEL AND CANVAS—HEIGHT—UTILITY.

AN easel adapted for out-of-door use or sketching purposes differs in many respects from its counterpart of the studio. Its primary qualifications should be lightness and portability, in order that it may be easily carried even, as sometimes happens, for a considerable distance to a good "subject." The conveniences for raising and lowering the canvas, adjusting it to different angles, etc., which are found in a first-class

studio easel are not expected in it; indeed, they are not necessary, as the canvases painted out of doors are seldom of large size. Therefore all that is required in the way of adjustment can be done by simpler means than are adopted in a heavy studio easel. In addition to the essentials of portability and lightness, the sketching easel must be sufficiently rigid to bear the canvas being painted.

The easel I am about to describe is of a type which, rightly or wrongly, is generally attributed to the late David Cox, whose pictures, done direct from Nature, are in such high and increasing repute. Whether he actually invented this simple form of easel or not, there is no doubt that he used it and largely popularised it among artists; and the probability is that much of his work was done on no other. I do not think that I need say any more to show that this kind of easel is thoroughly useful and serviceable, though its popularity with artists of the present day might be adduced as an additional evidence of its utility.

Of course, I am far from saying that the construction of the one I am about to describe has not been elaborated or, if the reader likes to consider it so, even improved. A glance at those in an artists' colourman's shop will show that. At the same time, it is open to question if these alterations are always improvements. Extreme lightness may be got at the sacrifice of strength, and the other modifications may rather be regarded as luxuries than as actual necessities. However, I have not to do with the nicely finished arrangements of the artists' colourman so much as with a good, practical easel which can be made in the simplest manner with materials which can be found anywhere. The constructive work, also, is so trifling and of such an easy character that even the novice at wood-working can manage it, and in the event of his not being inclined to do it himself, the most unskilled and thickest-headed country carpenter cannot have the slightest difficulty in grasping the main features and carrying them out in a satisfactory manner. From this it will be gathered that the cost is small. As some guide to those who want to get one of these easels made, I may say that the one from which this description is taken cost me 1s. 6d. complete from the village joiner who made it for me.

By referring to the illustration (Fig. 1), it will be seen that the easel is formed of three legs, the back one being merely a support for the other two, on which the canvas rests. Now what may be called the actual making is of the very slightest, as, beyond smoothing and cleaning up the three long pieces, it consists almost entirely in the formation of the block at the top, to which they are attached. This block is shown on an enlarged scale in Fig. 2, and may as well be of some comparatively hard wood, such as beech—anything, in fact, that is harder than common pine, which, however, will do very well for the other parts, and may be used even for this one.

The dimensions of the various parts can best be regulated by individual requirements, so that I cannot say much about them, and beyond determining the substance of the three long pieces, we have little to do with them at present. I may, however, say that in the easel referred to the parts are all of 1 in. stuff. The only reason for making any remark about this now is that the size of the opening of the block may be made to correspond with the width of the top of the back leg, which is fitted within it. If it corresponds in thickness, so much the better for appearance, but not for any other reason. Let us suppose the width to be 1 in.

Hinge the end of the back leg by means of a piece of wire—a French nail will do very well—driven through as shown by dotted line in Fig. 3.

The front pieces now have to be fastened to the block, and this may be done easily by means of a screw-nail through each. The plain parts of the screw-nails will allow of the legs moving sufficiently easily on them; and to allow of the legs opening outwards, the holes should be placed near their ends, which should be rounded as in Fig. 4.

It will now be seen that the front legs can

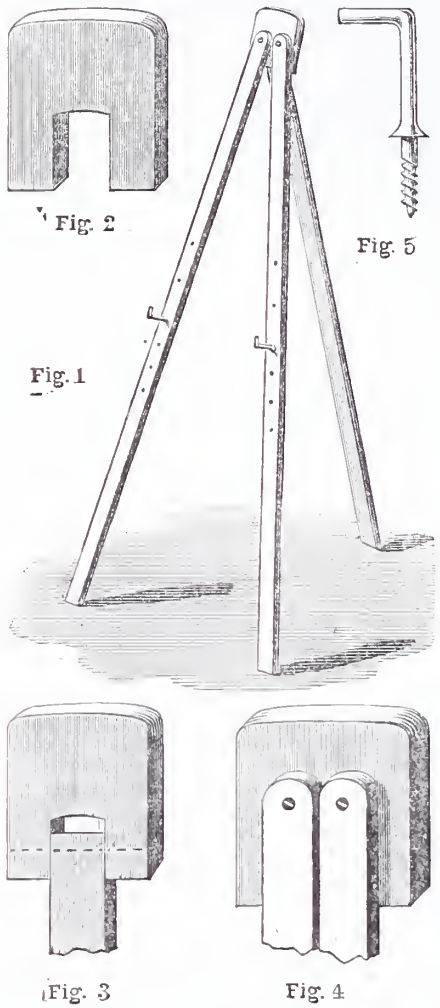



Fig. 1.—Easel. Fig. 2.—Block for Top. Fig. 3.—Back Support fastened to Top. Fig. 4.—Front Supports fastened to Block. Fig. 5.—Screw-Hook.

be spread open sideways, and that the back one will support them at any desired slope, while, when the easel is folded, they lie close together, and form as compact a bundle as possible.

To complete the easel, it is only necessary to bore holes at intervals through the two front pieces, so that pegs may be inserted in them for the canvas to rest on. For the pegs themselves almost any short pieces of stick will do. My own are nothing but bits of twig cut off with a piece of a projecting branch left on at the outer end, thus forming a kind of rough hook within which the bottom of the canvas lies, so that it is prevented from accidentally slipping off.

The ends of the legs may be left as they are, but it will be better to fix a piece of stout wire or thin iron rod into each to prevent them slipping, and to allow of their being firmly fixed. If wire is not handy, they may be simply sharpened to a point, so that when sketching in fields or on soft ground they can be driven into the earth. Of course, the points will want sharpening occasionally, as they will, under ordinary circumstances, soon get worn away. As everyone who has painted in the open air knows, it is necessary often to fasten both canvas and easel so that they may not be blown over; but novices may not quite see how it can be managed, as it may be, very easily. So far as the easel itself is concerned, there is no difficulty when the ground is sufficiently soft to allow of its points being driven in. It is not always, however, that this can be done, and then some other means must be adopted. The simplest is to fasten a piece of rope or sufficiently thick string by one end to the top block, and to the other end fasten a stone or anything else—such as a rod—that may be handy, and let it hang near the ground.

It is not, however, the easel itself which catches the wind as much as the canvas; and everyone knows how awkward it is for this, when the paint is wet, to be blown down—perhaps, in the effort to save it, right on to the palette. Various contrivances may be adopted to secure it to the easel, but it will be unnecessary to do more than suggest the simplest. One way, which will no doubt readily occur to the young artist, is to fasten a small nail or two into the top edge of the canvas stretcher. A piece of string tied there and to the easel will then make all secure.

Another and somewhat neater-looking way, but I do not think any more serviceable method, is to screw a hook into one or both of the front legs just above the top of the canvas. By slightly turning the hook, the picture may be fastened or released as occasion may require. The ordinary brass screw-hook (Fig. 5) does as well as anything for the purpose, and is easily obtainable.

A still cruder method, but one not always convenient, is to tie a piece of string over the front of the canvas and round the easel; enough has doubtless been said to show that any simple way which may be found satisfactory will do equally as well as the most complicated arrangement of clips.

Nothing has been said about the height of the easel, for naturally this must depend on circumstances. For instance, much will depend on the size of the paintings and whether the artist intends to sit or stand to his work. If he habitually sits, a much shorter one will do than for a standing position, but I may name what I consider a fair average size—viz., about 5 ft.; while for a sitter, probably 4 ft. will be found sufficient in the majority of cases. It will easily be understood that it is not advisable to have the easel too long, not so much on account of inconvenience while painting as of its being cumbersome for transport; nor, on the other hand, too short and, consequently, awkward to paint at.

For small and, consequently, light paintings, even slighter substance than 1 in. square will do very well; and those who want to make the easel still more portable than as described, can do so by cutting each leg in half and bringing the parts together by means of a screw, or other suitable tie. A piece of stout wire or French nail passed through holes will prevent the legs collapsing, and render them sufficiently rigid when the easel is in use.

Of course, it must not be understood that a more highly finished easel might not have

been described, but to have done so would have been to increase the difficulty and cost of making without in any material degree increasing what I may call its workable capacity. The maker might, for instance, have been advised to make it of mahogany, and carefully French-polish it; but *cui bono?*

I have spent many pleasant hours in company with such an easel and its accompaniments of paints, brushes, palette, canvas, etc., out of doors when sketching, and have not disdained to use it in the house. I think any readers of Work will not regret adopting the pattern if they are on the look-out for a cheap, serviceable, and handy easel, whether for in- or out-door use.

## THE WINTER CARE OF CYCLES.

BY "CYCLOPS."

At this time of the year cyclists are thinking of stowing away their machines, and it may interest many readers of Work to know that a cycle, when stored for the winter, may be doing itself as much harm, and wearing itself away almost as much, as when in active service in the rider's use. This may seem, on the face of it, ridiculous, but a closer examination of the question will show that there is more truth in the seemingly sweeping assertion just made than is at first apparent.

I say "*may* be wearing itself away" advisedly, because there are many experienced cyclists who take care to put their machines away in good condition, and thus prevent this wear.

It must not be supposed that I am in favour of thus banishing for the winter a friend who has stood us in good stead during the summer. I myself am of opinion that almost as much pleasure can be had out of the constant use of the bicycle during the winter as during the summer; and any cyclist who has sallied forth on his machine on a clear frosty day, with a good hard macadamised road under his wheels, will testify to the exhilarating effects of such exercise—an enjoyment not to be compared with that of going forth on a hot day, with the rider's temperature almost at boiling point.

There is a distinct difference between the two feelings, and I am inclined to give the preference to the winter ride. But to return to our subject: There are no doubt many riders of cycles whose interest in their machines ceases with the advent of winter, and who take up some other hobby or pastime, and leave cycles and cycling to take care of themselves until summer comes round again. To these cyclists I would say: Take care, in putting away your machines, to make them thoroughly comfortable, as a coachman would his horses after a hard day's work.

It is often the case that a cyclist, going to his machine to get it into condition for use again, is surprised to find that it is looking very bad indeed. The enamel is, perhaps, cracked in many places; there are marked signs of the plating stripping; the spokes are rusty at the points where they enter the hubs and rims; the wheels, on being turned round, are found to be very stiff, and the pedals refuse to revolve when tried. All this may be avoided by carefully observing the following directions:

On deciding to put the machine away for the season, the first thing is to thoroughly clean it in every part. First remove all the dust and dirt with a cloth and stiff brush, then thoroughly clean all the bright parts as follows: Procure some very fine flour of emery, and mix into a thick paste with common paraffin oil; with a soft cloth and a small quantity of the paste thus formed rub all the bright parts carefully over, and dry with a clean rag; then polish with a soft duster and a little dry whiting, and finally, rub all over with a soft leather. This will take all the moisture out of the plating which may have got into it by exposure to rain, etc., and help to keep it from rusting and stripping off.

The enamelled parts next require our attention. They should be rubbed all over with a cloth dipped in benzoline, and afterwards carefully polished.

The machine, unless very much used and worn, will now have the appearance, almost, of a new one, and the worker will be surprised at the effect his labours have had on his old friend.

Before proceeding further, the bearings should be thoroughly run out with paraffin oil—or, better still, this could be done before the final polishing process.

The running out of the bearings may be effected as follows:—Support the wheel so that it is free to revolve, and underneath each side of it set a can to catch the paraffin which will drop out from each side of the bearing; then open the oil-cup, fill with paraffin, and revolve the wheel.

This should be continued until the paraffin, which at first runs out thick and black, has assumed its proper density, and runs through the bearings perfectly clear. This should be done with all the wheels, bearings, and pedals, and when they are all quite clear they should be carefully oiled with best machine oil.

Here let me caution the reader against the use of common oils, which only eat into the bearings, and eventually prevent that free movement they are intended to assist. Good oil may be procured from any sewing-machine shop, and, for the trifle of extra cost, it is far and away superior.

The next consideration is the chain. This should be taken off the machine by unscrewing the movable link, and soaked in paraffin oil until all dirt and grit are thoroughly removed. It should then be dried and well black-leaded, or rubbed with one of the many chain lubricants advertised in cycling journals, and afterwards fitted on the machine again.

We must now procure some vaseline, or, as it is known in the trade, petroleum jelly. This may be got by the half-pound of any chemist, and should any be left over, it will come in useful for putting on the hands in frosty weather, to prevent them getting chapped.

But this by the way. We must now thoroughly grease the whole of the machine over with vaseline, even including the saddle, as it will keep it from becoming hard and cracking.

Our machine is now ready to put away. The vaseline will keep the plated and enamelled parts from cracking, and the new oil in the clean bearings will prevent them clogging, so that when summer comes, all we have to do is to wipe the grease from our "iron horse," oil up, and set off for a run, without all the trouble and bother of first overhauling it. "Safe bind, safe find," is advice which holds good for cycles as well as other things, as will be found by all who follow the instructions given above. If the cycle is put away clean, it will be found clean when the time comes to use it again.

## TRAMMELS: THEIR USES, AND HOW TO MAKE THEM.

BY J. H.

Their Purpose—Description of Common Form—Pattern Work—Fitting up—Wooden Trammel—Ditto—Fine Adjustment—Drawing Trammel.

*Their Purpose.*—Trammels, or beam compasses, are used for striking circles and radii larger than can be embraced by dividers and ordinary compasses. They are used by fitters, pattern-makers, boiler-makers, and draughtsmen, and are more or less slightly modified according to their special uses.

Fig. 1 shows the common form used by fitters, pattern-makers, and boiler-makers. The only essential difference that need be made in these trammels is that when used on wood the points are ground off at a more acute angle than when used for metal.

*Description of Common Form.*—In Fig. 1, A is the body of the trammel, made of brass, sliding along the beam or bar, B, and pinched in any position with the screw, C. To avoid bruising the beam, there is a thin washer, D, interposed, with shouldered ends, to prevent it from slipping out endwise when the trammel head is being slid along. The pin E is formed of a bit of steel, either screwed into the boss on the body or driven into a drilled hole.

*Pattern Work.*—To make such a trammel, a pattern like Fig. 2 is necessary, where A is the pattern itself, and B, B, prints for carrying the core for taking out the holes. Leave extra metal—say $\frac{1}{16}$ in. in diameter—upon the bosses for turning, and a very little—say $\frac{1}{64}$ in.—on the finished sizes of the hole and the outside of the body for filing. Centre the bosses very truly to scribed centre lines, and see that the prints are cut quite central also. Attention to these minute details saves a deal of after trouble in filing up.

Fig. 3 is the core-box for taking out the interior of the body. It is a perfectly plain rectangular box, put together as shown. Be precise as to thickness, for if thicker or thinner than its prints there will be unequal thicknesses of metal in top and bottom sides.

On receipt of the castings, it does not much matter whether the turning or filing is done first. But I should proceed thus:—

*Fitting up.*—Plane up a short strip of hard wood, 6 in. or 8 in. in length, very accurately to the section of the trammel rod intended to be used. Have its faces quite parallel, and its edges at right angles. This, being smeared with red lead, is the gauge to which the holes in the trammel bodies will be filed out until they will just slide over it freely—neither head fitting tighter or slacker than the other. This will give some little trouble; and it will be as well to make another gauge strip just a shade smaller than the actual templet, and fit the heads roughly over that first.

To save the trouble of filing over the entire flat surface, those who make their own trammels often core them out concave, as shown in Fig. 4. Then, only about $\frac{1}{8}$ in. or $\frac{1}{4}$ in. at each end has to be actually filed instead of the entire surface. The outside of the casting is made convex, to retain a sufficiency of metal. Then the core-box is made like Fig. 5, the box sides taking the place of the open top and bottom of Fig. 3, and the concave portions are cut in the sides.

Having the inner faces true, slide both heads upon the gauge piece, and mark the centres of all the bosses with scriber block central with the strip, and squared over at

right angles with it. The holes in the bosses can then be drilled to these centres, and the bosses turned concentric with them. Each of these operations can be performed in one of two methods. The holes can be drilled by hand, holding the heads in the vice. But as they are liable to become out of perpendicular, the better plan is to drill them in the lathe, pinching the head on an angle-plate the while, and holding the drill in the slide-rest. Or the head may be clamped on the slide-rest, and the drill run in a drill-chuck. The bosses also may be turned while the head is held in an angle-plate; or the head may be clamped between dogs; or it may be held between centres with a small carrier at one end, and pivoted on the poppet centre at the other. In either case the boss nearest the poppet will have to be turned first, and then the head reversed to bring the other boss next the poppet for turning.

The flat faces, A, A, of the heads (Fig. 1) will be also skimmed over in the lathe. A quick speed will be used, and either hand or slide-rest tools will be employed for turning the bosses and facing the ends, and a file and emery-cloth will be used for polishing. After the turning is finished, the outside faces of the heads will be filed and polished.

It gives less trouble to cast a bit of brass for the screw than to turn it down out of steel or iron. It will be turned and milled, and then screwed.

The washer, D, is made from a pattern, or filed out of a bit of solid brass. Another form of washer answering equally well is shown in Fig. 6, where the ends, instead of being turned upwards, are spread at the sides.

The pin, E, is a bit of steel, which should be turned taper for good appearance, and driven into the body.

*Wooden Trammel Head.*—A cheap wooden trammel head is shown in Fig. 7. It is turned in hard wood, box being preferable, and bonded with small brass ferrules, A, at each end. The screw, B, is made of brass or steel, and its nut, C, consists simply of a square bit of brass or steel sunk into the trammel head within the slot cut through for the trammel rod. This plate will be about $\frac{1}{8}$ in. thick, to take three or four threads, and will wear an indefinite time. The washer, D, is of the form shown in Fig. 6. Such a trammel is very easily made, and yet for wood-work answers as well, or nearly as well, as a more elaborate one of metal.

Fig. 9, there is no pressure on the washer; but when the pin is turned round to bring the opposite or full portion lowermost, it presses upon the washer, D, and tightens the head.

The rounding of the bottom edge of the rod, F, is thought by some to be a slight advantage, as tending to increase the stability of the head upon the rod, giving a more wedge-like grip than a flat face would afford.

*Fine Adjustment.*—The pinching of the top screw of the trammel head does not alone furnish that precision of adjustment which is desirable for the most accurate kinds of work, such as the pitching out of centres of wheels, the striking of pitch circles, and other lines and centres where

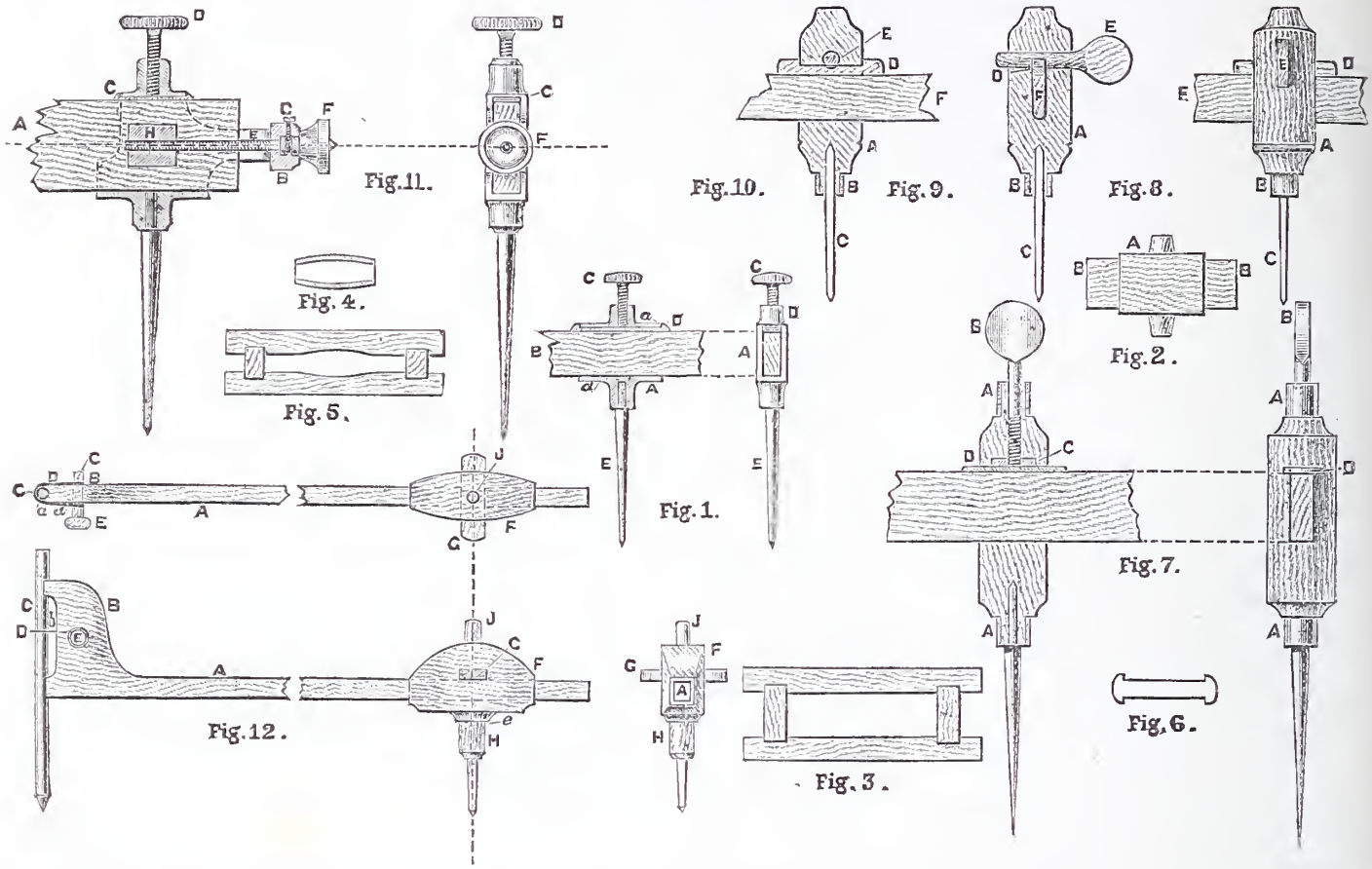



Fig. 1.—Brass Trammel Head. Fig. 2.—Pattern for same. Fig. 3.—Core-Box. Fig. 4.—Section of Concave and Convex Head. Fig. 5.—Core-Box for same. Fig. 6.—Form of Washer, alternative with that at D in Fig. 1. Fig. 7.—Wooden Trammel Head with Screw. Fig. 8.—Wooden Trammel Head with Cam. Fig. 9.—Ditto: Transverse Section. Fig. 10.—Ditto: Longitudinal Section. Fig. 11.—Brass Trammel Head with Fine Adjustment. Fig. 12.—Draughtsman's Pencil Trammels.

*Wooden Trammel.*—Figs. 8, 9, 10 give three views of a trammel head made in hard wood. It is very easily made, very simple in action, involves no metal work except the fitting on of the brass ferrule, and requires no screw cutting. Yet for wood-workers it is quite as serviceable as the trammels made entirely in metal.

Fig. 8 shows the trammel in outside elevation, and Figs. 9 and 10 in transverse and longitudinal sections respectively.

In these figures, A is the body of the trammel, turned of hard wood, and bonded with a small ferrule, B, to prevent the wood from becoming split on the driving in of the leg, C. Through the head passes the washer-piece, D, and the tightening-pin, or cam, E. The cam-like form is given to the pin, E, by simply cutting out a narrow portion at the centre (see Fig. 9) eccentrically. When, therefore, the pin is in the position shown in

adjustments of $\frac{1}{50}$ in. or $\frac{1}{100}$ in. are required. A fine adjustment, like the screw adjusted leg of a spring divider or of wing compasses, is then desirable. There are two or three ways of effecting this. I think the method shown in Fig. 11 is as good as any that I have seen, and I therefore illustrate it.

Of the two trammels used, only one is like that shown in Fig. 11, and it always remains near the end of the rod, A. The other is made without the extension, E, and slides anywhere on the rod. The narrowing of the upper part of the head where the washer, C, and screw, D, come is simply a fanciful form that one often sees, and is no essential part of the design; so that as regards the shape of the head in Fig. 11, it is simply a common trammel head, extended at the end, B, to form a boss through which passes the fine adjusting screw, E.

The mechanism of the screw, E, is seen in section in the figure. There is a turned and grooved portion next the milled head, F, which fits into a hole bored in the boss, B, of circular form. The purpose of this groove is to prevent the endlong movement of the screw, E, for the small pin, G, being tapped into the boss, and fitting into the groove, prevents any endlong movements, while allowing it to be turned freely by the fingers.

The screw is tapped into the gun-metal nut, H, which is a cubical block of brass let right through the trammel rod near the end, and drilled and tapped throughout longitudinally to receive the screw, E. Consequently, when the trammel head is set approximately, with the pinching screw, O, slackened, the turning of the milled head, F, of the fine adjusting screw, E, causes the screw to travel endlong in the nut, H, and so carries the trammel head along with it. When the correct adjustment is made, then the pinching screw is tightened.

*Drawing Trammel.*—A drawing trammel, useful to both draughtsmen and pattern-makers, is shown in Fig. 12. It is made of mahogany. The length of the staff, A, may be anything—say, from 2 ft. to 3 ft. long—2 ft. 6 in. being a useful average for ordinary drawings. Make it as follows :—

Plane up a piece of straight-grained mahogany to ½ in. thick, and of the full width of the head, B, at one end, which will then be cut out of the solid ; or plane a strip of mahogany to ½ in. square, and glue and screw the piece for the head upon one edge of it. The head is hollowed at *a* to receive the pencil, C, and is recessed at *b*, so that the pencil only bears at two points, and the tightening of the string, D, around it tightens it very firmly. The tightening is effected with the tapered button, E, which passes through a hole in the head. The string, D, is passed through a hole bored at C, and is turned once or twice round the pin at *d*. When, therefore, the button is turned in the proper direction, it tightens the string around the pencil, and a slight thrusting forward of the tapered pin, E, at the same time into its hole tightens it so that it will not slacken back of its own accord. The pencil is released as easily by the turning back of the button in the opposite direction.

The sliding head, F, is cut in a solid piece of mahogany. The hole is cut through first—not a difficult matter with centre-bit and chisel—and then the outer portions are shaped. The head is made deep in the middle, so that the pressure of the wedge, G—which is, however, only tightened with the fingers, not with the hammer—shall not be likely to split it off.

There are two turned portions fitted to the head into holes bored with a small centre-bit. One is the boss, H, into which the steel point is driven ; the other is the pin, J, upon which the finger is placed to steady the trammel when in use. The boss, H, terminates at *e*, the hollow which comes to meet it being cut out of the solid head. The wedge, G, bears directly upon the rod, and being broad, and only gentle pressure being exerted, it does not bruise it.

Of course, the details of such a tool as this are very much a matter of taste ; so, too, the dimensions can be varied. I simply copy from trammels of my own, and have seen a good many similarly made.

Provision is often made in brass trammels for the use of a pencil, by casting a boss upon the side of one head, and drilling a hole through it to receive the pencil, which may either be tightened with a screw or be a tight sliding fit only. This I need not illustrate.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

The Study: Dealing with an Objectionable Window—Mullions—Glazing without the Glazier—Panelling of Window—Glazing Door on Novel Plan.

*The Study: Dealing with an Objectionable Window.*—The only window to my study (as I found it) was a mean affair. It had a wooden frame divided into three lights by clumsy square wooden "uprights"—for of the name of "mullions" they were in no way deserving. Its glazing was of small square panes, set in broad lead-work, which by no means admitted a proper proportion of light ; in the middle compartment was also the further obstruction of a clumsy iron casement. This window was as inefficient for lighting purposes as it was unsightly ; and as its size was full small for the room, something had to be done with regard to it. To have made a larger opening would have been too serious an undertaking for me, so I had to do the best I could with the existing space.

As the room had a door to the open garden, I concluded that I should have abundant ventilation without the casement, which would make one difficulty the less. Accordingly I cleared out the leaded lights and the casement with them. The wooden "uprights" I sawed out, and in their stead inserted a single mullion. How this was constructed (and since it other mullions) must be more particularly described, as a useful wrinkle may thus be imparted.

*Mullions.*—Fig. 12 gives a section of the special mullion in question. Its body, A, is a piece of squared oak (the top, in fact, of one of the head-posts of an old-fashioned bedstead, other parts of which came in handy in other parts of my house). This I dowelled into the frame at top and bottom. On its four faces are screwed four strips of deal ; B is the outside strip, and this is so much longer than the mullion as to admit of its being screwed to the outside of the frame at top and bottom ; this, with the dowels, renders the mullion as firm as if it had been mortised in. The other three strips are of the same length as the body.

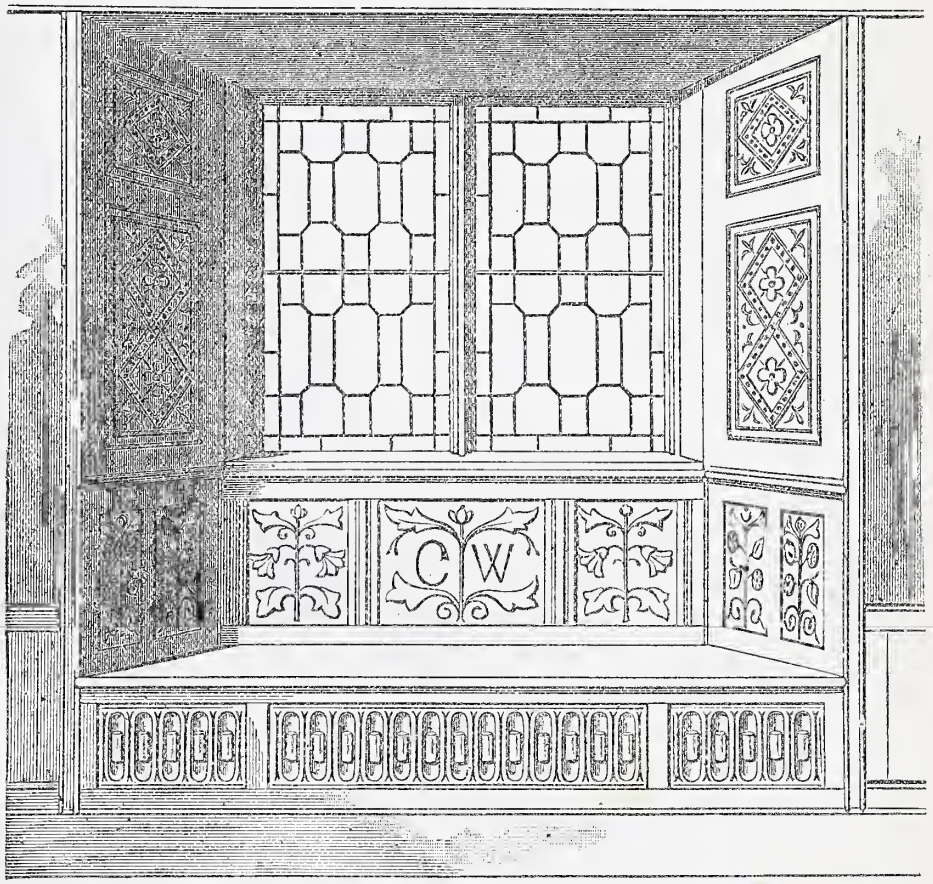



Fig. 11.—Study Window as improved.

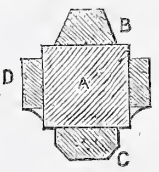



Fig. 12.—Section of Mullion of Window.

The strip C is screwed to the inner face ; the two strips, D, D, to the sides so as to form rebates to hold the leaded lights. To finish my mullion and to prevent any air from drawing through it, I laid putty up the angle at back of D, smoothing it down with a gouge, and thus making a round hollow moulding. The result was a firm, strong, boldly moulded mullion, fully equal for its purpose to one worked from the solid.

*Glazing without the Glazier.*—It will be seen from Fig. 11 that the reconstructed window was again fitted with leaded lights ; but these are both more decorative and less obstructive than the old ones. They are put together with thin string lead, which keeps out very little light. I might, of course, at less cost, have fitted each light

with a single sheet of glass, but this would not have suited the style of the room; besides which, as a general matter of taste, I consider moderately small panes to be far better in effect. Large panes have a cold and comfortless look, as they do not (in appearance) sufficiently cut off the room from the outside world.

The actual leading of the glass together was not done by myself, nor did I call in the glazier to help me. I found that the best and most economical way was to draw out on paper a full-sized cartoon of one of the lights, marking, of course, all the lead lines, and to send this to a wholesale Birmingham glass warehouse, from which the lights all already for fixing, with the necessary saddle-bars and ties, were promptly forwarded to me. These lights, 35 by 19 in., cost about 8s. or 9s. each. I fixed them in place myself, which was a very simple matter.

*Panelling of Window.*—The window had clumsy shutters of painted board. I removed them, and substituted some of my old oak panelling, as shown in Fig. 11. The carving upon it is my own, and its style is in keeping with some of the old carving round the fireplace and elsewhere. Below is a window-seat. This I also panelled round, the wood used being the front and ends of a small oak chest of, say, Cromwell's time, which I picked up at a sale for 2s. 6d. The initials C. W. on the central panel were there originally; the other ornamentation is incised work like that above the fireplace, and of my own doing. The pieces of gouge work below the seat are part of the wreckage of an old bedstead. The edge of this oak-work, on the side towards the room, was finished, as shown in the illustration, by an ebonised moulding.

*Glazing Door on Novel Plan.*—I have mentioned that this room had a door leading to the open air. As my only window was so small, I proposed to make this a passage for a little additional light. Had it been a panelled door I should simply have taken out the upper panels and filled their places with British plate glass; but it was not panelled, it was a plain ledger door, yet a strong well-fitting door of its kind, and gave me no excuse for going to the extravagance of a new one.

Now I had made a collection of things of a kind which, perhaps, no one else, of all the thousands who read WORK, has ever thought worth the collecting—namely, the feet of broken wine-glasses. But the reader must by this time have seen that I am an enthusiastic utiliser of odds and ends. I hold that by the judicious employment of such "unconsidered trifles," wonders can be worked at little cost; and that there are very few things which cannot be made of use if you only know how to use them; indeed, great part of the object of these articles is to indicate how odds and ends may be utilised to good purpose.

My small discs of glass—my wine-glass bottoms—I had thought might come in useful for ornamental (plain pattern) lead glazing; I now, instead, arranged them for my door in such a geometrical design as would best admit light without seriously interfering with strength; I then pierced my round holes through the wood, and puttied them in.

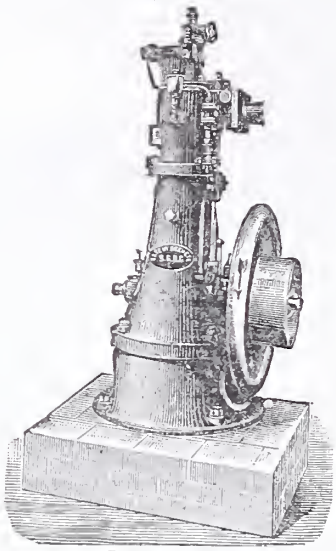
And in this situation they have *one* especial advantage over larger sheets of glass—namely, that no slamming of the door will ever be likely to crack them. At all events, there has been no breakage since they were first put in, and, possibly, there never will be.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 92.—Capitaine's New Petroleum Engine.

I HAVE been asked to call the attention of readers of WORK, and especially those who are interested in motors and wish to avail themselves of a cheap machine, worked by oil, for generating motive power, that a new petroleum engine (Capitaine's patent) has been recently introduced into this country and, I am informed, has met with the approval of all who have, as yet, seen it at work. The engine, as may be seen from the accompanying illustration, is of vertical type, and has a crank shaft at the bottom. Its construction is such as gives a noiseless and steady motion, without any vibration whatever. Owing to the vertical arrangement the cylinder is not liable to get oval. A simple and ingenious driving-gear is acted upon by the governor placed within the driving pulley, and the introduction of oil is therefore regulated automatically by the work done. The space required for, and occupied by, the engine itself is very small. After having been started, the engine does not require any attendance until the oil tank is emptied. Ordinary lamp oil is used as fuel. No electric spark is required for effecting the ignition, as *one* lamp fed with petroleum is used for vaporising the oil and igniting the gas mixture. The consumption of oil is about from seven-tenths of a pint to one pint per actual horse-power per hour, according to the size of the engine. I am told that an extensive use of this high speed engine is being made for agricultural purposes, as well as for electric lighting, driving ventilators, propelling small launches, for working cranes and hoists and capstans on board sailing vessels, etc. The cost of Capitaine's New Petroleum Engine is but little more than one-half that of any other oil engine. The agent in the United Kingdom is Mr. Leopold Tolch. These new engines are now to be seen working in Liverpool.



New Petroleum Engine, Capitaine's Patent.

### 93.—Minnitt's Patent Double Grip Lock Nut.

This new and ingenious invention by Mr. H. Minnitt, which has been recently patented and described at length in Specification No. 17,799, is, as will be readily recognised from the illustrations, given in elevation, section, and plan of one of the nuts in Figs. 1, 2, and 3, especially suitable for railway fish plates, agricultural machinery, and in all cases where there is much vibration. There are two forms of nuts employed, the parts of which are lettered respectively B, C, and B′, C′, in Figs. 1 and 2; and these nuts are used in the following manner, the two parts being called respectively in each form the cap nut (B and B′) and the cone nut (C and C′). The cap nut (B or B′), whichever form may be used, is first slipped on or over the bolt A against the plate which it is desired to tigthen up, and the cone nut (C or C′) is then screwed on the bolt and *into* the cap nut. Being provided with a saw-cut which entirely severs the cone nut on one side, the pressure of the cap nut, as the cone nut enters it, causes compression on the latter, and thus forces it to grip the bolt after it has been drawn up tight. This prevents it shaking loose through vibration. The cone nut, and the cap nut as well, are made in two forms, as already said, and as shown in the illustrations as No. 1 and No. 2. No. 1 is shown with the cone screwed and the cap nut threaded inside to take it. No. 2 shows only a plain cone, and in this case, as the nut C is screwed on the bolt, it forces itself into B, and is thus subjected to compression. In Fig. 3 another form of C′ is shown, as seen in plan from below, C″ being the plan of C′ as seen from above. As made in the manner shown in Fig. 3, the cone cap, instead of being provided with only one saw-cut by which it is entirely cut through from the outer to the inner surface, has three or four cuts extending only the length of the cone, and stopping when the hexagonal portion is reached. It is, however, used in the same manner, being screwed on the bolt after the cap nut is put on, and forced into the latter, thus causing the wings to tighten on the bolt. The nut shown in Fig. 3 can be made with screwed or plain cone. THE EDITOR.

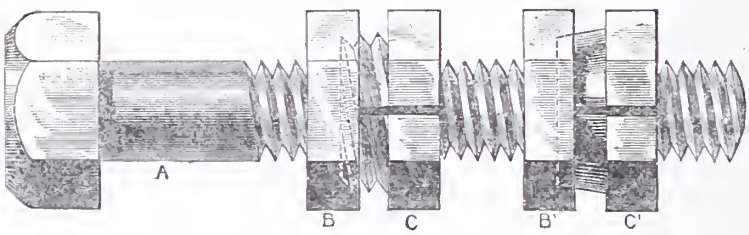



Fig. 1.

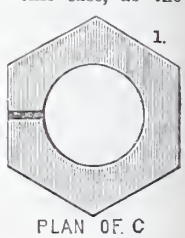



Fig. 3.

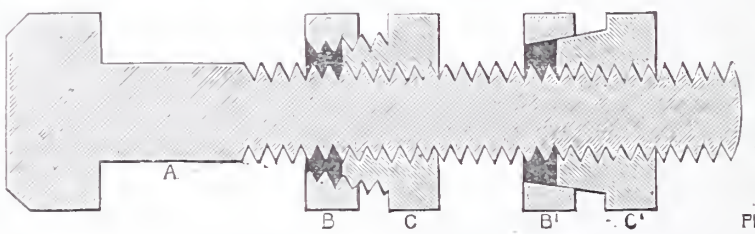
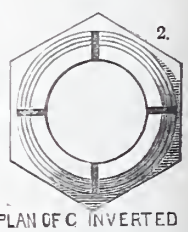



Fig. 2.




**Minnitt's Patent Double Grip Lock Nut. Fig. 1.—Elevation; and Fig. 2.—Section, showing two Forms of Nuts—A, Bolt; B, Cap Nut; C, Cone Nut; C″, Nut C′ in Plan seen from above. Fig. 3.—Another Form of C′ as seen from below (C″).**

# SHOP:

## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Sussex "Trug" Baskets.**—The Redonda Phosphate Co. (*Montserrat, West Indies*) write:—"There is some demand here for baskets of the following measurements (inside): Length, 20 in.; width, 16 in.; depth, 8 in. This is the size of the 'oak-spelk hand coal-baskets' imported from England. They are identieal with those used by coal-porters, exeept the iron hooping. Those we have, the iron hoop is riveted to the rim and erosses on the bottom. They need be *very* strong to stand the rough usage here. I will explain the use we make of them. The phosphate—a hard, very *sharp*, eompaet rock—is quarried by the men in places where it is very difficult to erect any kind of machine. Boys are employed to fill the baskets with the rock and carry it from the quarry to the shipping place—a distance of about half a mile. The load is about 70 lbs."—[Clog and Trug Basket manufacturers will probably follow Captain Cuttle's praetice, and make a note of this.—Ed.]

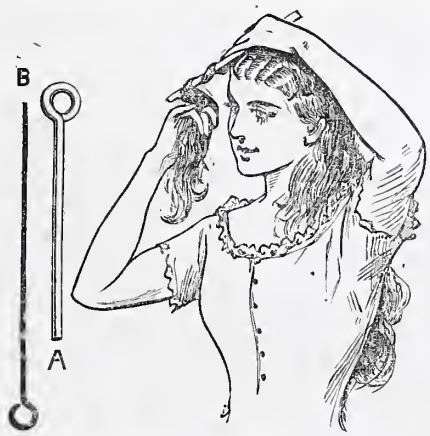
**Diamond Chips.**—F. W. (*De Beauvoir Town*) writes:—"The answer given eoncerning diamond ehips by Damon (see Work, No. 138, p. 541) might be clearer. He says that bort is almost, if not quite, as hard as diamond. Now, bort *is diamond*. Technically, real bort is somewhat harder than ordinary diamond. It cannot be cut and polished like ordinary diamond; but what is known to the trade as bort are diamonds which are too flawy or off-coloured to cut for jewellery purposes, and is, when crushed, used for slitting crystal, pebbles, etc.; made into powder for polishing hard stones, such as rubies, sapphires; and also used, when broken into small pieces, for drilling glass and china. They are the pieces known to ehina-riveters as 'diamond sparks,' or, as your correspondent puts it, 'diamond chips.' I might also mention that the material black diamond is known to the trade as carbonate, or carbon. It is black, and it eanuot be cut or polished: used principally for turning emery wheels. It is better than diamond for glass and ehina drilling, for it never wears smooth, like the diamond: it maintains its rough surface to the last. Both diamond or carbon sparks ean be obtained from firm mentioned by Damon—viz., Woods & Toussaint. I might mention that carbon is double the price of diamond."

**Wire-Work.**—Erratum.—J. S. (*London*) writes: 'On p. 534, No. 138, line 18, column 1, 'right hand' should be substituted for 'left hand.'"

**Mechanical Voting.**—J. S. (*London*) writes:—"*Re* your remarks on Mechanical Voting in No. 138, contained in 'Hints to Inventors,' I take the following from a journal I read weekly: In the Italian Parliament the voting is said to be done by electricity. Three buttons, marked 'Aye,' 'No,' and 'Abstain,' on each member's desk, are connected with a central printing apparatus, which records the votes automatically as the members touch the buttons. Doubtless, something similar would answer for the voting alluded to."

**To Restore a Damaged Mirror.**—G. A. S. (*Edinburgh*) writes:—"Judging by the number of inquiries in the columns of 'Shop' as to how damaged mirrors may be re-silvered, I think that some easier way than re-silvering may be very welcome to many readers of Work. As has been already pointed out in 'Shop,' the process of re-silvering is too difficult a job for most amateurs; and it will be found more profitable, where the plate is worth the expense, to send it to the professional. But the object of the present paper is to show whereby a small plate—say, 15 in. by 12 in.—on which the silvering is run or has been scratched, and in its present state is generally unsightly, may be made, with a very little expense, a thing of beauty and (to the owner, at least) a joy for ever. As mirrors don't all get damaged in the same place, it would be useless and out of place to lay down any hard-and-fast rule to go by, so we must leave a great deal to individual taste: the intention being to make, by the use of scraps, an imitation of a hand-painted mirror. I suggest a lake or river scene; but that is on the supposition, as well as for the sake of example, that the mirror is damaged round the sides only. For material, we require the mirror, which may be some old dressing mirror, or one which may have seen better days in the back of a case, but, having been exposed to damp, or carelessly laid past, has had its silver back partially destroyed. Then we will require some scraps, such as foliage, water-lilies, flying birds, swans, and boats (these should be in duplicate), a little starch-paste, and a dip of varnish or paint. Laying the mirror on its face, we select the scraps which we think will best suit. For the sides we take the foliage: this may take the form of a tree, or hanging ivy, or a clump of tongue fern; with a little weak paste we stick the scrap, face down, so that it covers the damaged parts; in the same way, stick on the top the flying birds, and on the bottom the water-lilies, swans, or boats, or whatever you may think will suit best. The proper placing must, of course, be left entirely to the taste of the worker or the needs of the mirror. Next paint over the scraps, going particularly into the edges, with a little lamp-black, or some dark colour, mixed with a little paste or size; or with a sharp instrument cut close round the margin of the scraps: the object being, when the scrap is removed, to leave a clear outline. Now with a sharp penknife scrape off the silver which has been covered by the scraps, keeping as sharp an outline as possible, and getting the glass quite clean. The scraps we have taken off will probably be destroyed; at any rate, they should not be used again, as the second coating of paste on the painted surface might cause them to peel off. Therefore, we take duplicate copies, and, pasting them on the face with starch-paste, or any transparent paste or gum, we place them in the spaces scraped out for them. Give the whole of the back a coat of size or starch-paste, and when dry, a coat of varnish or oil-paint. Should the scraped-out spaces be too large for the scraps, use oil-varnish; and when it has set—which will be in about three or four hours—dust some silver-bronze over the bare parts; and if your scraps have been laid on with taste, you have a good imitation of a hand-painted mirror."

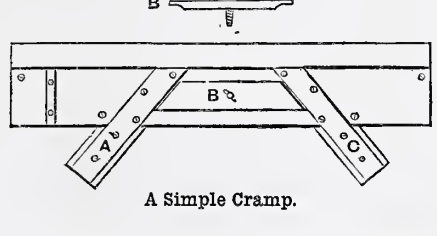
**A Simple Hair Curler and Crimper.**—F. H. (*Battersea*) writes:—"Perhaps some readers of Work will think anything appertaining to hair curling out of place, but I am describing an appliance which, as it is very useful, and is very simple to make, will be none the less welcome for being first made public through the pages of Work. A is a




Hair Curling and Crimping Appliance.

piece of ¼ in. iron gas-pipe about 12 in. long, bent to form a handle: it is filed and burnished; B is 18 in. of ¼ in. iron rod, used as the heater. It is placed in the fire and made red hot, and then inserted into the tube A for a few minutes. By this means there is no fear of the iron being hot enough to singe the hair, and it is always kept bright. The female figure explains how the appliance is used."

**A Simple Cramp.**—Markwell writes:—"One of the first things I made, soon after Work first appeared, was a mitre shooting board and cramp combined. By its aid, sundry frames which I made have been comfortably tapped together. In the illustration below, A, B, and C are made of hard wood. I think J. W. would like it better than his. The angle-piece is rabbeted, and the rabbet lined with




A Simple Cramp.

leather. When screwed strongly down, English gilt moulding is not injured, and brads may be used; but I must say I like the idea of screws. A little chalk on the back of moulding, and also on board, is useful. I put my shaded lamp a few inches from the mitre points, and can at once see if the joint is quite close front and rear. By unshipping A, B, and C (often done), an ordinary shooting board is available."

### II.—Questions Answered by Editor and Staff.

**Rubber Types.**—E. M. (*London*).—Climax date bands may be made by forming a sufficiently deep mould, the surface of which should be carefully levelled, and using two or three thicknesses of raw sheet rubber compo, backed with one thickness of linen, the die being cut into suitable strips, and the strips cemented end to end with rubber cement after vulcanisation. Solid rubber type may be made in a similar manner (omitting the linen), and cut with a keen knife-blade, wetted with water, to the desired length. Rubber-faced type cannot be made with appliances available to an ordinary amateur.—Qui Vive.

**Fretwork Enlarged.**—R. M. (*Penicuik*).—The designs drawn full size have often to be reduced to fit the space available in Work, when so many conflicting tastes must be represented. To enlarge patterns there is a simple mechanical contrivance known as the pantograph, which any cyclopædia will explain. Unfortunately, it would take up too much room to do it here. "Letts's sectional tracing paper" provides another way. You trace the design on a sheet ruled in tiny squares of red lines, and then, by a mechanical process of counting squares, you copy it on one of much larger scale. This is easier to do than to describe; but if you have seen anyone working the old-fashioned Berlin wool work from a small pattern, you will gather the ruling motive of the process. For your kindly words anent Work, and the censure of dilatory agents, compressed thanks in a few words, but none the less real.—G. W.

**Panel.**—Cartridge.—The basket-work or dotted effect of background in patterns in low-relief carving is gained by hammering the ground with punches sold for that purpose at any tool-maker's. The commonest one of simple lines in a square produces the wicker-work pattern.—J. G. W.

**Patent Agents.**—W. G. S. (*Bristol*) is strongly advised to place himself in the hands of a patent agent in his own city. It is important that the patentee should be near his agent. We are unable to recommend anyone at Bristol, and it would not be safe to take a name from a directory merely. W. G. S. might place himself in communication with two or three local patentees (whose names he could get from advertisements, or from their articles), and take their opinions as to the best agent. Among London agents, we may mention Rayner and Cassell, 37, Chancery Lane, W.C., and Messrs. Carpmael & Co., Southampton Buildings, Chancery Lane, as of high professional reputation. Judging from our own experience, as well as from common sense, we incline to think that Mr. Eustace Smith's remarks are calculated to give too low an idea of the value of provisional protection.—C. C. C.

**Blue Prints.**—Cosmos.—The following formulæ will answer well:—

| | | |
|---|---|---|
| Ferricyanide of potassium . | 70 grs. | No. 1. |
| Water . . . . . | 1 oz. | |
| Ammonio-citrate of iron . . | 100 grs. | No. 2. |
| Water . . . . . | 1 oz. | |

Mix equal parts of 1 and 2 just before use, and apply evenly with a brush or sponge, and dry in the dark.—D.

**Toy Wheels.**—J. M. C. (*Greenwich*).—You would, I think, be able to buy your toy bassinette wheels of The Victor Cycle Co., Grimsby, Yorkshire, who advertise in Work, and who would be able to get them for you if ordered. The price of a set of wheels 11 in. by 7 in. would be about four shillings, or a little over, as I am able to procure a small-sized set 18 in. by 12 in., for an ordinary bassinette, at five shillings and sixpence the set, wholesale price, in Manchester.—W. P.

**Wheels.**—G. H. A. (*Sheffield*).—The proper address is The Victor Cycle Co., Grimsby. I know of other makers, but as they do not (unlike the Victor Cycle Co.) advertise in Work, I do not think it fair to mention them, but by writing to the above address you will receive every attention.—W. P.

**Ice-Cream Freezer.**—J. C. (*Belfast*).—Glad to give you any information in my power; but I do not see the point of your terming yourself a "man of wood," as these freezers are made out of a very different material. They are, or ought to be, made of pewter, and, as a rule, are about twice as deep as the diameter of them. The sizes vary according to the quantity required. You say you want to make a sufficient quantity to dispose of in your shop. I think, when you look at it, that seems rather vague. I cannot tell whether your shop is a large or small one, or whether the Belfast folk are fond of ice or not. But to return to the subject. If you can use a soldering iron, it is not a very difficult job to make an ice pot. Get a piece of sheet pewter, 15 × 10; turn it round on a wooden mandrel; let the edges "butt"—that is, just meet—and, with a hatchet soldering iron, solder down the seam on the mandrel, using resin and oil as a flux, and pure solder. Do not try to make the solder flow after the iron, and never mind if it looks rough. After you have soldered the seam down, rasp off all superfluous solder till it is level with the metal, and then scrape smooth with a knife or piece of steel. Then cut out a bottom that will just slip in, and solder that round in the same way. Turn a piece for the rim of the cover, 1½ in. deep, and solder this, and make it smooth at the seam inside and out, so that it will fit well. Put a cover on this, the same as you did the bottom. The shop ones are hollowed up; but that is not essential. Lastly, bend a piece of ⅜ in. tin pipe across the cover, and solder it to each side,

for a handle, and the affair is complete. For instructions in soldering, see Nos. 19 and 23.—R. A.

**Furniture Restoring.**—PAPYRUS.—I am afraid you will not be able to improve the appearance of your mahogany chairs by ebonising them; or, perhaps, it should rather be said that such chairs as I gather yours are would not look well ebonised. I make these remarks, as you ask for any suggestions; but it is certainly possible to ebonise your mahogany chairs. If they are good wood—*i.e.*, finely figured, and of a good colour—it would be a great pity to blacken them; for, though you object strongly to mahogany colour, the probability is that most of your friends will object more to the black. Of course, if your chairs are the fiery red so often considered to be the true mahogany colour, do anything you like to them; you can't make them more unsightly than they are. This may be a consolation to you, and you may adopt several different courses. If you want to ebonise them thoroughly, all the existing polish must be removed, either by washing off, or scraping, or papering, or perhaps a little of all three. Then stain, and re-polish in the usual way. If this seems too tedious, polish them with blackened polish, which you may make by mixing gas-black in ordinary French polish. This, of course, is not such a satisfactory way as the other, as the stain does not enter the wood, but is merely on the surface, from which wear will remove it. If you want an easy way of darkening the wood, not blacking it, use French polish with some brown in it. It is quite impossible to restore faded and worn leather chair coverings to their pristine appearance; but if not too far gone, and you are skilful enough, it is possible to improve and, to a certain extent, to obliterate the marks of wear and tear. Unless you are careful, though, you are more likely to do harm than good. The only way is to go lightly over the leather with a rubber just moistened with thin French polish or white of egg. Without seeing the things, it is impossible to answer your further query as to the desirability and economy of re-covering the furniture. Your own judgment, or the decision of an experienced upholsterer, after he has seen the coverings, will be more reliable; but your idea of covering things which have leather seats—and are, therefore, probably dining-room chairs—in cretonne, is peculiar. Why not use something which will not be so *outré*? There is leather-cloth, which so closely resembles leather that at a very short distance the difference could hardly be detected. Be careful, though, to get only the very best quality. It wears for years, and is cheap enough for anything.—D. D.

**Plush on Brackets.**—F. C. (*Belfast*).—As I have not seen the frame to which you refer, I cannot say whether the plush was glued or backed on, though you might have noticed for yourself. The plush having been put on well is only owing to the skill of the worker. We cannot give you this; and I very much fear that what hints I can give you will not avail you much. However, that is your look-out. Plush may be put on frames by gluing the wood either all over or just at the back, so as to fix the edges on behind. At the bends and angles on the inner edges of the frame cut the plush neatly. Do not apply the glue to the plush, which should not be pressed down too hard: only enough to cause adherence. If you ask at any good cabinet-maker's, you will be able to get suitable plush. Ask for silk plush, and at the same time ask the price, which depends on quality. You might get the sconces (the brasses to which you allude) at the same place, or from any shop dealing in cabinet-makers' brass-work. If you do not know any, write to Grew and Bridge. How can I tell you the price of the brasses you saw? You might as well ask how big a piece of stone is.—D. D.

**Wood-Wool Making Machine, and Folding Furniture Designs.**—G. D. (*Oldham*).—You must forgive me if I create disappointment by saying that I am entirely ignorant of the article you are in quest of; viz., wood-wool making machine. I have made inquiries among my friends and relatives, but fail to elicit any information likely to be of use to you. Perhaps some reader may peruse this somewhat "queery" reply who, perchance, is fully acquainted with the above article. If so, I shall personally thank him if he will be so good as to forward the fullest particulars, for the benefit of yourself and others. There is one query, however, which I am glad to say I can reply to. Several designs of folding furniture have been given by various contributors, including myself, in the volumes of WORK so far published. You will, doubtless, have seen the announcement that Indexes to WORK are obtainable, at the cost of 1d. My advice is: get one at once. Therein you will find specified several folding furniture designs. You will find two folding arm-chairs and three folding tables, by me, in Nos. 41 and 37 respectively; and in No. 23 are also three designs of folding chairs. I must inform you, however, that it came to light, after the publication of the latter, that Fig. 3 design represented an article which is patented in this country (see p. 476, No. 30). My fellow contributor was unaware of this fact when he sent the designs in. I mention all this that you may not infringe the patentee's rights by making this particular chair. You need not fear to progress with any of those (folding or otherwise) which I have given, as I make a point of giving original designs. The price of volumes of WORK, bound, is 7s. 6d. If you possess any skill, however, I should advise you to endeavour to bind back numbers yourself by reading the articles on Bookbinding, commencing in No. 57.—J. S.

**Portable Photographic Studio.**—R. H. (*Bishop Auckland*).—It is impossible, in the space at our disposal in these columns, to do more than give a mere sketch of how to build a studio. In the first place, much depends on the site and the surroundings; and, secondly, the amount of money to be expended. A "portable studio" is a very elastic term, and may mean anything between lath and canvas and brick and glass—in fact, anything else. "Portability" is a term signifying not *permanently attached to the ground* or *adjoining buildings*, and may cost, so to say, anything according to size, material, and decoration employed. A home-built small studio—say, 20 ft. by 12 ft.—might be made for £8 to £10; but it could only be roughly finished. Supposing the site available is an open space, not shaded with buildings, make eight or ten piers of bricks, about a foot high, as a support for the superstructure, and to provide ventilation under the floor for dryness' sake; and on these piers lay a frame that will enclose a space 20 ft. by 12 ft. of 4 in. battens. Lighter wood will do for the uprights and roof. The walls may be made of match-boarding, and the roof of the same, covered with roofing felt. One side, that towards the north, may be glazed, and also the north side of the roof; one corner inside to be partitioned off for a dark room; backgrounds to be fixed at each end; the whole of the framework to be *screwed* firmly together, not nailed; provision for a door on the unglazed side to be made where

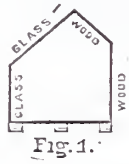


Fig. 1.

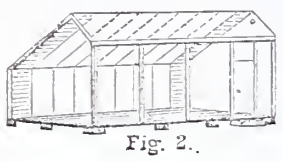
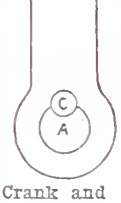


Fig. 2.

Portable Photographic Studio.

most convenient. The floor should be made of good stout planks, tarred on the lower side. *Any* kind of picture can be taken in such a studio, the kind being regulated by *the lighting*, which is controlled by blinds, that should be contrived to cover the whole of the glass, and easily opened and closed, according to circumstances. The woodwork of the walls may be made more sightly by stretching canvas over them, and papering; and the floor should be covered with floorcloth, and a few curtains disposed here and there, to give an air of comfort otherwise absent. A few coats of paint on the outside will be a useful protection. The subjoined diagrams will show the shape and general design of the place. Fig. 1 is a sectional end view, showing the slope of the roof; and Fig. 2 showing door and arrangement of the glass, the wooden side being towards the spectator. Ventilators should be placed near the ridge at each end, and of course, in a slight sketch like this, many details are, perforce, omitted. The above gives a general idea of one of the most useful forms. Many little matters will suggest themselves, when the place is set up, as conveniences or improvements, according to the taste or funds of the proprietor. Reflectors, furniture, head-rests, etc., are necessary accessories. The dark room should be lighted from the outside, and extra ventilation provided for it. A deep wooden sink, covered with sheet lead, is practically best, there being less danger of breakages to bottles, measures, etc., than if stoneware is used. There should be plenty of shelf room, and space to lay down the dark slides for filling and emptying; and, it goes without saying, total exclusion of daylight.—D.

**Safety Bicycle.**—H. W. (*No Address*).—I rather think H. W. will find that the crank is not *screwed* on to the shaft A. The screw that appears behind the crank is for the nut to adjust the bearing. Neither is it usual to have the key C round as shown, as that sort of key works loose much sooner than a rectangular one. If this crank is really screwed on, the other will do so, and they would be screwed right and left screws. The pin C may possibly be screwed as well; in that case a *nick* would have to be made in the end of it to unscrew with a screwdriver, then the crank would screw off. If the crank is on plain it may be wrenched off with a crank-puller, used by repairers. The best thing to do is to give the job to a repairer.—A. S. P.



Crank and Shaft.

**Patenting an Invention.**—H. W. (*Nottingham*).—If the machine is to be worked by downward pressure of the hand (a succession of blows), and not by a wheel, the idea, so far, is not new. We have been shown such an apparatus, its price being, I believe, 1s. 6d. Before incurring expense, H. W. would do well to ascertain that nothing with which his own machine would clash has been protected. Perhaps he could not do better than make a model, and submit it to Mr. Clarence S. Newton, General Business Agent, Royal Courts Chambers, 70, Chancery Lane, W.C. From him he will get information on the above point on what the commercial chances of his invention may be worth, and so forth. Communications with such an agent would, of course, be considered confidential; but if the inventor fears piracy, he can first get provisional protection. As to the third query: till H. W.'s orders become large, we do not see that he can do better than buy his spools of cotton in such a cotton-consuming place as his own town. For needles, he might go to F. G. Heath & Co., Crabb's Cross, Redditch; and for light brass tubing to Stone & Benton, Birmingham.—C. C. C.

**Stain for Blackboard.**—A WELL-WISHER.—Much information upon this subject appears in the following back numbers of WORK: 39, 44, 98, 102, 103, 104, which may be obtained through any bookseller, price 1d. each.

**Globe.**—EQUATOR.—I doubt whether you can get what you require; but you might inquire of some map publishers, as Philips & Son, Fleet Street; Stanford, of Charing Cross; or W. & A. K. Johnston, 5, White Hart Street, Warwick Lane, E.C.—F. B. C.

**Concert Flute.**—NORTHAMPTON.—There are about a dozen different bores, and as many systems of key arrangement in flutes, in each of which the holes are differently laid out, so that it is impossible to help you. Your only plan would be to get a flute of the pattern you wanted and work to it. We may tell you, however, that the arrangement of the holes on the conical-bore flute is altogether different from that on the cylinder-bore instrument.—G.

**Makers of Copying Apparatus.**—W. O. J. (*No Address*).—A reference to Kelly's "London Directory" will give the information wanted.

**Bois-Duré.**—J. S. (*No Address*).—If this is the material we take it to be, it is wood fibre condensed by heavy pressure, and has been patented. We believe that Mr. T. Remus, Tabernacle Street and Castle Street, Finsbury Square, London, supplies it in combination with his patent angle-brasses. Possibly, J. S. might do well to apply to him.—S. W.

**Making Small Still.**—DEVON.—In WORK, Vol. II., pp. 490 and 651, Nos. 82 and 92, you will find a full description and particulars of a small still that, I think, will answer your requirements. The answers are at full length, and I think you would have no trouble in making one from these instructions.—R. A.

**Brazing Bicycle Tubes.**—BRASSY.—If BRASSY will provide himself with the numbers of WORK containing papers on the "Construction of the Safety Bicycle," he will get all the information as to brazing he can possibly desire.—A. S. P.

**Affixing Glass Letters.**—GLASS.—If I had this to do I should simply use the best varnish, covering the letters well, and when nearly set, giving another coat round the edges to fill up all holes, so as to keep out damp and moisture. There is a very good cement in the market, called "Coagiline," also Le Page's liquid glue. If you use either of these I should still put a coat of varnish round the edges. If it does not matter to have it transparent, you will find red lead thinned with varnish answer well; or the following: Litharge, two parts; white lead, one part: boiled linseed oil, three parts; gum copal, one part; mix just before using; or you could use red lead thinned with varnish.—W. E. D.

**Eidograph.**—NIL DESPERANDUM.—I am unable to give the required directions, but NIL DESPERANDUM will find the instrument (which is an improvement on the pantograph) illustrated and described in Knight's "Practical Dictionary of Mechanics," p. 775, published by Cassell & Co., London, E.C.—S. W.

**Waterproofing Cloth.**—J. B. (*Hastings*).—Our correspondent does not tell us what material it is he desires to waterproof, therefore we cannot give him any satisfactory information. If it is woollen cloth, then one kind of treatment has to be adopted; if it is flax, cotton, or other vegetable material, then another plan has to be adopted. What will be correct for one material will be quite inapplicable to the others. If he will state specifically what he wants to do, we may then possibly be in the position to give him the required information.—C. E.

**Quarter Horse-Power Engine.**—G. M. L. (*Selborne*).—You are quite right, it would be most convenient to have full-size drawings of the engine to put up on the workshop wall, or on a board, to go to for measurements. In fact, it is almost necessary. Whether such drawings will be supplied, I cannot say as yet, but the very best preparation for making the engine would be to make full-size drawings from the scale drawings in WORK, taking the *written* dimensions wherever possible. Before very long, I think, the castings will be advertised; you will then be able to make the drawings well and carefully: the time will not be wasted, even if drawings are eventually supplied, since it is sure to give the workman a better knowledge of what he has to do, and will save him from making mistakes.—F. A. M.

**Mechanical Office Work.**—F. H. B. (*Manchester*).—You should advertise your requirements in WORK. Any writings you care to send, on approval, will be considered, if suitable for WORK. London is already overcrowded with workers, and, as you are in a manufactory much in your own line, the best thing you can do is to stop there, and make such headway as you can in business and out of it; but don't come to London.

**Photo Frame in Fretwork.**—NO NAME.—Your large design, as you have made it up, looks well, and shall be published if I can make room for it, but you have sent your letter and large sketch without name, initials, or *nom-de-plume*, so

I am unable to follow the above side-heading with one or the other of these in the usual way. Kindly send your name and address.

**Battery for Electric Night Light.**—LUX IN TENEBRIS.—I cannot advise the use of a chromic acid or bichromate battery in a bedroom for supplying current to a small electric lamp used on electric night light. Although the fumes from such batteries are said to be non-injurious, the odour from them is to me objectionable, and is highly injurious to my brother, causing sore throat and constriction of the bronchial tubes. The large agglomerate tin block Leclanché is very suitable for a night-light battery; so is the Gassner dry battery of large cells. It would take six such cells to light an 8-volt lamp. The cost of the Leclanché battery at 10s. 6d. each cell will be three guineas; the cost of the Gassner at 5s. per cell will be 30s. Mr. K. Schall, Wigmore Street, London, W., supplies a 6-cell chloride of silver battery, specially made for small electric lights, at a cost of £2 9s. These, although costly, are clean and portable. A correspondent at Ipswich has made his own Leclanché battery for an electric night light. The agglomerate Leclanché and the Gassner can be obtained from Messrs. T. Gent & Co., Faraday Works, Leicester, who also supply lamps and other electric light appliances. You can also, as you suggest, get everything from Mr. Bottone, who is agent for a very good portable dry battery. Replying to your questions as they stand in your letter: (1) Large cells, carbons, zincs, etc., in a battery, lessen the internal resistance and furnish a larger volume of current, lasting for a longer time than the current from small cells. (2) Amalgamating the zinc with mercury means coating the cleaned zinc with this metal to prevent waste by excessive or local action. (3) Either of the firms mentioned can supply carbons, zincs, clamps, switches, wire, and lamps, and will quote you prices for the same. I do not know a firm in Dublin. (4) A sickly odour, to me, proceeds from a bichromate battery, so I would not have one in *my* bedroom. This objectionable feature does not exist in the Leclanché, Gassner, and chloride of silver batteries. The Lithanode battery of Messrs. Cathcart & Peto, Hatton Garden, E.C., is also free from objectionable fumes. A battery may, however, be left outside, and the conducting wires only led into the room. (5) A battery would need recharging about once a week, if you use the light for from ten to twenty minutes at a time, about a dozen times in the night, as this would mean at the least two hours per night. I thank you for your kindly appreciative words respecting WORK and members of the editorial staff. We endeavour to couch our instructions in "good Anglo-Saxon language," and hope you may long enjoy, as a subscriber, some more half hours with us.—G. E. B.

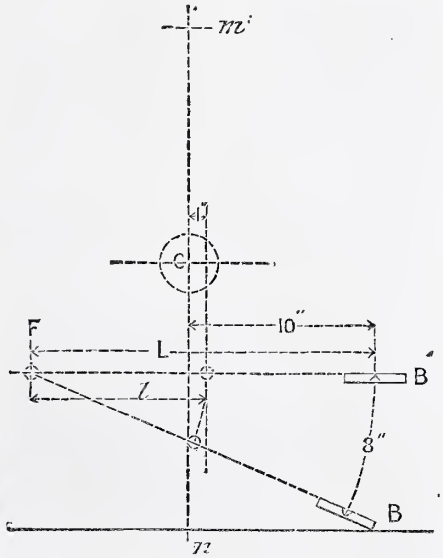
**How to Make a Dynamo.**—J. G. (*Edinburgh*).—Articles giving illustrated instructions on making small dynamos appeared in Nos. 92, 94, 97, and 99, published December 20th, 1890; January 3rd, January 24th, and February 7th, 1891. An article on accumulators appeared in No. 101, published on February 21st, 1891. "The Dynamo: How Made and Used," by Mr. Bottone, Wallington, Surrey; and "How to Make a Dynamo," by Mr. A. Crofts, Dover, are both good books on the subject, well suited to the wants and knowledge of amateur dynamo makers.—G. E. B.

**Battery for Medical Coil.**—T. A. (*Shotley Bridge*).—Yes, a Leclanché battery can be, and is, used for working medical coils, but special large cells should be employed. The large 6-block agglomerate cells are suitable to this work, but their cost (10s. 6d. each) is rather high. The Gassner dry battery has also been employed for this purpose. Messrs. T. Gent & Co., Leicester, supply these and other suitable batteries. The new chloride of silver cells made by Mr. K. Schall, Wigmore Street, W., will give a strong constant current for several hours whilst working a medical coil. If the coil has to be used for from 1 to 1½ hours each day it will be necessary to frequently charge the battery—say at least once a week.—G. E. B.

**Battery for Firing Fuses.**—W. K. S. (*Whaley Bridge*).—If you know anything about the construction of electric batteries, and can make them yourself, you may get all the materials and instructions from Mr. Bottone. You will have to tell him just what you wish to do, the kind of fuse you wish to fire the shot with, the distance of the battery from the fuse, and size of the conducting wire to the battery. He will then tell you what things to get and how much they will cost. Messrs. King, Mendham, & Co., Western Electric Works, Bristol, make a special battery of 8 cells for this purpose at a cost of £4.—G. E. B.

**Incandescent Gas Light.**—R. C. B. writes respecting the address of the Incandescent Gas Light Co., given in No. 134, p. 475, Vol. III., of WORK, in reply to C. N. V. (*Aldershot*). He says the address is not the one C. N. V. wants, but he shall be very pleased to let C. N. V. know the address or anything else about the light. I should have been better pleased if R. C. B. had given me the proper address, and the information offered, so that it could have been published for the benefit of all readers of WORK.—G. E. B.

**Lathe Proportions.**—WALLACE.—The dip or throw of a crank is not measured over all, but from centre of shaft to centre of pin. Assuming your square crank-shaft to be 1 in. square, then the throw of your crank would be 4 in. and the stroke would be 8 in. Now 8 in. is just about the proper stroke for the footboard to move up and down; for a small 3¼ lathe, 7 in. will do, but for a 5 in. you require a little more power; a greater rise of the footboard is more fatiguing for the leg. You could not with this crank use the ordinary kind of treadle, as it must nearly double the stroke of the crank, and I think you should give it up. The proper throw for the crank is determined by the movement it is desired to give to the foot (say 8 in.), and the proportions of the lever arm of the treadle. In the sketch sent herewith, *m* is the centre of the mandrel; *m n* a perpendicular dropped from *m* and passing through the centre of crank-shaft at C; F is the fulcrum of the treadle; B B the footboard, the centre of which should be 10 in. in front of the perpendicular centre line; L is the full length of the treadle lever, and *l* is the short length measured from fulcrum to the point of attachment of pitman or crank-hook; this point of attachment is rather better placed 1 in. in front of the perpendicular, as it lengthens the down stroke when the lathe runs forwards. F is rather better placed 6 or 8 in. high, because then, in descending, the foot moves a little forward, which is somewhat easier. Now if L be twice as long as *l*, then it is evident the throw of the crank will have to be 2 in. and the stroke 4 in. If the crank had a throw of 2¼ in. and a stroke of 4½ in., then the fulcrum would be moved back 2½ in., or more exactly 2⅞ in., so as to make L = 20½ in. and *l*




Sketch of Treadle Arrangement.

=11½, in order that L may bear the same proportion to *l* that 8 does to 4½. You will see from all this that 2¼ is a proper throw for a crank if the other parts are made in proportion. With regard to your second question, I have never seen a weaver's shuttle tip, and cannot tell whether it would do to insert one in each end of the crank-shaft to form a point on which it would turn. To do this the pin must be at least ⅝ in. diam., or it might break right off; also the angle of the cone should not be more obtuse than 60 degrees. I should prefer to bore a ½ in. hole up each end of the shaft, and insert a hard steel plug 1 in. long, having a ⅛ in. hole bored right through the centre and countersunk to 60 degrees at the outer end; plug to be driven in tightly, and the hole in the centre to form a reservoir for oil. The screws on which the crank-shaft turns may be ⅝ in. diam., screwed with a Whitworth thread and pointed to exactly 60 degrees so as to fit well into the holes in the crank-shaft; these screws can be tapped into the beech wood standards so as to fit pretty tightly, and they will hold very well without any metal plate or backnut. If you are 5 ft. 6 in. in height, your lathe centres, from the floor, should be about 3 ft. 6 in.; if higher you will get too many chips in your face; if lower you will not see so well. The top of your lathe bed will, therefore, be 3 ft. 1 in. high. It would not do to incline the connecting rod or pitman 30 degrees, as you propose, but it may be inclined a little, as shown in the Fig. I send; the effect is to lengthen the down stroke and make the foot rise rather faster, which is an advantage in running forwards, but a disadvantage when running backwards, as you want to do in sand papering.—F. A. M.

**Electric Detector.**—MINING DETECTOR.—You evidently have an ordinary linesman's current detector or galvanometer with the dial marked in degrees of the arc of a circle, numbered from 1 to 60 on each side of zero. When you send the current from one cell of a battery through the instrument, the needle is deflected to 30 degrees; with two cells you get a deflection of 50 degrees; and with three cells you get a deflection of 60 degrees. Now you wish to know the value of those degrees. I fear that I shall not make the value clear to your mind by stating that it is "as the tangent of the angles of deflection," so will try to simplify this statement by saying that the value of the deflection increases disproportionately with the distance of the needle point from the zero mark. From 1 to 20 the degrees will indicate proportional strength of current passing through the instrument—that is to say, a deflection of 20 will indicate a strength twice that of 10. But, from this upward, we may put down 30 as 15 × 2 + 3·076; 40 as 20 × 2 + 8·066; 50 as 25 × 2 + 18·275; and 60 as 30 × 2 + 39·220. You will not be safe in taking even these figures as being absolutely correct, since the grading on the dials of these instruments is not made to a standard, nor are the needles all made of the same weight. This short table will, however, give you some idea of the value of the deflections, and enable you to make rough approximations of the strength of the current from your cells. The use of this instrument in the hands of a linesman or electric bell fitter is to test lines for leakage of current, and to give a rough idea of the strength of a battery. For instance, he knows that the current from a cell in good condition should deflect the needle to 30 degrees. If it fails to do this, he knows that the battery is getting weak. The value of the deflections is not given in volts or ampères, but there are instruments made which are so graded as to indicate the strength of the current in volts and ampères by the deflections of the needle. Volts represent the pressure of the current; ampères show its volume, or bulk, so to speak. Thus, a current of 1 volt will represent the pressure (E.M.F.) of that obtained from one cell of a Daniell battery; whilst a current of 1 ampère will represent the volume of electricity obtained through a resistance of the ohm when the pressure or E.M.F. is 1 volt. Taking water as an analogy, the ohm may be said to represent the dimensions of a pipe, and the volt the pressure or head of water, whilst the ampère will show the volume of water obtained through the pipe. This is the nearest I can do for you in the way of simplifying these terms.—G. E. B.

**Telescope.**—T. H. (*Spennymoor*) wants to know first, "The proper method of mounting the various glasses that they may be correctly fixed in their places." From a former remark made it is evident he wishes to work with as little cost as possible, and has mentioned a paper tube. I thus take for granted he does not use a lathe. Make a cell for the object-glass thus:—Procure a piece of brass tubing large enough to take the object-glass, and cut off 2 in.: cut the ends perpendicular to the length. Anyone who has a lathe would be pleased to do this. In the next place cut a disc of sheet brass 4 in. diameter, to which solder the tube, leaving ½ in. all round. Cut out the centre, leaving the opening ½ in. less than the tube; this will form a bed for the lens to rest on. This opening can be cut with an ordinary hand fret saw. I have sawn stout sheet brass repeatedly thus. Take another piece of tube and cut a slit in it, so that it may be sprung into the cell now made. Place the lens in its cell and spring in the slit tube and the lens will be held firmly: it may be further secured by means of a bayonet joint. Four small holes must be made in the flange to take screws. Now get a turner to turn a wooden ring 2 in. wide, ⅜ in thick, and of a diameter large enough to admit the paper tube made. When the object-glass is secured by the spring in its place, it can be attached to the tube with four screws. Of course, this is rather a clumsy way, but it will be efficient and not costly. Secondly, the probable cost of an ordinary object-glass of 3 in. diameter and about 36 in. focus, also price of an achromatic of similar dimensions. An ordinary object-glass 3 in. diameter and 50 in. focus may be procured from 5s. 6d. with lenses for eye-piece; achromatic, 3 in. diameter, about 45 in. focus, from £4 to £6, according to maker and quality. Thirdly, eye-pieces. The optician supplying the object-glass would send the lenses required; they will cost about 2s. An article is in the hands of the Editor on the construction of eye-pieces, which will supply every particular needed; that being the case, I will save space here. Lastly, the best house to purchase from. Without undertaking to say which house is the best, I would say that repeatedly have I done business with Lancaster, Birmingham, and have always found satisfaction. Should T. H. not like the primitive plan suggested, and can command a screw-cutting lathe, then he will find in another answer over my initials the proper method of making and mounting cells.—O. B.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Flower-Pot Cases.**—INQUIRER writes:—"Could any of your numerous readers oblige by giving the name and address of a firm or firms where ornamental flower-pot expandible envelopes (wood) can be had?"

**Darning Weavers.**—MART writes:—"Will any reader of WORK please give me address of firm that make the Patent Darning Weaver, with price of same?"

**Wool Winder.**—MART writes:—"Will some kind reader of WORK please give me a design and the construction of a wool winder—one to stand on the table and wind the wool into balls?"

**Canoe Building.**—CENTRE-BOARD CANOE writes:—"Will some practical hand kindly answer the following?—(1) How is a canoe keel built to take a centre-board? Please give rough sketch. (2) Does the special form of keel cause any difficulty, or necessitate a different method in fitting on the first plank (or garboard streak, as I believe it is called)? If so, please give sketch, and say how difficulty is to

be overcome. (3) What thickness of wood should be used for centre-board well? How is it put together, and how is it attached to keel? Sketch would much oblige. (4) Please give the special advantages of mahogany or cedar, as compared with pine, for canoe building, and say if oak (best white English) would make much difference in the weight of the craft, or be more difficult to mould to shape. This question refers to the planking. I have no steam killer, and wish to do without one."

**Invisible Printing.**—TULIP writes:—"Could any reader tell me what kind of stuff is used to print with on cardboard, etc., that is invisible in the daytime, but can be seen in the dark?"

**Pipe Mouthpieces.**—C. H. C. (*Manningham*) writes:—"Will any reader kindly tell me how vulcanite pipe mouthpieces are polished?"

**White Metal.**—L. S. L. (*Kirkcaldy*) writes:—"Would some correspondent kindly give me some information about white metal? I am constantly coming across articles made from it, and it appears to me to be such a useful and cheap substitute for silver for many purposes, that information as to its precise composition, properties, and applications would be acceptable to many of the readers of WORK."

**Pins.**—A. W. B. (*Bristol*) writes:—"Can any reader kindly give me some particulars as to the manufacture of pins, the district where principally made, and names of two or three firms engaged in the business."

**Saw Bench.**—WOODWORKER writes:—"I have read CHOPSTICK'S note on Hand Sawbench in WORK, No. 135, p. 491, and I wish to know whether he or any of our readers can instruct me as to the making of one such as he describes."

**Taps.**—D. G. C. (*Bradford*) asks for "the address of any firm where I can buy taps made of iron exclusively."

**Handles for Driving Whips.**—E.E. S. (*Newton Abbot*) writes:—"Can any reader give me the address of a shop where I can get handles for driving whips?"

**Modelling Wax.**—CARVER writes:—"Can any reader inform me how to make modelling wax, and what articles to make it with?"

**Razor Case.**—J. A. (*Gristhorpe*) writes:—"Could anyone give me a design for a razor case?"

**Markets for Wood Carving.**—F. G. W. (*Kettering*) writes:—"I would like to know of some exhibition where I could enter a carved oak mantelpiece recently designed and executed by myself. If any of your correspondents can tell me of any such exhibition, I shall be much obliged."

**Colour Matching.**—CONSTANT READER wants to know the best book on matching colours, with colours in book, and how to make them.

**Gum.**—GUM writes:—"Will anyone please give me a good recipe for making gum liquid—something that will keep so, and without becoming musty?"

**Re-transfer Ink.**—W. E. (*Bristol*) writes:—"Can any reader of WORK tell me the way to make re-transfer ink from plate to stone?"

**WORK Exhibitions.**—YENNIL writes:—"Will you kindly say if there will be any sort of exhibition this year, or early next, where small inventions may be exhibited? I have taken out a provisional protection for an improved mangle and wringer, and should like to get it, or the improved part, exhibited."—[There will be no WORK Exhibition again for the present, but local workmen's industrial exhibitions are constantly being held all over the country. You should watch the public announcements in the daily newspapers. In the meanwhile, I shall always be glad to receive from secretaries and projectors of such exhibitions early intimation of plans and intentions in this respect, in order to give them prominence in WORK.—ED.]

**Model Yacht Fittings.**—T. H. S. (*Newport, Mon.*) writes:—"Not having seen an answer in the columns of WORK for deck fittings and rigging of model yacht, 4 ft. long, I would be glad if one of the readers would give an insight of same."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Colouring Bright Steel Surfaces.**—H. B. S. (*Liverpool*) writes:—"BARIUM asks for a method of colouring steel articles (see p. 542, No. 138). Why not colour them in the usual way, which really means tempering them by heat? The heat required for tempering watch-springs, etc., which gives a bright blue to the articles, is only 288° C., and cannot be considered high. The method used for small flat objects is to heat them upon an iron plate until the colour is attained; then throw them into water. Mercury would cool them quicker, but would be much more expensive. A neat way of proceeding is to have an iron pan filled with fusible metal, and to heat it up to the required temperature, which may be noted on a chemical thermometer, just dipping in the metal. The articles are strung on a wire and placed in the bath, and allowed to remain in the melted metal till they have acquired the temperature of the bath, then taken out and rapidly quenched. I do not know that the latter plan has been used on a large scale—it has on a small scale—but it is worth trying. Keeping the bath at the proper temperature is the chief thing. I may say that pens are coloured by heating to the required temperature in a revolving cylinder. Perhaps the latter plan might suit you. I need hardly say that the articles must be clean and bright."

**Drilling Grindstones.**—STONEMASON writes, in reply to T. A. D. (*Royton*) (see p. 510, No. 136):—"Holes are not drilled in grindstones, but are cut by hand with a mallet and small chisels. The chisels must be kept sharp. It is a stonemasons' job, and I should never attempt to drill holes in grit-stone. Before cutting holes in thin stones, they should be fastened down on another stone with plaster of Paris."

**Measurement of Paraffin Barrels.**—H. B. S. (*Liverpool*) writes, in reply to PARAFFIN (see p. 526, No. 137):—"I think you will find that the '120 tests,' marked on the barrels, has nothing to do with the measurements of the barrels. It evidently alludes to what is known as the 'flame test,' which is conducted in the following manner: A small quantity of the oil, contained in a metal cup, is heated in a suitable manner in a water bath. In the oil is immersed the bulb of a thermometer. At short intervals a lighted taper is passed over the surface of the oil, and when a flash of light is noticed, the oil is giving off inflammable vapour, and the temperature is noted. In your particular case the oil gives off an inflammable vapour at 120° F. This test is necessary, as some of the oils give off an inflammable vapour at little above the ordinary temperature, and these oils are very dangerous. It is required by Act of Parliament that oils of this description should be called petroleum."

**Lapidary Work.**—H. B. S. (*Liverpool*) writes, in reply to SPES MEA (see p. 542, No. 138), upon the cutting of pebbles:—"The apparatus is a lapidary's table, consisting of a small bench with raised sides. Under the table is a fly-wheel and treadle, and the wheel is geared on to another small wheel revolving on a shaft horizontally. The shaft passes through a hole in the table, and upon it small thin wheels of lead, sheet-iron, or wood, may be fixed for the cutting and polishing. The cutting is done by the edge of the wheel of sheet-iron, which is kept moistened with fine emery and water—the stone held against it by the hand or some mechanical contrivance. After the stone is cut, it is rubbed down on the face of a lead wheel with fine emery; it is then polished upon a wood wheel, using rotten-stone and water. The stone must be frequently looked at to see how it is getting on; all the scratches made by the emery must be rubbed out: the polish will appear after a time. Finish on a wood wheel covered with cloth or leather, using a little putty-powder. I think you might make the lapidary's table. All the other appliances may be bought at a paint-shop. The cost of a lapidary's bench, complete, means money. Do you think your few pebbles are worth it? I think your best plan would be to choose a flat face on the pebble, and to rub it down on a flat stone with emery, smooth with rotten-stone, and finish off on a piece of smooth slate with putty-powder and oil; finally, with putty-powder and oil on a piece of smooth glass."

**Drilling Grindstone.**—M. (*Bishop Auckland*) writes to T. A. D. (*Royton*) (see p. 510, No. 136):—"You might try a hollow drill in the form of a tube, fed by coarse sand and water. Unless the stones are very soft, you need not have any notches or teeth on the end of the tube. But why not have the holes made the right size at the quarry? In the Newcastle district the square holes are cut by a mallet and chisel; the grindstone is then mounted on a mandrel driven by steam, and the faces and edge turned with a steel tool. If you get the holes made 1½ in. square at the quarry, you can mount them in your machine as well as having a circular hole, unless you have some other reason for having a circular hole. To the best of my remembrance, the mandrels on which they are turned are circular, the stones being fixed by a plate and screw."

**Model Steam Launch.**—M. (*Bishop Auckland*) writes, in reply to A. M. C. (*Holywood*) (see p. 491, No. 135):—"If you refer to No. 71, Vol. II., of WORK, you will find a plan of steam launch. You can make it of yellow pine, free from knots or shakes, and hollow the inside out, leaving the sides ¼ in. thick. You can get engines from Mr. Lee, of Holborn, who advertises in WORK. If you will send me the size, I will tell you what size of engine you will require, and any other particulars you may require."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—S. (*Bristol*); A. M. L. (*Nuneaton*); F. W. C. (*Dublin*); H. A. W. (*Holt*); H. M. M. (*Bootle*); C. B. (*Regent's Park*); R. A. DE P. (*South Kensington*); W. F. (*Leeds*); W. H. E. (*Crewe*); J. W. (*Plumstead*); P. B. (*Clapham*); J. B. (*Dundee*); GAMMA; H. R. (*Blackpool*); G. G. (*St. Blazey*); P. M. (*Shields*); W. M. (*Heigham*); CHURCH OF ENGLAND TEMPERANCE SOCIETY; E. E. S. (*Bickington*); S. E. (*Camberwell*); W. H. (*Edinburgh*); R. A. R. B. (*Oxford*); C. S. (*Wigan*); E. R. D. (*Sherborne*); NED; J. E. J. (*West Witton*); W. H. B. (*Leicester*); NO NAME; READER FROM THE BEGINNING; W. (*Glasgow*); A. D. (*Dunfermline*); T. G. P. (*Plumstead*); J. D. (*London, E.*); E. W. S. (*Surrey*); WING; A. W. B. (*Glasgow*); F. M. (*Holleslev Bay*); CHROMA; W. S. (*Harrow Road*); F. E. D. (*Bridgend*); R. S. (*Manchester*); J. P. (*Edinburgh*); M. & J. W. (*Conway*); E. P. (*London, S.E.*); H. B. (*Dewsbury*); G. R. E. (*Wakefield*); SCHEMER; T. A. (*Little Bolton*); D. W. K. (*Dumfries*); E. H. (*South Bermondsey*); AMATEUR ELECTRICIAN; W. M., JUNR. (*Norwich*); J. H. M. (*Liverpool*); CONSTANT READER; G. J. (*Didsbury*); J. M. S. (*Hull*); J. R. (*Dalton*); W. R. (*Brixton*); BOOKBINDER; BAROMETER; J. F. (*Paddington*); E. C. (*Folkestone*); AXLE; A. & H. (*London*); A. E. C. (*West Bromwich*); EVER WILLING; W. P. (*Aberdeen*); TRANSMITTER; W. F. H. (*Islington*); INQUIRER; WHITTAKER; W. H. (*West Bromwich*); DOBRA; EVENING.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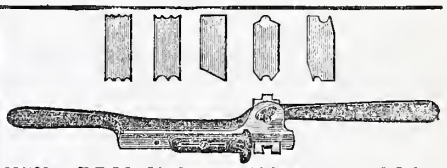

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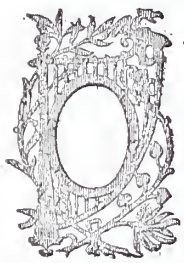

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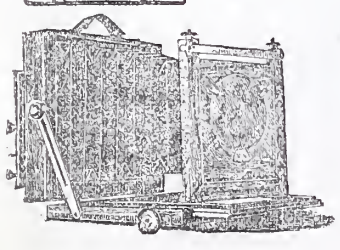

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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VOL. III.—No. 144.] SATURDAY, DECEMBER 19, 1891. [PRICE ONE PENNY.

## MODERN WALL COVERINGS.

### SOME NOTES ON THEIR PRACTICAL AND DECORATIVE ATTRIBUTES.

BY FREDERICK PARSONS, F.S.Sc.

NEW AND OLD WALLS: HOW PREPARED—THE CLAIMS AND QUALITIES OF OIL PAINT, "TEMPERA," AND WALL PAPER—FLAT *v.* GLOSSY SURFACES—PAPERHANGINGS—LEATHER PAPERS AND DECORATIVE RELIEF MATERIALS.

"WHAT shall I do with the walls?" No question relating to the interior of the home comes to the scribe who deals with "Home Art" so often as the foregoing. To whiten the ceiling and carpet the floor are decisions "as a matter of course" to the average householder; but when it comes to the walls, he usually "hesitates and is lost"—or rather, his peace of mind often is. Doubtless, many readers of WORK have already found themselves in the above predicament. Many others will, in time, equally doubtless, be so situated. The capabilities of the "Shop" columns are almost illimitable in all directions excepting that of space; therefore, notwithstanding this momentous question of taste will continue to be asked through all time, it will fairly entitle the writer to the thanks of a patient and long-suffering editor, as well as the present generation of our readers, if we succeed in removing for a time so prolific a claimant for "Shop" space.

Although the ground we try to cover herein is of no slight dimensions, it must not be expected that the substance of folios can be condensed into a paragraph. The intention is rather to enable an inquirer to find within the limits of a brief paper, aided by the knowledge of his own individual circumstances of selection, a useful and correct answer to the opening sentence.

*New and Old Walls: How Prepared.*—In order to obtain the best results, a well made

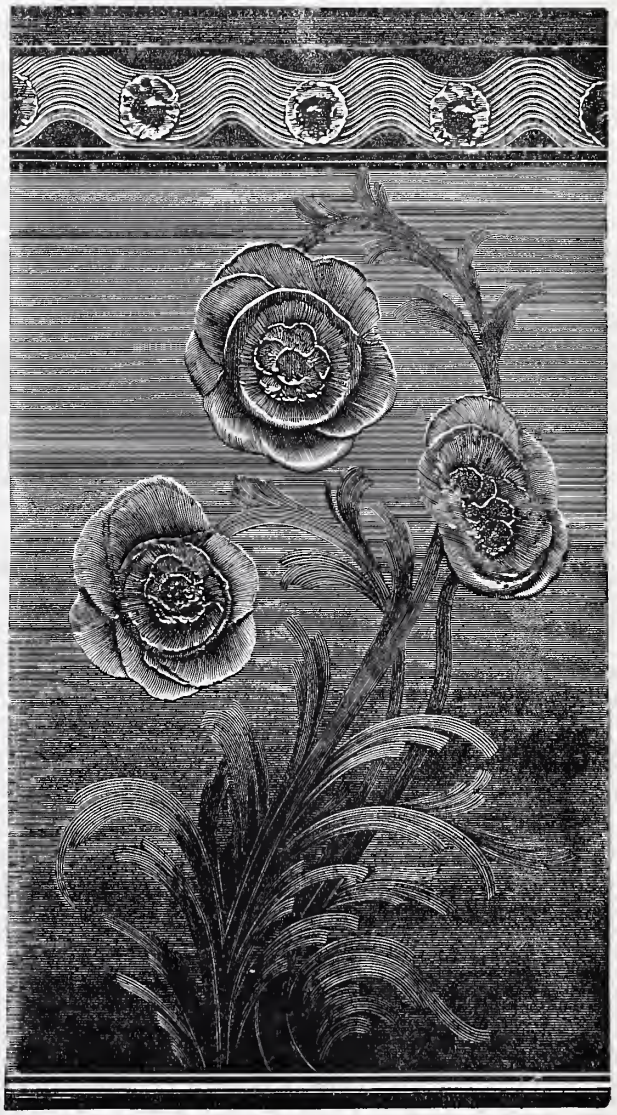


**Fig. 1.—Diaper for Walls (Ecclesiastical). Fig. 2.—Dado and Border: Semi-natural Treatment of Floral Motif (Domestic). Being Reproductions showing the Artistic Possibilities of Alabastine, the most Modern of successful Wall Coverings.**

and finished plaster surface is a *sine quâ non;* but, unfortunately, this is a condition of extreme rarity in the bulk of modern buildings of the cottage and villa type. However, we must make the best of that which we have. All old papers having been removed, and the old putrid paste and size well washed off the surface with warm water and a little soda or carbolic acid therein, we look to the plaster. If the surface skimming is cracked or blistered, cut it out; well wet the surface beneath, and make good to an even face with plaster and lime-putty, or plaster only if in small quantities. All holes and cracks being repaired, we rub down with glass-paper, and proceed according to the finish determined upon. If we adopt white lead and oil painting, see articles in WORK, Vol. I.; distemper or *tempera* processes are also explored therein. We therefore turn to the most favoured plan—wall papers. In fixing the latter, it is necessary to give ordinary plastered walls a preparatory coating of glue-size, diluted to a jelly consistency (when cold), and spread when warm. If this be not done, the moisture from the paste is at once absorbed into the plaster, making it difficult to fix the paper and to ensure proper and lasting cohesion between the two.

*The Rival Claims of Oil Paint, Distemper, or Paper* must be judged from various standpoints, some general to all circumstances, others particular to individual cases. Assuming that an ordinary plastered wall is under consideration, we state briefly the main practical attributes of the three treatments.

*Painted Walls* are somewhat costly, both for time in execution and for material; but, outside this, are certainly very serviceable, permanent, and sanitary, in the common acceptation of the term. With reasonable care, and having once been properly treated, a painted dining-room should last ten years, with careful washing every spring. It has one disadvantage: that in all but well-ventilated places any excess of moisture in the air condenses on the surface and trickles down the walls.

*Distemper*—in which term I include all water paints—is the antithesis of oil paint in many respects. It is not serviceable except in positions beyond reach and abrasion. It cannot be washed as can oil paint, and therefore permanence depends on position chiefly. Its chief qualities are cheapness, the temporary absorption and subsequent giving-off of atmospheric moisture, and the facility with which it can be completed.

*Wall Papers* to a certain extent combine the qualities of utility common to both paint and distemper. The main advantage of a pattern-paper lies in the fact of such giving a partly furnished sentiment to a room; whilst the pattern further prevents the eye noticing the knocks and soils that living-room walls are subject to. The cost of fixing a paper is about the value of distempering the walls; and since we live in an age of marvellously good and inexpensive papers, "you pay your money and take your choice" accordingly.

*Flat* v. *Shiny Surfaces.*—This is an aspect of the question directly connected with the previous treatments, which is well worth a little attention here. In oil-painted surfaces it is possible to finish the work in either a glossy or perfectly lustreless face—the latter appearance being technically known as "flat." The presence or absence of gloss thereon has much to do with the effect upon our mind of any painted wall. A flatted surface is obtained at some small sacrifice of durability; but where permanence is not the great object of using paint, a lustreless effect is infinitely preferable for the walls of all dwelling-rooms. By the judicious intermixing of linseed oil and turpentine, it is possible to vary the "shine" of paint to several definite degrees between the flat and oily extremes. The merits of the former are softness and repose to the eye, added to a full charm of *colour* employed; whilst the latter tries the eye by its reflection of light, destroys all feeling of softness, and mitigates against the effect of any tint employed. If flatted paint is cleaned by those who understand its nature, it is almost as durable as the oil coats; but when the average housemaid gets to work every spring with soft soap and the scrubbing-brush, nothing but the hard and glittering surfaces of oil paint, varnish, or enamel can long withstand these periodical onslaughts. We must, therefore, with respect to painting, choose between flatting and artistic effect on the one hand, and oil and durability on the other. Concerning distemper processes, little need be noted here, since a perfectly dead surface is one of the chief merits of water paints for use in the embellishment of interior walls. Where dados and such-like divisions of walls are permissible, paint may well be used for the lower part, and distemper for those portions out of danger of abrasion. Turning now to gloss on wall papers, we are confronted by a common practice of varnishing such—a practice against which we cannot speak too strongly. We may say at starting, that excepting such papers as imitation "oaks" and "tiles," for bath-rooms and butchers' shops, etc., not one paperhanging in ten can be varnished without great detriment to its appearance. Now, the main purpose of putting design on paper is certainly to increase the *artistic effect* of our homes; whilst, as before mentioned, the pattern prevents wear and tear from showing as quickly as on a plain-coloured surface. To varnish a paper with *copal* varnish (the usual plan) means to destroy the colour, and also all repose of the design. Staircase papers, with which we mainly are dealing, should invariably be cheerful and light in tone. If ordinary copal varnish is spread after twice sizing, as is necessary, upon any light paper, it gives it a nasty, shabby, "twenty-years-old" look; and although *spirit* paper varnishes are made which are almost colourless, they have not half the wear of copal, and, as is common to all, show every little inequality of paper and surface—a definite and lasting eyesore with badly plastered walls. The main and sole advantage of bright-varnishing walls is that they may be washed occasionally. It cannot, however, be too well known that copal varnish, even where washing is to take place, can be entirely dispensed with.

*Flatting, or Dead, Varnish,* although it will also *slightly* alter the colour of a paper, can be applied to such walls at a cost of a few more shillings than ordinary copal. We are of opinion, however, that no dwelling-house walls need be varnished at all. During the last few years sanitary washable papers—viz., papers printed in oil colours—have been greatly improved, and now possess sufficient durability even for staircases and bath-rooms. Not once in a hundred instances is a copal-varnished surface destroyed by fair wear; the householder gets tired and disgusted with it long before, and then the cost and trouble of removing it is an experience desired only once in a lifetime. The house-painter has been responsible for many common offences in his generation; but the worst, we think, must be the introduction and practice of varnishing wall papers.

*Paperhangings and Decorative Relief Materials.*—Having in the foregoing reviewed the practical *pros* and *cons* of my subject concerning wall coverings of comparatively an inexpensive nature, I will briefly notice the claims of the more costly products and materials. But first, a few useful notes on the varieties of ordinary wall papers. These may be divided into three classes, according to *quality, make,* and *surface.* The cheapest are known as "machine pulps," meaning papers in which the ground or pulp is itself coloured, and which are printed on afterward by machinery. They are retailed in prices from 2d. per piece of 12 yards run, to 1s., or even twice that sum, when sold with a good design upon them, and in tasteful colourings, as the speciality of a Regent Street firm. The next grade higher is known as "grounded papers" and "satins." The former term implies that the paper used, being white in the first instance, is grounded all over with the desired tint previous to the pattern being printed thereon. "Satins" are papers in which the ground or part of the design has been polished by the aid of powdered French chalk, etc., to a satin gloss. The value of the two last varieties is from 1s. to 2s. 6d. per piece. "Hand-printed" papers—viz., those having the design blocked on by hand instead of by machinery—are the most costly and artistic of paperhangings, ranging from 3s. to 10s. per piece. We have next the invaluable sanitary papers, made and sold in every range of colour and design, from 1s. to 3s. per piece. Embossed goods and imitation tapestry papers are the grounded and hand-printed kinds which are afterwards treated to a process of embossing, whereby varieties of texture effects are given to the surface, and softness to the colour and design is imparted. "Talc," "frosted," or damask papers are those of the best kinds, in which very silky effects are obtained by the use of powdered glass, etc. "Gold papers," so termed, are such as have parts of the design in gold bronze. If it were only possible to persuade the British public of their unsuitability for walls, the status of English home art would be greatly raised. Gold papers invariably give a flash and garish effect for a time, and then very soon the bronze turns black, and—instead of richness—shabbiness and gloom predominate. Gold papers are, happily, gradually going with "satins" into the list of things that *have been* popular. "Flock papers" are designs printed in flat relief of varying degrees of thickness. They are very expensive; but as it is usual to paint and flat them, a very soft and artistic surface of everlasting wear is obtained. Of leather papers and relief decorations, which are fixed like ordinary paperhangings, only with stronger mixtures of glue and paste, I must here say but little. The qualities of the former are those of the durability of paint, and with every range of artistic effect without the necessity of after-treatment. They range in value from 1s. 6d. to 10s. per yard super. Lincrusta Walton, Anaglypta, and similar well-known decorations, usually require after-painting; but both may now be purchased made in plain or elaborate colourings. Perhaps the most interesting recent addition to the formidable list of relief decorations is the "Alabastine," which has previously been brought to the

notice of our readers, and of which the two panel illustrations will speak volumes for its artistic possibilities and future. In a subsequent paper I will endeavour to further assist the reader respecting the mission of *colour* on our walls, with hints to its successful application.

## A TUNING METRONOME AND MONOCHORD FOR AMATEUR TUNERS AND MUSICAL INSTRUMENT BUILDERS.

BY H. CLARK.

*The Tuning Metronome.*—The simple apparatus to be described in this paper is intended for the assistance of amateur tuners and musical instrument builders, and was devised by the writer to enable him to tune, without professional assistance, a chamber organ which had come into his possession. It is not, however, in connection with *organ* tuning alone that this apparatus is useful, as it is equally useful in the tuning of the piano or harmonium.

The necessity for such an apparatus, and even its utility, may, perhaps, be questioned by professional tuners and qualified musicians, but it is confidently believed that such will not be the case with those who, whilst freely admitting the paucity of their musical acquirements, have still a love for the beautiful art, and are desirous of employing such talent as they possess in overcoming the difficulties which they may encounter in its pursuit. The apparatus has, however, received very favourable professional notice.

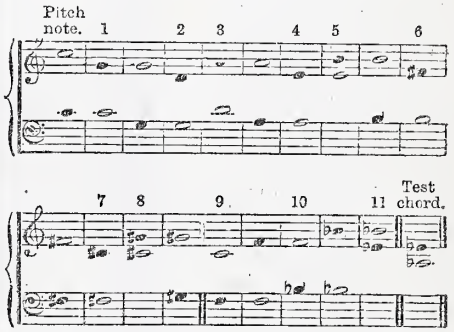
As most of the readers of this article will be aware, with the exception of the octave no musical interval, as rendered by fixed-toned instruments, like organs, harmoniums, and pianos of ordinary construction, is perfect, and it is usually the object of the tuner to so "temper" or distribute the imperfections of the various intervals as to allow of an approximately equal degree of softness and harmony being obtained in whatever key a piece may be played. This distribution of imperfections is termed tuning by "equal temperament."

If we take our place at the piano, and, selecting any note the strings of which are in unison, strike the key belonging to such note, and at the same time very gradually relax one of its strings by means of a tuning hammer, we shall observe a succession of "waves," or "beats," which, commencing slowly, will gradually increase in rapidity, until at length the result of our experiment is extreme discordance. If we strike any "third" or "fifth," a similar succession of slow waves will be noticed, and it is in regulating the rapidity of these waves, which varies as we ascend the scale, that our little apparatus comes into use.

The tuning metronome, shown in elevation in Figs. 1 and 2, consists essentially of a pendulum so suspended as to be readily adjustable to any required length, and is constructed as follows:—Two pieces of 1 in. deal board, 4 ft. long and 2 in. wide, are planed up true and square. At the distance of ½ in. from one edge of each piece a groove, ½ in. in width and depth, is made, as shown at *a*, in Fig. 3, after which the part *b* is planed away to the depth of ¼ in., as shown in Fig. 4. These two pieces are then screwed together with the grooves facing each other, as shown in Fig. 5, thus forming the standard. A strip of hard wood, such as beech or birch, 6 in. long, is then prepared, as shown in full-size section in Fig. 6. This will have to slide with as little play as possible, but without binding, in the T-groove formed in the standard. A flat bit of similar hard wood, 6 in. long, $1\frac{3}{4}$ in. wide, and ½ in. thick, is now to be screwed with a couple of screws to the tongue, *a*, of the slide, which should be left sufficiently high to prevent binding on the face of the standard. A piece of clock-spring, or hard rolled sheet brass, 6 in. long, is formed into a spring, as shown at Fig. 7, and fastened with screws through the straight part into the groove, *b* (Fig. 6), the curved part projecting somewhat beyond the face of the wood. At one end of the grooved face of the standard the wood must be cut away 3 in. long and 1 in. deep—*i.e.*, to the bottom of the T-groove—and a block of hard wood, $1\frac{1}{2}$ in. thick, fitted and screwed into the recess, leaving ½ in. projecting on the face to correspond with the slide described above. Two pieces of brass wire, $2\frac{1}{2}$ in. long and $\frac{3}{16}$ in. diameter, are now taken, and two holes, 1 in. apart and $\frac{1}{50}$ in. or less in diameter, drilled through each parallel to each other, one hole being ⅛ in. from one end of the wire. Two similar holes are drilled through a piece of similar wire, $1\frac{1}{4}$ in. long. The two longer pieces are to be slightly tapered at the undrilled ends. These pieces are then to be tightly driven into the face of the slide and the block at the top of the standard respectively, the holes being kept parallel to the length of the standard, and the inner one ⅛ in. from the wood when fully driven. The pin in the slide must be in the centre of its length, and that in the "head" 2 in. from the top. A pianoforte "wrest-pin" should be fitted into the head at 1 in. from the top and about ⅛ in. toward one side. This, likewise, is to be drilled with holes corresponding to those in the brass pins. A pendulum "bob" of about 4 lbs. weight, and preferably of lenticular form, must now be procured or made. The "bob" of an old "grandfather" clock, if available, will be just the thing. The short piece of drilled wire must be attached at the edge of the "bob," or to the regulating slide if the bob possesses one, the wire being kept parallel to the axis of the bob and at right angles to the slide, if any. A reference to the side elevation (Fig. 2) will clearly explain what is meant. Now lay the standard, face upward, on the work-bench, lay the bob upon it, with its centre not less than 36 in. from the pin in the head of the standard, and carefully mark the position of its top and bottom edges on the standard. These marks must be permanent. Find the centre between these two marks, and so place the slide that the lower side of the drilled brass pin in its face shall be exactly $7\frac{5}{8}$ in. from the centre mark just found, the distance being measured toward the top of the standard. Score across the face of the standard close to the upper edge of the slide and mark the line F—C[1]. Proceed in like manner to set off the following distances from the same starting-point, viz.:—$8\frac{9}{16}$, $9\frac{5}{8}$, $10\frac{3}{4}$, $12\frac{1}{16}$, $13\frac{1}{2}$, $15\frac{5}{16}$, $17\frac{3}{16}$, $19\frac{1}{8}$, $21\frac{1}{2}$, $24\frac{1}{4}$, $27\frac{3}{16}$, and $30\frac{3}{4}$ in., scoring across as before, and marking the lines E—B, E♭—B♭, D—A, C♯—G♯, C—G, $B_1$—F♯, B♭$_1$—$F_1$, $A_1$—E, G♯$_1$—E♭, $G_1$—D, F♯$_1$—C♯, and $F_1$—C. The pendulum bob has now to be suitably suspended. To do this, procure two pieces of hard wire of such a size as will just pass easily through the holes in the brass pins, and sufficiently long to reach from the pendulum bob to the wrest-pin in the head of the standard, with an inch or two to spare. These wires must be attached by soldering or otherwise to the cross wire of the pendulum bob, and threaded successively through the holes provided in the slide-pin, head-pin, and wrest-pin, which last must be twisted a few turns to retain the wires in their places. The foot for the standard is made of two pieces of 1 in. stuff, 18 in. long and 3 in. wide, the end of one being fitted to the centre of the other by a double tenon and mortise, as shown in the elevations, Figs. 1 and 2, and plan, Fig. 8. The standard is made to ride on the part A, Fig. 8, at *a*, where the thickness of A is reduced to ½ in., the solid wood at this part of the standard being removed to correspond. These parts should be well fitted, as a considerable strain is put on this joint when the apparatus is in use. Before use, the length of the pendulum must be so adjusted by means of the nut, *d*, immediately below the bob or by the wrest-pin, *e*, in the head, that the bob is truly centred in the position in which it was placed when the index scale was set out.

We have now a pendulum furnished with a flexible suspension, and so arranged that the touch of a finger will enable us to adjust it instantly as required to any length (and consequently to any speed) desirable. The lengths indicated by the index, commencing at the top and descending, correspond respectively to 11·3, 12·0, 12·7, 13·5, 14·3, 15·1, 16·0, 17·0, 18·0, 19·1, 20·2, 21·4, and 22·7 beats in ten seconds of time, and these rates correspond to the beats or waves heard when the fifths to which they respectively relate are properly tuned.

To use the instrument, middle C is first to be tuned with the assistance of a tuning-fork. We then proceed in the order indicated in the following scheme, in which the white notes indicate those already tuned and the black notes those to be tuned:—




The numbers at the top of the stave indicate the eleven fifths which are tuned successively by means of our apparatus, the test chord at the end being the remaining fifth of the circle. The unnumbered chords are octaves which it is needful to tune in order to keep our work within sufficiently narrow limits. Each octave is to be tuned "perfect"—*i.e.*, in exact concord—*and so left.* Each fifth must also be first tuned perfect, and the interval then diminished by *flattening* the *upper* note when tuning upward, as in intervals 1 to 8, and *sharpening* the *lower* note when tuning downward, as in intervals 9 to 11. The *amount* of flattening or sharpening is to be regulated by the metronome, which must be adjusted for each successive fifth by shifting the slide upward or downward as required until its upper edge lies exactly even with the line on the standard corresponding to the fifth upon which we are about to operate, and then setting the bob in motion. The note being tuned must be flattened or sharpened, as the case may be, *until the waves produced by the tempering exactly correspond with the beats of the pendulum,* when the note will be properly tempered. When the whole of the fifths 1 to 11

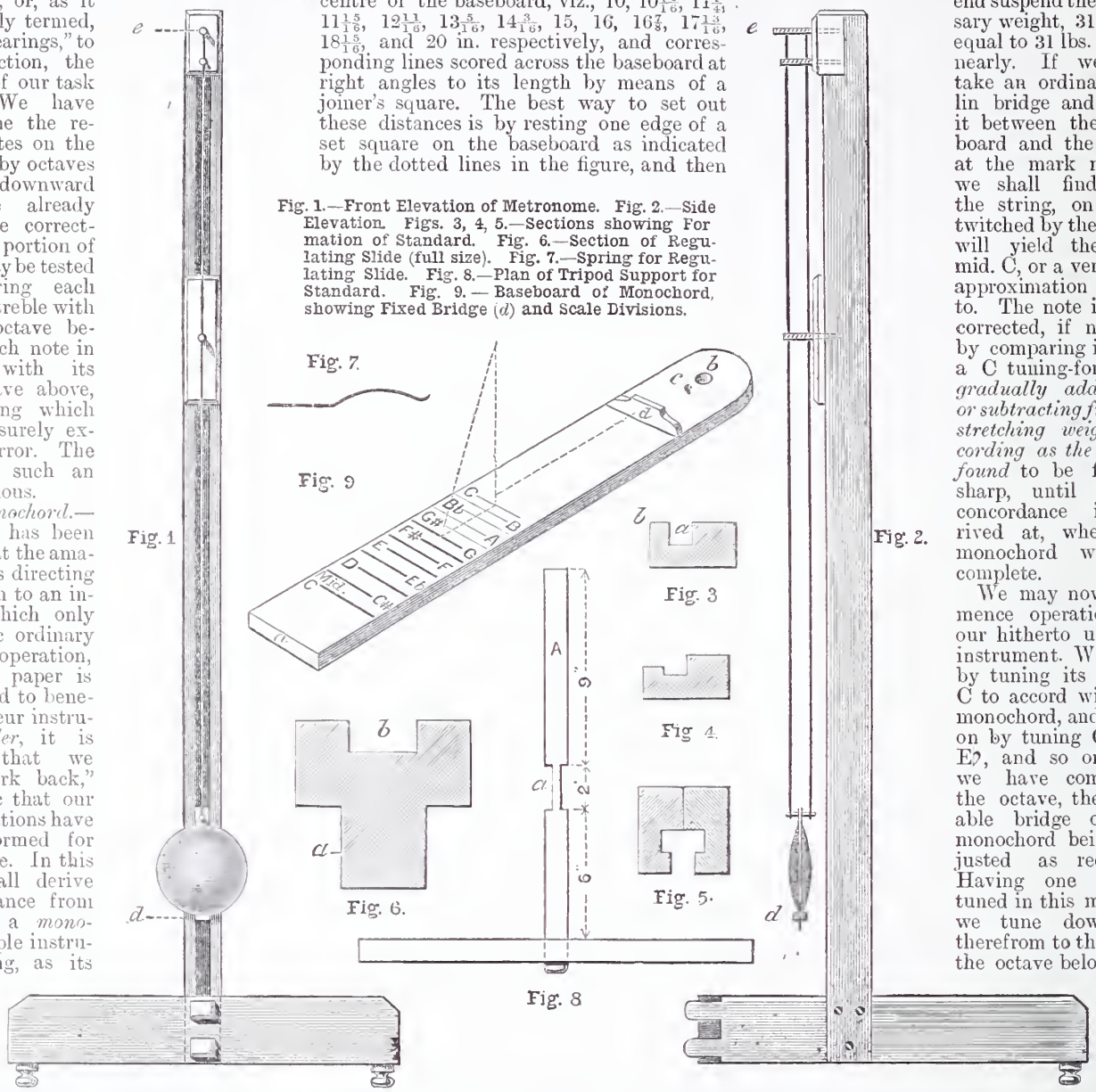
in the above scheme have been tuned in this manner, the result may be tested by trying the chord A♭$_1$—E♭, the separate notes of which have been obtained by working in contrary directions, thus making it a crucial test, which, however, our work should readily stand if proper care has been observed in respect of each step as it has been taken. Should it be found that the test chord is appreciably inferior to others the work must be carefully revised, an operation, by the way, which it is well to perform under any circumstances. Having tuned these notes, or, as it is technically termed, "laid the bearings," to our satisfaction, the remainder of our task is easy. We have only to tune the remaining notes on the instrument by octaves upward and downward from those already tuned. The correctness of this portion of our work may be tested by comparing each note in the treble with its *double* octave below, and each note in the bass with its double octave above, a proceeding which will most surely expose any error. The remedy for such an error is obvious.

*The Monochord.*—Thus far it has been assumed that the amateur tuner is directing his attention to an instrument which only requires the ordinary re-tuning operation, but as this paper is also intended to benefit the amateur instrument *builder*, it is necessary that we should "hark back," and suppose that our tuning operations have to be performed for the first time. In this case we shall derive great assistance from the use of a *monochord*, a simple instrument having, as its name implies, only one string, which string, however, is so arranged as to be capable of being "stopped" in such a manner as to produce successively all the semitones between the note to which its entire length is tuned and the octave to that note, the foundation note itself being obtained by means to be described.

The monochord, illustrated without string in Fig. 9, is constructed as follows:—The baseboard, *a*, is a piece of pine 2 ft. 6 in. long, 4½ in. wide, and ¾ in. thick, rounded at the upper end, at 3 in. from which a 1 in. hole, *b*, is drilled as a means by which it may be suspended when in use. At 6 in. from the top this board is crossed at right angles by a "bridge" of hard wood, *d*, 1 in. deep and ½ in. wide at the base, the top edge being reduced to barely ⅛ in. in width, and afterward shaped somewhat as shown in the Fig., leaving only about 1 in. in the centre of full depth. This bridge may be attached by means of a couple of screws passed through the baseboard from behind, and will be all the better for having a flat-topped wire staple driven into the centre of its top edge to assist in sustaining the pressure which will be brought to bear upon it. The following distances must be carefully set off from the centre of the fixed bridge along the centre of the baseboard, viz., 10, $10\frac{1}{16}$, $11\frac{1}{41}$, $11\frac{15}{16}$, $12\frac{1}{16}$, $13\frac{5}{16}$, $14\frac{3}{16}$, 15, 16, $16\frac{7}{8}$, $17\frac{13}{16}$, $18\frac{15}{16}$, and 20 in. respectively, and corresponding lines scored across the baseboard at right angles to its length by means of a joiner's square. The best way to set out these distances is by resting one edge of a set square on the baseboard as indicated by the dotted lines in the figure, and then taking the measurements from the top of the bridge to a point 1 in. from the right angle of the square. A mark made on the baseboard at this angle will be at the correct distance. The lines so set out are to be marked at one or both ends, C♮, B, B♭, A, G♯, G, F♯, F, E, E♭, D, C♯, and mid. C respectively. We now insert a small screw-eye at *c*, and are ready to string our instrument. To do this we take a piece of small-size piano wire—about No. 24 B.W.G. will be found suitable—*very carefully measure off 38¾ in., and ascertain its weight in grains.* For example, taking a piece of wire about 4 ft. long, we stretch it tightly between two wrest-pins or screws inserted in a plank and carefully measure and mark off the required length, which we then cut off as accurately as possible at the marks made, and ascertain its weight. Suppose this to be 31·7 grains. *This is the weight in pounds avoirdupois by which the string of our monochord must be stretched to cause it to produce the sound mid. C when vibrating at its full length of* 20 *in.* We now twist a small open loop at each end of the wire, which we then attach by one end to the eye, *c*, at the upper end of the baseboard, which must be suspended to some convenient nail by the hole provided for the purpose, and to the other end suspend the necessary weight, 31·7 lbs., equal to 31 lbs. 11¼ oz. nearly. If we now take an ordinary violin bridge and insert it between the baseboard and the string at the mark mid. C, we shall find that the string, on being twitched by the finger, will yield the note mid. C, or a very close approximation thereto. The note is to be corrected, if needful, by comparing it with a C tuning-fork and *gradually adding to or subtracting from the stretching weight according as the tone is found* to be flat or sharp, until perfect concordance is arrived at, when our monochord will be complete.

We may now commence operations on our hitherto untuned instrument. We begin by tuning its middle C to accord with the monochord, and follow on by tuning C♯, D, E♭, and so on until we have completed the octave, the movable bridge of the monochord being adjusted as required. Having one octave tuned in this manner, we tune downward therefrom to the F in the octave below and then bring our tuning metronome into use as before described.

**Fig. 1.—Front Elevation of Metronome. Fig. 2.—Side Elevation. Figs. 3, 4, 5.—Sections showing Formation of Standard. Fig. 6.—Section of Regulating Slide (full size). Fig. 7.—Spring for Regulating Slide. Fig. 8.—Plan of Tripod Support for Standard. Fig. 9.—Baseboard of Monochord, showing Fixed Bridge (*d*) and Scale Divisions.**




## HOW TO MAKE A DOOR.

BY E. D.

This short paper is to be taken as a practical reply to a question too long for "Shop," embracing the making of a door, put by Cowl (*Belport*).

Figs. 1, 2, and 3 show the front elevation, vertical and horizontal sections, of a four-panelled door. The horizontal bars are called the top, middle, and bottom rails respectively; the vertical pieces the stiles

(hanging and lock); the centre-pieces the muntings, or mullions; the panels top and bottom, as the case may be.

Fig. 4 shows the various pieces, with their names, showing how the door appears when it is all ready to go together. The mouldings are left out, for the sake of clearness.

Fig. 5 shows the door partly put together, with the panels omitted.

The method of procedure is as follows:—

First cut off and joint your panels to the width required (that is, if they are more than 11 in. wide, for up to this width you can buy stuff without any very great extra expense, but after 11 in. wide stuff gets very expensive). The joint in panels should

The pieces are now ready for setting out. The way to do this is to first put your two stiles together, face to face, with the tried-up marks inside and upwards; square across both edges about 2 in. up from the bottom, the width of your bottom rail; now from the bottom of the bottom rail measure off the height of your door, and square off the width of your top rail, working downwards. Find the centre of the height of door, and 1 in. above the centre square across the top of the middle rail and the width, working downwards. The inside of the top and bottom rails, and both sides of the middle rail, having to be ploughed for the panels, ½ in. deep, it is quite evident that the tenons

as long as the plough groove is deep. This is termed the haunching. Now allow ½ in. above and below all the marks you have made for your mortises for the wedges, turn your two stiles down, still keeping them together, and square the mortises round to the opposite edges. The marks for the wedges are generally only put on the outside edges of the stiles, as they are not necessary on the inside edges—in fact, are apt to be very confusing.

Now lay your mullions on the stiles, and square them round to the distances between the top and middle and middle and bottom rails: not between the tenons, mind. This will give the cutting line for the shoulders. Now

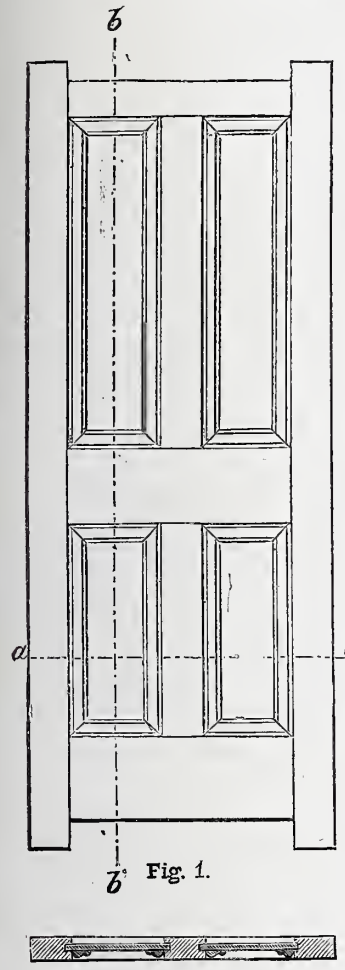


Fig. 1.

Fig. 2.


Fig. 3.

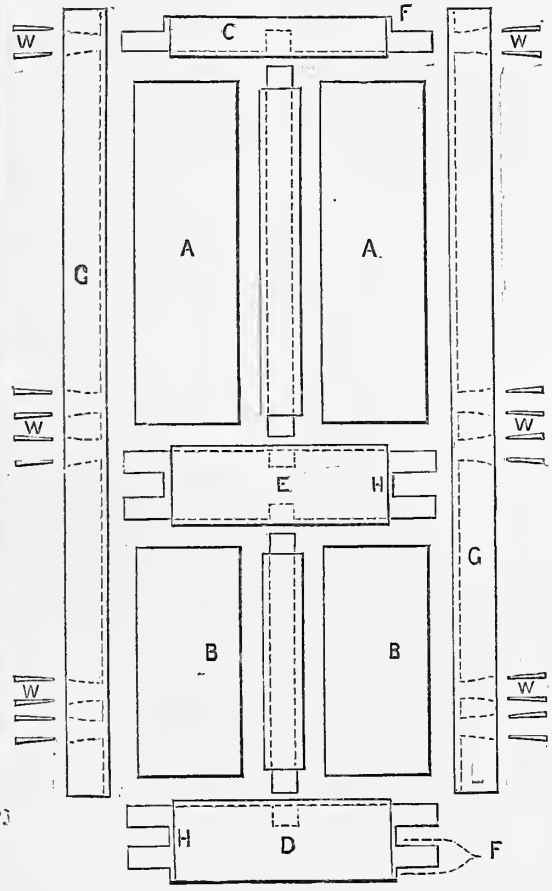


Fig. 4.

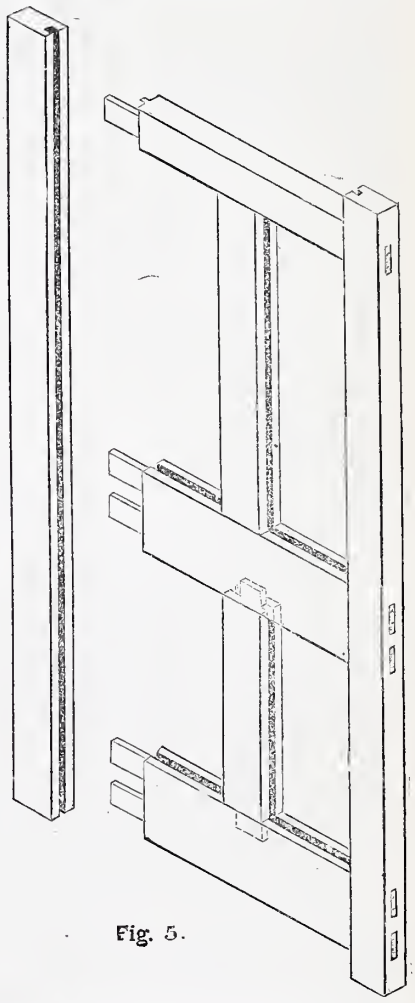


Fig. 5.

**Fig. 1.—Four-Panelled Door: Front Elevation. Fig. 2.—Ditto: Vertical Section. Fig. 3.—Horizontal Section. Fig. 4.—Various Pieces of Door, except the Mouldings—A, A, Top Panels; B, B, Bottom Panels; C, Top Rail; D, Bottom Rail; E, Middle Rail; G, G, Stiles; H, Shoulder; W, Wedge. Fig. 5.—Door partly put together, with Panels omitted.**

be what is known as tongued and grooved. Now rip out the stuff for the stiles. These are generally what is termed 4½ in. wide—that is, a 9 in. board cut down the centre. The top rail should be the same width as the stiles; the middle and bottom rails should be 9 in. wide. The stiles and rails must now be planed very straight, and out of winding on one face, and one edge shot perfectly straight and square with this face. If possible, try and arrange that this tried-up edge works with the grain, so that when you plough for the panels you do not have to work against the grain. Put a tried-up mark on the planed face and edge. (See p. 696, Vol. I.) Next gauge your various pieces to as wide a width as the stuff will hold up, and thin or gauge to a general thickness.

on those edges of the rails will be ploughed out, so set up and down, as the case may be, ½ in. on the edge of stiles—this will give you the inside edges of the mortises. Next set down, 1½ in. from the top of top rail, and 1½ in. up from the bottom of the bottom rail, and this will give the width of all your tenons; but as the bottom and middle rails are so wide that to make a mortise as wide would greatly diminish the strength of the stiles, there is generally two tenons, formed as shown. (See Fig. 4.) In good work there are always four tenons on the end of the middle rail that take the lock, so that the lock passes between the tenons, and does not weaken the door so much. A piece is left between the tenons of the middle and bottom rails and above the tenon of the top rail, and below the tenon of the bottom rail,

take your rails: lay the bottom one on the bench face upwards, on top of this the middle rail face upwards, and then the top rail face downwards, keeping the tried-up edges towards you. Square down the distance between stiles and the width of mullion in centre, allowing the mortise for the mullions ½ in. less on each edge for the plough groove. Take the middle rail out, and square over to the opposite edge for the mortise for the top of bottom mullion; square over the shoulders of the rails of both sides, and then with a mortise gauge, set to the thickness of the panels, which should be just under the third of the thickness of the framing, but of such a thickness that will suit your plough iron and mortise chisel.

Now cut the tenons, make the mortises, and plough for the panels, taking care that

all your gauging and ploughing are done from the tried-up or face side. After ploughing the stiles and rails, plough a groove in the same manner across the end-way of a piece of stuff, about 4 in. long, 2 in. wide, and the same thickness as the stiles. This is called a mullet, and is used for gauging the thickness of panels.

The framing should now be knocked together, and see that all the shoulders are up. By doing this, you know that if the shoulders do not come up when you get the panels in, the fault is in the panels, and not the framing. Now having got the door together, you can easily get the exact height and width of your panels, which should be now cut off to the exact size, allowing them a trifle narrower and shorter, so that they do not stop the framing from coming together all right. Plane up one side of the panels, and then try to get the grooved mullet on the edge all round, reducing them until you can do so. You may then be sure that the panels will go into the grooves in your stiles and rails quite right, because a similar groove has been all round them. Knock off the stiles, put in the panels, cramp the door together, to see that everything is as it should be, prepare your wedges, and you are ready for gluing up.

The method of gluing up a door is to lay two pieces across the bench as long as the width of the door. See that they lay out of winding, and are just a little above the bottom rail and below the top rail, so as not to interfere with the cramp. Take the door to pieces, glue the mullions into the rails, taking care that no glue gets into the panel grooves, put in the panels, and knock the stiles on as quickly as possible, but not quite home. Now glue as much of the tenons as is left exposed between the shoulders, and cramp up; drive the wedges of the middle rail first, then the bottom, and lastly the top rail, wedging the bottom rail upwards on to the bottom mullion, and the top rail down on to the top mullion. Now set the door on one side, to allow the glue to dry. When the glue is dry, take the two pieces off the bench, lay the door flat down, and cut a piece of wood thinner than the door, tightly between the horns, above and below the top and bottom rails; nail these pieces to the bench, and they will hold the door firmly whilst you clean it off and put in the mouldings.

In bradding in the mouldings, care should be taken that you do not nail into the panels, but into the framing, for if you fasten the moulding to the panels they cannot shrink (not that they ought to), and so split up the middle, or wherever they are jointed. After this is done the door is completed, with the exception of cutting off the projecting ends of wedges and the horns; but the horns are generally left on to protect the rails, etc., until the door is fitted into its place.

In giving this description of making a door, I have assumed that you are conversant with the method of making the mortises, cutting tenons, and planing up stuff, or you would never attempt to make a thing that could be bought for the same money as you could buy the materials, if bought in small quantities, allowing for waste, etc. But if you only want to make it for the pleasure of doing so, I should advise you to first thoroughly digest the above, and then buy an old door for about a shilling; cut it right across the lines marked *a a* and *b b* in Fig. 1, and this will give you a practical demonstration of the horizontal and vertical sections.

## CONSTRUCTIVE STRENGTH IN METAL WORK.

BY J. WHITFIELD HARLAND.

HYPOTHESES CHALLENGED—SIR WM. FAIRBAIRN AND HODGKINSON—TAY BRIDGE—SIR JOHN FOWLER'S CONDEMNATION OF RAILWAY BRIDGES—NEUTRAL AXIS NOT ALWAYS, IF EVER, CENTRAL—SUGGESTED EXPERIMENTS—WROUGHT IRON PREFERABLE TO CAST—USE OF STEEL TO SUPERSEDE THAT OF WROUGHT IRON—REITERATED TRANSITORY LOADS—CONTRACTION AND EXPANSION—BOX-GIRDERS: THEIR COMPARATIVE STRENGTH—DISHING OR CORRUGATING PLATES—DOUBLE BOX-GIRDER BRIDGE—DRILLING RIVET HOLES PREFERABLE TO PUNCHING—TANKS: THEIR SHAPE, CAPACITY, WEIGHT OF CONTENTS—STAYS—CROSS-STAYS—BEARERS FOR—CONCLUSION.

I HAVE endeavoured to show in former papers how to counteract forces known to be in imperceptible action in all constructions tending to destroy them, either by carrying them off harmlessly or by pitting one against the other, and thus neutralising them; but a few important items yet remain that seem to me worth reasoning out in the same connection.

My former hypotheses on one or two points have been pointed out by correspondents (see "Shop," p. 363, Vol. III.) to be open to the charge of being contrary to the leading engineers' teaching of to-day. I would say that I do not write by any means as an authority, but suggest the probability of error in practice. Until the experiments of Hodgkinson and Sir Wm. Fairbairn, the proportions of the upper flange of a girder to the lower flange were not understood *by the then authorities* to have any ratio to the difference between the resistance of cast iron to compressive and to tensile strains; so much so that Sir Wm. Fairbairn, in his "Application of Cast and Wrought Iron for Building Purposes," states that "very commonly girders were laid indiscriminately either side up," it not being thought that it made any difference! Is it not, therefore, possible that there is still something unknown to present authorities?

That there is, and has been, bad construction, two instances will be sufficient to prove. Sir Wm. Fairbairn showed the weakness of the Tay Bridge so long ago as 1864, if not earlier; and now, on one railway alone, Sir John Fowler has condemned *nearly half the bridges* as dangerous.

I further pointed out that a great responsibility rests on those who construct bridges and buildings, where failure means often a sacrifice of life and limb, and I consider it is their duty to find out by actual experiment the value of any suggestion thrown out. I repeat that I think the centre of the web is the most fatal position for holes (by centre, I mean equidistant between upper and lower flanges).

One correspondent quotes Sir John Anderson: "Holes may be made with impunity in the neutral line." I have not referred to the book to see whether this is in reference to *cast* girders, but supposing that it is so, still this does not absolutely contradict my theory, although it appears to do so, because the neutral axis is not always—if it ever is—equidistant between the flanges. Is it not probable that holes *alter* the neutral axis? I will not here repeat my reasons, already given, for holding this opinion, but suggest that model cast-iron girders (for I limited the remarks solely to cast girders) on a small scale, all off one pattern, could easily be made and subjected to pressure till broken, after the holes had been made in different positions in each; the breaking weight in each case would show the value. In like manner, holes in the upper flange of same diameter, in similar positions relatively to the length between supports, being made, such diameter to be, say, equal to thickness of the web, and the breaking weights being ascertained, would give the value for comparison. It is, of course, quite possible that these experiments have already been made; but if so, I have not seen the results. It is true that in modern times the tendency is to substitute wrought iron for cast, because, strength for strength, the former is both lighter and more economical in the long run, and because its elasticity and flexibility are nine or ten times as great, and also from the fact that a warning is given of its fracture by gradually giving way, which the latter does not, so that the value of the above experiments would be much dwarfed. As steel becomes more cheaply obtainable, we may expect that it, in turn, will supersede wrought iron in building construction, it being lighter, strength for strength, still more flexible—and therefore, after deflection by transitory loads, leaving less permanent deflection or *set*—and more fibrous.

It has been established that not only time itself, but the constant application of transitory loads and their removal, in addition to permanent loads, upon all girders, ever reiterated, must in the end result in destruction; but so far it has not been sufficiently subjected to research and experiment. Just as we know that "constant dripping wears away stone," so we know that trains passing over a bridge time after time will ultimately undermine its constitution, and result in its ultimate destruction. We do not know, as yet, the true antidote to administer for deterioration. Therefore, we use more material and increase the strength of construction to a probably safe proportion of three, four, or even six times the greatest possible strain before the calculated breaking strain can be reached. Science will, no doubt, ultimately furnish us with the means of overcoming this tendency to deterioration; at present we ought to be thankful that we know of its existence.

I must disagree with a correspondent who says that in bridges of 40 ft. to 50 ft. span no allowance for expansion and contraction is made—which may be the case—as to its being unnecessary. If the expansion only amounted to ½ in., something would have to give way. However slight the extent might be, still the strain would be there; and in the event of the bridge having been deflected permanently, there would be a tendency to increase still more such deflection. I think I remember being told whilst walking over the top of one of the tubes of the Menai Tubular Bridge that its expansion, in all, had in some cases exceeded 1 ft. in its length. Every schoolboy knows that this was foreseen and provided for.

In my former papers I omitted to mention the so-called box-girder, which consists of the longest possible strips of wrought-iron plate riveted to angle-iron at their edges, to form a square, or, rather, oblong tube, instead of a central web and two flanges. The box-girder has, therefore, two webs, one at each edge of the flanges. Sir Wm. Fairbairn gives the proportionate strength, other things being equal, of the box-girder at 100, the plate-girder (one web) at 93, and the trellis-girder (not the lattice-girder) at 84. It has, however, one drawback—viz., that its interior cannot be re-painted from time to time; but this

might be remedied by the plates being made rustless by the Bower-Barff process at but slight expense, when neither inside nor outside would require painting at all. Certainly, the tendency to buckle must be less in them than in other (single-web) girders. The longer the strips the fewer joints across there would need to be: hence, if possible, the whole of the girder should consist of but one long strip from end to end for each side, for top and for bottom; and if joints are required, the plates should lap over sufficiently for eight or ten rivets in line (chain-riveting, as it is termed), lengthwise.

Of course, a box-girder should be laid, not on its side or widest dimension, but on its narrowest; the deeper it is, within certain limits, the stronger it will be. I am inclined to think that it would be strengthened yet more by fixing inside it crosswise plates fitting its hollow at intervals, and still more by dishing or corrugating the long strips of which its sides are constructed, which would stiffen it still more. This would also tend to take out of the plate the inherent buckle that seems to occur in almost all rolled plates: due, no doubt, to unequal contraction in cooling. The top and bottom might also be corrugated, but lengthwise—not as in the case of the sides, across or merely bellied out to form a slight arch. Whether the extra cost of thus adding to strength and stiffness would or would not discount its advantages is another matter.

For a bridge, it occurs to me that with two girders of the box type, the upper one straight and the lower one arched to a segment of a circle, and so fixed that it should abut on springers at the pier, and, rising, meet the underside, and support at the centre the straight upper girder, good construction would result, and the spandrels thus left might be strutted with radial diagonals or otherwise, or might even be filled up with dished or corrugated plates riveted to angle-iron first riveted to the centre of underside of top and upper side of lower girders. In all riveting operations I should prefer drilled holes to punched ones, firstly, because there is less disturbance of the iron fibres, just as a clean cut is better than a bad bruise; and secondly, because it is easier to set them exactly opposite the corresponding holes in the angle-iron or the other plate, and thus greater accuracy is secured: and as many holes can be drilled simultaneously, the cost of the work can hardly be greater.

In conclusion, I should like to put in a word or two about cisterns and tanks: not that they demand any great amount of science in construction, but because they are, for that very reason, more likely to be attempted by amateurs; and some remarks on them may be appreciated by WORK readers.

Tanks made of galvanised iron, as it is termed, are not really made of this material, but of ordinary iron riveted to angle-iron at the corners and round the open top, and when finished are "galvanised" by being dipped whilst hot in melted zinc—a process which most makers, and, therefore, all amateurs should, delegate to those who make this their business.

The shape of the tank must often be governed by the space at one's disposal: it may be square cubically, or long, narrow, and deep, or long, broad, and shallow, etc., and still hold the same quantity of water. To find its capacity in gallons, multiply its length and breadth together, and then this by its depth, and the total in cubic feet by $6\frac{1}{4}$. Thus, a tank 3 ft. long × 2 ft. wide = 6 square ft. × 1 ft. deep = 6 cubic ft × $6\frac{1}{4}$ (gallons in a cubic foot) = $37\frac{1}{2}$ gallons. To ascertain weight of water, multiply number of cubic feet by 1,000 (ounces in a cube foot) and bring it to lbs.; thus, in this case, $\frac{6000}{16}$ oz. = 375 lbs. when full.

In cisterns or tanks of greater length than 4 ft., unless of very thick plate, a stay should be riveted across to prevent the sides bulging out; when they are also more than 3 ft. deep, another stay, halfway up, should be riveted across, and if the width be over 4 ft., a cross-stay will be necessary; two if it be also deep. Its total weight plus weight of water when full should be ascertained, so as to guard against the bearers on which it rests being too weak to carry it. As it is not a permanent load, but varies as it empties and fills, the bearers ought to be able to bear at least four times its maximum weight.

Such tanks are far preferable to wooden ones lined with sheet zinc, are far less liable to deteriorate, and could readily be made by an amateur, especially if he had a good drilling machine. Do not use copper rivets, but red-hot iron ones; otherwise, should any portion of the galvanising be imperfect, magnetic action would be set up between the copper and the zinc, and the tank would soon leak in consequence. This concludes the *causerie*—for it cannot be called much more—on Constructive Strength in Metal Work, which subject is far too vast for more than mere passing notice of a most superficial character, intended only to show what to expect and what to investigate, and what experiments to try before any important construction is attempted.

## SUB-STAGE AND POLARISCOPE FOR MICROSCOPE.

BY H. B. STOCKS.

SUB-STAGE—UTILITY OF POLARISCOPE—METHOD OF MAKING SUB-STAGE—STANDARD SIZE OF SUB-STAGE—METHOD OF MAKING POLARISCOPE—FITTING OF POLARISCOPE PROPER—OF ANALYSER—PRISMS USED—METHOD OF FIXING SUB-STAGE TO MICROSCOPE—CENTREING.

To those readers of WORK who have a microscope, the adjunct which I am about to describe will no doubt be valuable, as it consists not only of a polariscope, but also of a sub-stage into which many other accessories may be fitted in place of the polariscope, and also when using the apparatus they may be thrown in or out without disconnecting them, which has usually to be done.

The polariscope is a useful adjunct to the microscope for the examination of starches, and also rock and mineral sections, and the price is about £1 4s. for polariser and analyser. As I had a microscope without a polariscope, it occurred to me that one might be made for much less than that sum, and the following is a description of how I made it. Those who have a lathe will find no difficulty in the making, but as I had no lathe I had to get the turning done for me.

Fig. 1 shows a general view of microscope with polariscope fitted, and Fig. 2 underside of stage, showing the two positions of sub-stage. The fitting consists of four portions: (1) The sub-stage; (2) the fitting for polariscope; (3) the polariscope; and (4) the analyser.

(1) The sub-stage consists of a casting of a ring, having a projecting portion upon it of about $\frac{1}{8}$ in. thick. The ring, when turned, is $\frac{3}{4}$ in. deep, and must be perfectly true on the face, and turned inside to such a size that a ring $1\frac{1}{8}$ in. external diameter will slide within it, but will not slip out: what may be called a full $1\frac{1}{2}$ in.; the outside of the ring may be turned down to about $\frac{1}{4}$ in. thick to reduce the weight, leaving the upper portion, the width of the projecting piece, a little thicker. The projecting portion is for fixing to underside of stage of microscope, and will require filing into shape (Figs. 2 and 3).

The sub-stage, being of the standard size, will take any other fitting made of the standard size—*i.e.*, $1\frac{1}{2}$ in., which is the usual one.

(2) Fitting for polariscope.—A piece of tubing is now required $1\frac{1}{2}$ in. external diameter and $\frac{3}{4}$ in. wide; this can be bought. If it is a trifle over $1\frac{1}{2}$ in., turn it down to the proper size. Now cut out a circle of

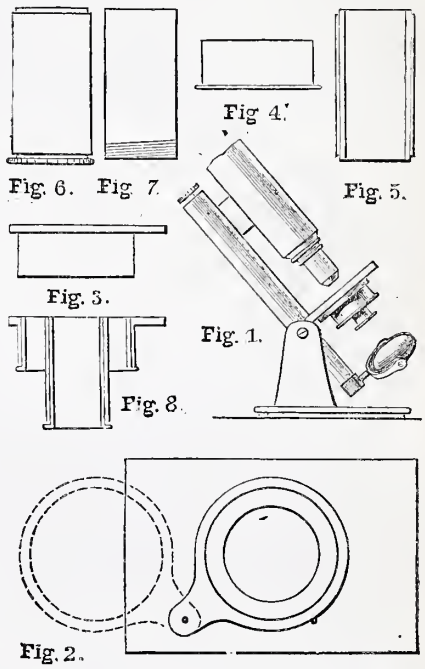



**Fig. 1.—Microscope with Polariscope fitted. Fig. 2.—Underside of Stage, showing Two Positions of Sub-stage. Fig. 3.—Sub-stage. Fig. 4.—Ring and Circular Plate. Fig. 5.—Tubes of Polariscope. Fig. 6.—Polariscope Tube finished. Fig. 7.—Analyser. Fig. 8.—Polariscope and Ring combined.**

sheet brass $1\frac{3}{4}$ in. diameter, and exactly in the centre bore a hole $\frac{3}{4}$ in. in diameter; this will require enlarging slightly to take polariscope. Braze or solder the circle to the ring (Fig. 4).

(3) The polariscope consists of two pieces of tubing, one of which will slide easily within the other; the inner tube is $\frac{3}{4}$ in. external diameter and $1\frac{1}{4}$ in. long., and as it will be found difficult to get a tube to fit over this, a piece of tubing may be taken $\frac{7}{8}$ in. external diameter and 1 in. long. Cut it open lengthways by means of a fret saw, file a little off each face of slit, and solder or braze together again. It will now be a trifle too small; the smaller tube may be turned down outside until they fit (Fig. 5).

Another portion of the larger tube may be treated in the same way and cut into two rings, each $\frac{1}{8}$ in. wide. Braze or solder one of them on to one end of small tube; on the other ring, inside, get a thread turned, and a corresponding male thread on the other end of small tube. Now cut out a

circle in sheet brass 1 in. diameter, and in the centre drill a hole ⅝ in. diameter; solder or braze this circle on to the ring with thread cut upon it, and it will then form a kind of cap, screwing on to the smaller tube. Place the larger tube on to the smaller one, and then screw on the cap. When screwed up tight it should allow the outer tube to move round easily; a drop of oil will help it to do this.

The polariscope tube is now finished (Fig. 6). Solder or braze it into the hole which you have made for it in the 1½ in. ring, having the top of the polariscope flush with the top of the ring, and the screw cap outside (Fig. 8).

(4) The analyser.—Fig. 7 is a plain piece of tube similar to the smaller tube of polariser, with a thread cut on one end to fit thread which is usually cut inside of objective, and it is screwed into the objective before screwing it on to the tube of the microscope, and of course goes inside the tube. If there is no thread inside the objective, then some other method of fixing must be devised; even placing on top of objective will do.

The two prisms of Iceland spar had better be bought; I do not advise anyone to try to cut and polish and cement them, as it is a difficult thing to do. Send inside diameter of small tube of polariscope to any microscope maker, and I have no doubt he will supply them. They are fixed in the tubes by cutting a cork in two, cutting out the centre of the shape of the prism, and putting the whole thing, cork and prism, into the tube, taking care that the prism is exactly in the centre of the tube; if a thin glass circle is cemented on to each end of the corks, it will prevent dust and moisture getting to the prisms.

The difficulty now will be the fixing of the sub-stage to the stage of the microscope. Drill a small hole in projecting portion of sub-stage for screw to pass through; glue to the upper face of the sub-stage a sheet of paper, and make a small hole directly in the centre of the ring (this can be done with compasses). Fasten the sub-stage to the underside of stage by means of clamps somewhere about the right position, and having a moderately strong objective, look for the pinhole in the paper, move sub-stage until it comes into view, and bring it directly in the centre of the field; you will be surprised to see the pinhole, as it will look more like the crater of a volcano than a pinhole. But, however, proceed. Having got the pinhole right in the centre of the field, with a steel point placed in the hole in projecting portion of sub-stage, make a mark on the stage, and bore your hole there, not quite through; tap it (small taps are sold at 6d. and screws at 6d. per dozen, very suitable for this kind of work), and having filed the screw to the proper length, screw on the sub-stage. Also fix a peg for it to rest against when in proper position (Fig. 2).

It is important that the sub-stage be properly centred, otherwise on revolving the polariscope the field of view does not appear properly dark and light, which is essential for good work.

For the properties of polarised light see WORK, page 389, September 7, 1890; and the lacquering has already been described in "Shop," so there is no necessity for me to say any more on this part of my subject here. To save readers the trouble of asking where the instructions have been given, let me suggest a search in the index to each volume, which every amateur workman and reader of WORK should possess and use.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

SETTING OUT, INVOLVING THE USE OF THE SQUARE AND GAUGES.

We have dealt with the plane and saw, only using the square to test the accuracy of our planing, or to make guide lines for sawing. This naturally leads on to "setting out," in which judgment is required. First, as to the joinings required. In order to make, say, a table top, the use of the plane is required, as has been described. There are several lessons on the subject in Vol. I., to which refereuce should be made. Such joints are to add to the width of wood, or to allow it to be made into articles for which one width of stuff is not sufficient. Then there are a multitude of joinings to unite pieces at right angles to each other; of these, the dovetail and the mortise and tenon are, perhaps, the most important, though other joints are of constant occurrence. When two pieces, say, 6 in. wide and 1½ in. thick, are to be joined at right angles, if the joint is in the width, or the 6 in. of each united, then dovetails are usually suitable; if the edges, or the 1½ in. surfaces, are to be joined at right angles, the mortise and tenon will be, no doubt, more eligible, but much depends on the direction of the grain, as tenons are only suitable when at the end of a rail, and mortises are only available when chisel cuts at right angles to fibre of wood.

If mortise and tenon are chosen, appearance and custom suggest that the mortises should be cut in the vertical pieces, or stiles, as they are usually called; this implies a vertical joint, and that the vertical portion of the frame is continued to the base. An illustration may be found in doors and shutters. If the wood is joined like the sides of a box, probably dovetails will be more suitable.

In either case the use of the square and gauge must be acquired. We will first look at the tenon. This is formed by cutting away part of the wood at each side. Generally, but not always, the surfaces of the tenon are parallel with the surface of the wood; a gauge is therefore a proper instrument to mark the lines to guide the sawing of the tenon. As the tenon is of uniform thickness, a gauge with double teeth may be used; this is called a mortise gauge. The mortise gauge is set so that the distance between the two points is equal to width of chisel used to make the mortise.

The mortise also is usually parallel with the surface of the work, so this gauge, which might with equal truth be called a tenon gauge, is applicable to both purposes.

The proportions of mortise to the work are not very definitely fixed, but custom has fixed the width of the mortise at about one-third of the thickness of ordinary work, or a trifle more. rather than less. As suitable chisels are made for mortising to every $\frac{1}{16}$ in., between useful limits, we can easily find one suitable for any purpose or thickness of wood. The width of the tenon is generally about two-thirds of the width of rail, but in some cases, internal rails for instance, they are often the full width of the wood. Tenons that are too wide, however, are apt to become loose through shrinking. In wide rails, therefore, two or more narrow tenons are preferable to one wide one.

In order to ensure correctness and good work, the rule, square, and gauge cannot be used too much.

## STAGE CARPENTRY.

BY WILLIAM CORBOULD.

PRACTICAL DOORS AND WINDOWS—MODE OF MAKING DOORS AND WINDOWS—SPRINGS, DOGS, ETC.—VAMPIRES—HINGES FOR VAMPIRES.

*Practical Doors and Windows.*—In scene painting, doors and wiudows are, of course, frequently painted, but it is of those which are used in a practical manner that I wish to treat here. These are generally made in cottage set pieces or in flats. I must here explain. A cottage set piece is usually set from one of the wings, as shown in Fig. 14. Flats, on the contrary, are two built pieces seut on from each side of the stage, meeting in the middle, and buttoned or hooked together, forming one flat surface, similar to a cloth when rolled down. At the same time a flat may be drawn up where there is room to do so, but then it would be made in one instead of two parts. We will suppose that a cottage is either on the right or left side of the stage, usually called the P. and O. P. sides—that is, "prompt" side and "opposite prompt."

*Mode of Making Doors and Windows.*—The door or window of a cottage is made with the same framework as the set piece, covered with canvas the same. When making it leave a good ½ in. all round, so that it may work easily. Use back-flap hinges: those about 1½ in. or 2 in. will be found to be strong enough. There should be an india-rubber spring on the front of the door at the top corner, so as to ensure its closing after passing through, as there may be scenery on the other side, or inside of the cottage, which would not be appropriate if the door should not close. The cottage might be standing in front of a foliage or rock scene, instead of showing the inside of a cottage. Therefore, as soon as the person has passed through the door should close. By the same rule windows should do the same.

*Springs, Dogs, etc.*—In Fig. 14, D is the wing, C the cottage, B the sky border. The spring is seen fixed at A. These springs are bought at about 7d. each. They are shown in Fig. 15. A shows the spring; the rubber is bound round two brass eyelet holes; one end is fixed on the doorpost with the screw, B, the other end is caught by the hook, C, fixed on to the door, as at D. Cottages or set pieces are usually held in their place firmly by the use of dogs. There are several ways of making these; the most simple one is dog No. 1, which is shown in Fig. 16. Dog No. 2 has a twisted half screw at one end, and the dog, when being fixed, is held on one side, the twist being put into the eye and the other end brought down to the stage and fixed with a stage screw, B. Dog No. 3 would be fixed with two small stage screws or screw-eyes, one to the set piece and the other to the stage. Sometimes a staple or screw-eye is put into a wall or post, one in the set piece, which may be held by a dog, as shown in Fig. 17. Another good way of fastening, which I invariably adopt when possible, is to tie with a piece of cord. Have a screw-eye in the set piece with a piece of good cord, such as small sash-cord or Venetian blind cord: keep this on the set piece so that it is always ready when placing it in position. Have another screw-eye in the wing, or whatever the piece may be set against; slip the cord in, and make fast by a good slip-knot. This method of tying is much safer than hooks and eyes, as these often come undone, which should be avoided: all fixings should be made as safe as possible, rendering accidents almost impossible.

*Vampires.*—We now come to the making

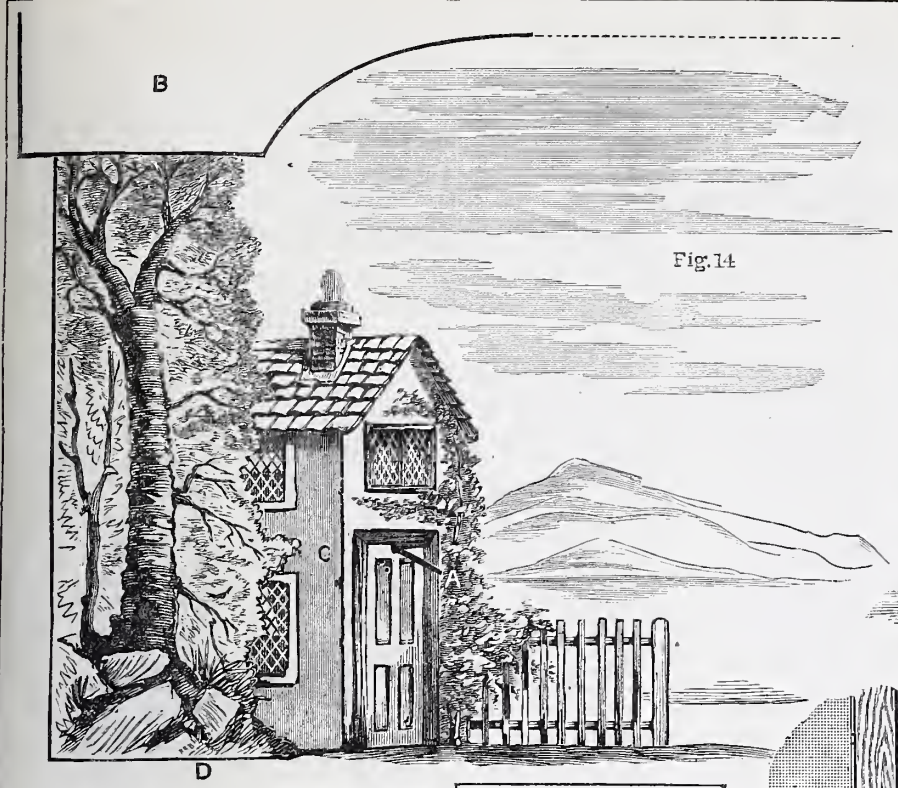



Fig. 14.

Fig. 17

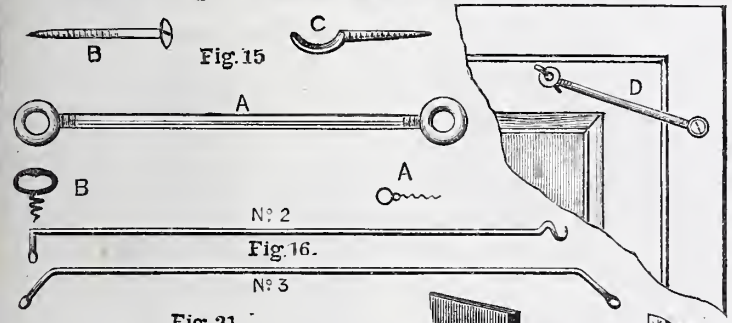



Fig. 15




Fig. 16.

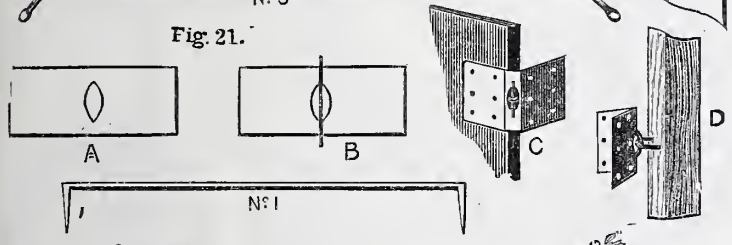



Fig. 21.

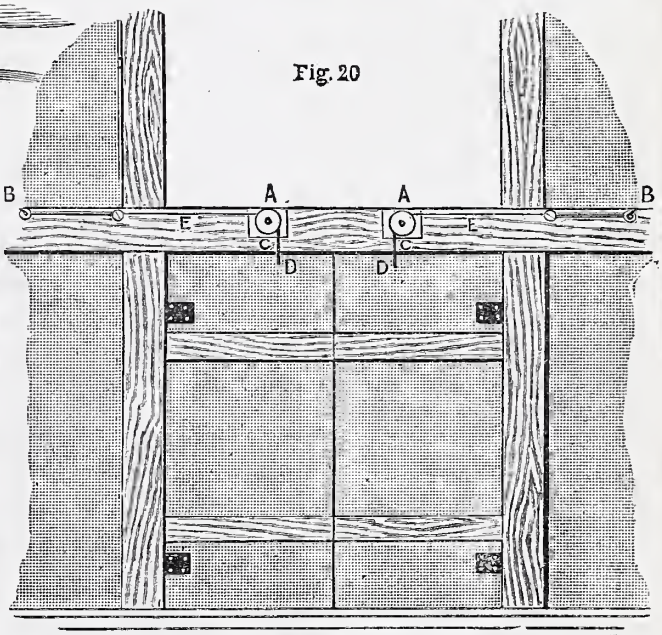



Fig. 20

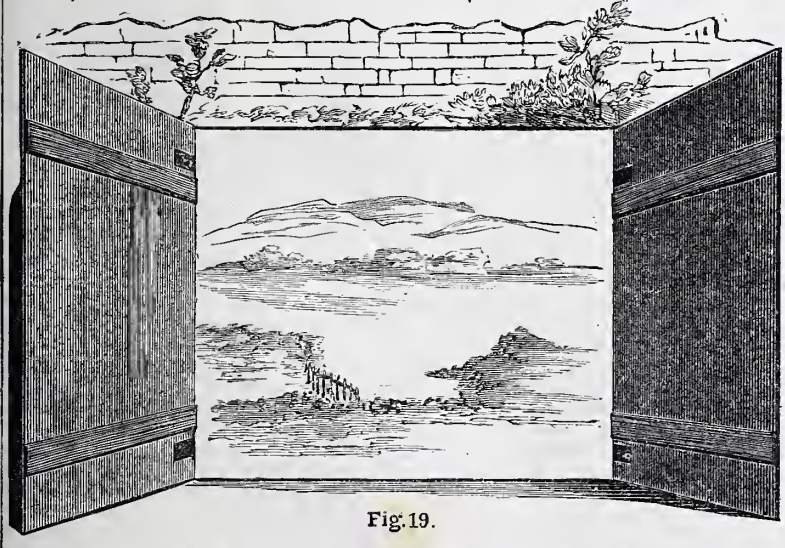


Fig. 19.

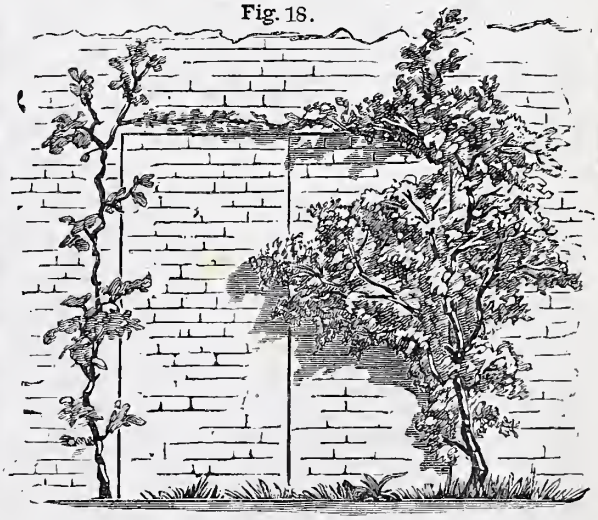


Fig. 18.

Fig. 14.—Cottage with Practical Door and Window. Fig. 15.—Springs. Fig. 16.—Dogs. Fig. 17.—Part of Set Scene secured by Dogs. Fig. 18.—Vampire in Garden Wall. Fig. 19.—Vampire Open. Fig. 20.—Back of Vampire. Fig. 21.—Diagram showing how to make Hinges.

of "vampires." They may be doors, windows, or the walls of the house or set piece, such as garden walls, the trunks of trees, rocks—in fact, anything may be made to open or close directly the actor in the scene passes through. For instance, jumping through a window from the stage and rolling back through the brick wall under the window. The "vampire" is usually made with two profile boards, hinged to a frame, each one having a rubber spring, A, as in Fig. 15, fixed on the inside, which closes the vampire so quickly that the audience hardly see the working of it. In Fig. 18 we have a vampire in a garden wall; the square lines and the line down the centre show the vampire closed. In a scene on the stage these lines would not show if painted properly. Fig. 19 shows the vampire open. It must be understood that the doors seldom come back as far as shown in the drawing, the vampire pressing against the individual passing through and closing the moment they are released. In Fig. 20 is shown the back of the vampire: the open part at the top might represent a window, cupboard, pier-glass, clock-face—in fact, it might be anything, as we see in pantomimes, in which the clown will go through and roll out of the vampire, followed by policemen and others in quick succession. I will now explain the way the vampire is made to act. In Fig. 20, A, A, shows two small grooved wheels, such as are used for Venetian blinds. Cut out two mortise holes so that the wheels work in the centre on a pin. Bore a hole through at C so that the trick-line over the wheel passes through it and makes it fast to the two doors at D, D; cut a groove out of the top of the framework at E E, so that the trick-line may lay in it; this keeps the line away from the hands and feet of the party jumping through. The line is attached to the indiarubber springs, B, B. When the jump is higher up than represented at Fig. 20, or when in a wall, as Fig. 18, no groove need be cut out at E E, as the line and spring may be placed higher up.

*Hinges for Vampires.*—Fig. 21 shows how to make the hinges. Cut a piece of tin about 4 in. long and 2 in. wide, make an oval hole in the middle, as at A, then cut a piece of stout wire a little longer than the plate is wide; solder this to the tin, turn the two ends over and solder them down, as shown in B. Now bend the plate round the edge of the vampire door, as at C; after bending it to the shape of the edge of the door, take a small staple, place the hinge against the frame of the vampire in its proper position, and drive the staple over the wire and through the hole; the hinge will now be ready to receive the door, as at D. The staple should be driven in as far as possible, to admit of the door working close and easy.

It may be objected by some reader of Work that, although practical doors and windows are and must be used in scenery constructed for amateur theatricals, yet the pieces that are played are not such as involve the introduction of vampires as an absolute necessity. Everyone, however, who urges this objection must kindly bear in mind that these papers are not written in the interest of amateur performers only, but for those who are, or desire to be, professional scene painters; and who, possibly, are, and have been, unable to obtain instruction at first starting. Moreover, in entertainments, and especially in pieces based on fairy tales, a vampire is most desirable for the introduction of all characters who have to come and go with the utmost rapidity.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

### 94.—"The Art of Graining and Imitating Woods."

In Vol. III., page 90, of Work, I noticed at some length Parts I., II., and III. of "The Art of Graining and Imitating Woods," produced by the Decorative Art Journal Company, Manchester, and I dwelt then and there on the nature, aim, scope, and character of the work itself, the beauty of the colour printing, and the wonderful fidelity with which various kinds of wood were portrayed as guides for the inexperienced and unpractised hands in their endeavours to carry out the instructions conveyed in the text, and the comparison of the results obtained with the results that should be produced by means of the specimens of colour printing that are placed in the worker's hands. Part IV., which completes the work, and with which a title page and index to the whole are given, contains fine and striking representations of pollard oak, brown oak, and satin wood; a fine inlaid panel exhibiting a rosewood ground inlaid with tulip, ivory, and boxwood, and enriched with painted decorative work; studies in maple graining showing the progressive work in various stages; studies of mahogany in three stages of the work, and other studies of the same wood when roughed in with the tool; an oak door complete with suggestions at the sides for treatment of dado; and—a study most useful in itself, especially for beginners—examples for grounds of various woods. The entire volume is most valuable, both as a technical work and a work of art, and should be found in the hands of every professional grainer.

### 95.—Hollier's Safety Stand and Home Trainer.

As very many readers of Work are cyclists, and as much interest has been evinced in the papers relating to cycles which have appeared from time to time in the pages of this Magazine, it will not be out of place to call attention to a new contrivance by which the attainment of a double purpose is secured, namely, the provision of a safe and convenient stand for the bicycle—I should say, safety bicycle—when not in use, and means whereby the yet unpractised beginner may learn to ride on his own machine, and get used to pedalling without risk of doing any injury to either the machine or himself when learning to ride. The appliance to which I am referring is known as Hollier's "Safety Stand and Home Trainer," and is illustrated in the accompanying engravings, of which Fig. 1 shows the Safety Stand with a safety bicycle placed upon it, and Fig. 2 the bicycle, thus placed, utilised for home training. That a good stand for a bicycle is a desirable thing for every cyclist who owns a machine to have is undeniable, for by its use both wheels are always kept in the same plane, and it is raised above the level of the ground, which is a better position for cleaning and oiling, and takes off much of the strain and tension of the framework which must result from allowing the machine to rest continually on the parts—I had almost said points—of the tires of the front and back wheels where the wheels come in contact with the surface on which the cycle is standing. Regarded as a home trainer, when the machine is fixed and mounted on the stand, the weight of the rider brings down the back wheel on to a pulley, which revolves, and is regulated to work hard or easy by means of two brakes and movable weights on each side, as shown in Fig. 1 and also in Fig. 2. The distance covered may be indicated, if desired, by a crank log or cyclometer, but this adjunct is not supplied with the stand, and forms an extra. The advantages claimed for the Safety Stand, which has been patented by Mr. Hollier, are:—First, that every person who has a machine may, by purchasing one of the stands, have a home trainer complete at the cost only of the stand itself, which is estimated at about one-third the cost of those already in the market; secondly, the supports are not fixtures, and the machine can be placed on them and removed in less than a

Fig. 1.—Bicycle on Hollier's Safety Stand.

Fig. 2.—Bicycle on Stand for Home Training.

minute, and the stand placed away, occupying but little space when not in use; thirdly, the stand, or stands—for there are two in reality—supply a great want to learners in practising pedalling, which, when thoroughly mastered, overcomes one of the beginner's chief difficulties; and fourthly and lastly, as a stand simply for cleaning, oiling, repairing, etc., the supports are most desirable, because, when the cycle is raised on them, the wheels are free and elevated, and they are stable in themselves from their construction, and save any undue stooping. The supports are so constructed as to adapt themselves to any kind of machine and width of tire.

The Editor.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Rate of Circular Saws.**—A. R. (*Scorrier*) writes in reply to Chopstick (see No. 135, p. 491 of Work):—"I might say that I am not the proprietor of the Scorrier Saw Mills, but am pleased to say that what I have written in reference to circular and hand saws is the result of experience; and I am of opinion that there are not many men within the last twenty years who have had greater experience in circular, frame, band, and hand saws than myself. Again, I do not sneer at home-made machinery. We have a home-made machine, and it does its work well; but there are many home-made and factory-made machines that are not worth their room, especially when driven by hand. In reference to a rip saw cutting 3 in. pine, what I said was that the joiner for whom I sharpened the saw said he had been cutting 2½ in. and 3 in. pine with it two days. I don't suppose the man meant that he was continually cutting with it, but that was his principal work for the two days. Time must be allowed to prepare his work; and I argue that a good hand saw, well sharpened, would cut in clean pine most of the two days before being re-sharpened. Of course, if you use an inferior tool it has to be sharpened often. Chopstick let the cat out of the bag when he said he could saw as much 3 in. deal in one day as six men with the hand rip saw, with a labourer to turn the wheel. I suppose he meant if the poor labourer could continue to turn the wheel at a good speed! Since my reply to Chopstick on p. 379, more than one reader of Work has said to me, 'I was pleased to see your reply to Chopstick, and quite concur with what you said in reference to driving a circular saw by hand.' Again, I think there would be no difficulty in Chopstick getting a job in a respectable joiner's shop, where there is a small circular saw to be driven by hand, if he would take his labourer with him to turn the wheel—even if they only do the work of three men with the hand rip saw, leaving six men quite out of the question. Perhaps Chopstick will say (using his own words—see p. 398) whether, if I should he wanted to cut 3 in. deep, I should require two labourers, as it would be hard work for one. I, for one, should be pleased to see a description of Chopstick's saw bench, and how he can cut 3 in. deep so much easier than those I have seen at work; and I have seen many."

**Fiddle Making in Earnest.**—A. X. E. (*Nottingham*), an esteemed correspondent to Work, sends the following cutting from a local paper, thinking, no doubt, that it will amuse some of his fellow-readers. We think so too; for which reason a little editorial license is granted in this case:—"At the Leigh County Court, the case of Beaumont *v.* Medling came on for hearing. This was a claim for teaching the defendant how to make violins, and also how to play the same from music. Mr. Grundy represented the plaintiff, and Mr. Whittingham defended. Plaintiff's case was that he told defendant what kind of wood was necessary, and he replied that he had two beech planks in the back yard, which would do for the body of the double-bass, and an old cart-shaft, which would do for the neck. Defendant also purchased some deal, and the instructions began. Defendant was in a great hurry to finish the instrument; and when he had finished gluing the belly, it was found that he had forgotten to take out the glue-pot. (Laughter.) The neck was made from the cart-shaft, according to instructions; but defendant fixed it on the wrong end of the instrument. After everything was prepared for the strings, plaintiff told defendant to go to a music shop for them; but, instead of doing so, he went to a watchmaker's, and got the catgut rope of an eight-day clock. (Laughter.) He put this string on, and when he was winding it up to tune the fiddle, the string broke, struck him in the face, and gave him a black eye. (Renewed laughter.) When all was completed, it was found that defendant had made the instrument so large that he could not get it out of the room.—After hearing a mass of evidence on both sides, his honour gave judgment for the plaintiff for £3 16s., and for defendant, on a counter-claim, for 3s. 6d., which had been paid into court."

**Air Pump.**—A Correction.—O. B. (*Preston*) writes:—"Please read 'Sprengel' for 'Springle,' on p. 497, Vol. III. The mistake was not observed in reading proof. And Mawson & Swan's 'operator,' at foot of front page, should read 'aspirator,' as in the text of the articles. As I did not see the proof of the illustration, I had no means of correcting it."

**Blacklead.**—H. B. S. (*Liverpool*) writes:—"In Work, Vol. III., p. 509, is an answer to H. P. by F. P., in which, in the interest of the correspondent, I would like to make one or two corrections. The chemical name for blacklead is carbon; the terms blacklead, plumbago, and graphite are technical terms for one particular form, or, as it is called, allotropic modification of carbon. Plumbago is not an oxide of carbon; there are only two oxides of carbon: carbonic acid and carbonic oxide. F. P. should read some new text-book on chemistry, such as Roscoe's, before answering correspondents on chemical subjects. He will no doubt take this hint kindly, as it is intended."

### II.—Questions Answered by Editor and Staff.

**Patent.**—J. S. (*East Dereham*).—Before patenting, J. S. would do well to consult some person of repute in each of the trades to which his inventions belong. Such persons can best tell him whether his ideas are of any commercial value. If he fears that, by so doing, he will expose himself to piracy, and does not object to paying for the £1 stamps, he should first obtain provisional protection. He will most readily bring his inventions before the public by getting them taken up by established firms; and the necessary information as to obtaining provisional protection and patents he will find in the article on "Taking out a Patent" in Work, Vol. I., p. 545.—C. C. C.

**A Patent.**—One from the Start.—Your invention appears to be one by which a considerable saving in time in office work might be effected, and as the article is to be purchased at so small a cost, it ought to have a good chance of success. You cannot do better than first obtain provisional protection (see Work, Vol. I., p. 545), and then offer it to some well-known firm which manufactures such things—say, such as Messrs. Perry & Co.—C. C. C.

**Shipping Models.**—Toymaker.—You will be able to get anything you want in the way of model boat fittings from any of the following firms, who would probably name prices in the ordinary way of business if you apply to them:—Stevens, Model Dockyard, Aldgate, London; John Bateman & Co., 131, High Holborn; John Sowles & Co., 75, Queen Victoria Street, London; Hitchen & Squire, 36, South Castle Street, Liverpool. When you ask us to give you prices of "rigging and deck fittings of small model steamships or sailing ships," I wonder if you think there is unlimited space in "Shop," and that we have nothing to do but collate price-lists. The best way, when you or anyone else wants to know the price of anything, is to write to dealers. The names of these we are always happy to give; but it is quite another matter to give prices of a few hundred articles, when perhaps only half a dozen are wanted by the inquirer. If you had specified what you wanted, we might have helped you.—D. D.

**Frame Moulding.**—W. S. B. (*Leeds*).—You can get D. F. O. G. rosewood, as your sample, of City Frame Company, 29, Basinghall Street, E.C., who are sole makers of this article. We have sent your letter, with request to give you their trade terms, which, no doubt, they have complied with.—G. R.

**Mitre-Cutting Machine.**—Nemo.—In reply to yours, Messrs. Booth Bros., Dublin, are the patentees of the mitre-cutting machine. You can get it through any respectable tool maker of your town, price 15s. complete.—G. R.

**Moulding Composition.**—Gala.—The moulding composition used in rubber-stamp making consists of a mixture of china-clay and French chalk, kneaded with water to a stiff "dough;" two parts of clay to one part of chalk will answer very well, but the proportions may be considerably varied. Considering the cost of materials when purchased in small quantities, and the labour of mixing it is better to purchase the compo. ready prepared. Some wholesale houses, as the London Rubber Printing Company, 33, Cheapside, London, E.C., sell the compo. in the dry state, so reducing expense when cost of carriage has to be incurred. The above-named firm supply handles and all other stamp-making accessories wholesale.—Qui Vive.

**Stamps.**—F. G. H. B. (*Rowley Regis*).—It is quite "possible for an amateur to make indiarubber stamps in his own handwriting." To perform this apparently puzzling feat, it is necessary to procure a *fac-simile* block from an engraver in wood or metal, and use the block instead of type. The name to be copied is written, preferably with copying or lithographer's transfer ink, and transferred to the blank block of wood or metal by laying its face in contact with the block, and applying some little pressure. By this means sufficient ink is transferred to the block to give a clear outline of the matter to be copied—reversed, of course—and the bare metal is then removed by the aid of gravers. With a little perseverance, F. G. H. B. might manage such a job for himself.—Qui Vive.

**Iron Work.**—J. M. (*No Address*).—Bradley, 180, Fulham Road, West Brompton, sells the iron.—J.

**Violin Case.**—A Reader of "Work."—A description of how to make a violin case appeared in No. 131 of Work.

**Waltham Watch Parts.**—W. P. (*Dundee*).—Apply to the Waltham Watch Depôt, Holborn Circus, London, E.C.

**Telescopes.**—J. J. M. (*Liverpool*).—It would occupy too much of "Shop" space to reply adequately to your question there. Please await Vol. IV. of Work, when it is hoped the subject of telescope construction will be exhaustively treated.

**A Self-acting Fountain.**—Hydrostatic.—A fountain constructed upon the lines of your sketch would be quite useless. An illustrated article upon the construction of a self-acting fountain is in the hands of the Editor, awaiting space for publication, which will give you full particulars as to principle and method of construction.—C. M. W.

**Graph Solution.**—T. S. (*Huddersfield*).—I have not been able to try the solution you give; but, of course, indiarubber will not dissolve in water. You do not say whether you applied heat or not. I should be inclined to add sufficient methylated spirit to the rubber to dissolve it; add the gelatine next, and stir in the glycerine, oxalic acid, and water, mixed together, both solutions being warmed. The spirit will ultimately evaporate when the plate has been poured and cooled, leaving the ingredients you mention. If this does not answer, write again, and I will try to find time to make the experiment, and let you know the result.—J. W. H.

**Artificial Eyes.**—Justice.—A guinea each for artificial eyes, to fit exactly and match the other optic, is the ordinary price; and even much higher prices are charged, as they are frequently painted from life to match in colour. Of course, it is not the material but the highly skilled labour that makes the price appear disproportionate. Glass eyes, such as are used for wax-work figures, human life size, any colour, may be bought for half a crown a pair, whilst those for large wax dolls, for about thirteen to fourteen pence a pair, from Meeke, Westminster Bridge Road, or Wheelhouse, Waterloo Road. On inquiry at Mr. Grossmith's, 175, Fleet Street, E.C. (the oldest house in the trade, established 1760), we find that if a second quality be required, made by German artists, the price is 10s. each, if selected from stock, or 15s. each if made to order; and if the eye he sent to be re-enamelled, the cost is 5s. I am also informed that a movement is obtained, in the best quality, at £1 each, if selected from stock, precisely in accordance with the action of the natural eye; and that they can be fitted in a few minutes without pain or operation. As to your second question, I cannot say at all when articles on coach-building will appear in Work.—J. W. H.

**Hammock.**—J. R. W. (*Portsmouth*) asks me what size to make a hammock for his brother; but as he does not give me the size of his brother, I cannot help him further than to say that the usual size is 6 ft. long by 2 ft. wide, exclusive of rope for suspension. I have seen grass hammocks sold in New Oxford Street at 1s. 6d. each, but do not remember the address. At a seaport such as Portsmouth, I should have thought J. R. W. could easily have obtained the information he requires from the store-dealers and others.—J. W. H.

**Stereo Plates.**—Amateur Stereo.—I cannot see the cause of your failure, and can only suppose you have not followed the instructions. I advise you to write to the firm who supply your metal. Perhaps they have sent you metal intended for other purposes instead of paper process metal, which differs from that used for plaster, for backing electrotypes, or for casting type, etc., all of which also differ. I am almost inclined to think that your metal is dirty. Keep stirring it well at the proper heat—that is, when it will just scorch, but not light, a piece of brown paper. Some put a pinch of salt or a piece of resin in, to kill the sulphur and make the scum rise. A few drops of fatty oil also help. Then skim it well until the metal is quite clean, and pour at the heat indicated.—J. W. H.

**Besom Makers.**—£ S. D.—I have inquired in vain and looked over several directories for name and address of such. I hear the gipsies make them in the forests, but can obtain no information. Perhaps some Work reader may be able to throw some light upon the matter.—J. W. H.

**Metal Soldiers.**—L. A. C. (*Wigan*).—If the toy soldiers you refer to as so largely imported from Germany are to be made as an experiment, I think I can give you some assistance; but if you wish to try to establish it as a business in competition with the present makers, I could not guarantee that I know enough about the trade to give reliable help, and should advise you to take a trip to Nuremburg, where you could easily get to know how it is done and made to pay. The moulds—for they are evidently cast—are, I should say, electrotype matrices, made by depositing copper upon wax models, coated first with plumbago, made to part in the central plane of the figure into two halves. This may be done by modelling each side separately, and putting a strip of sheet gutta-percha between them, or they may be electrotyped separately. The metal may be any of the ordinary fusible alloys, which consist of lead, tin, and bismuth. Bismuth melts at 267°, lead at 334°, and tin at 228°, only 16° above boiling point of water. Equal parts of each would melt, therefore, at about 276°. The more tin and less lead you use, the lower the melting point and the greater the cost. For painting, use ordinary tubes of oil-colour, mixed with copal varnish, and lay it on with a sable brush (not a hog's-hair). I do not know of any book on the subject; but I fancy that a similar industry exists in Birmingham. Let me add that a slight pressure of the two halves of the mould will be necessary when poured; and perhaps they are hinged together, as in the case of casting type, and the mould held head downwards as the hot metal is poured, and an upward jerk given to force the metal into all the parts of the mould, which, in a few seconds, could be opened, and the figure shaken out of it, as the metal soon cools.—J. W. H.

**Coopering.**—J. S. (*Longsight*).—The prices paid for repairs, and for butts, puncheons, etc., vary in

different towns and at different times. I am afraid, therefore, that I can only advise J. S. to pump coopers in and around Manchester for the information he requires.—J. W. H.

**Stair Block Wood.**—J. P. A. (*Walthamstow*).—The "square blocks" you refer to are cut out of teak, as this wood will stand a lot of hard wear; although I think that "Jarreh" wood would last just as long and at a less cost, being cheaper than teak. It is now being used for wood-paving in many of the principal streets of London.—A. J. H.

**Astronomical Telescope.**—J. J. M. (*Liverpool*).—Although your questions are well put, practical replies to each one—that is to say, supposing you wish to construct a serviceable achromatic telescope—would occupy much more space than can at present be accorded in these columns; but if you merely wish to make a simple form of cheap chromatic telescope, you might carry out the following directions: First, procure or make a brass or zinc tube, to measure 53 in. long and about 3½ in. in diameter, and, after first making the ends quite true, solder a diaphragm, having a 2 in. aperture, at about 8 in. from one end of the tube. Now proceed to fit the 3 in. object glass into a turned wooden cell, retaining the lens in position by means of a ring of springy brass wire; after which the cell is tightly fitted into the end of the body tube nearest to the diaphragm. The draw tube must draw through a wooden collar, which is turned in a lathe to a suitable size, and fitted to the other end of the body tube. This collar should be furnished with a 1¼ in. opening in the middle, to receive the draw tube, which must be made of brass, about 12 or 14 in. long. The best form of eye-piece to use will be the Huyghenian, which is composed of a couple of plano-convex lenses of 1 in. and 3 in. focus, mounted 2 in. apart, with the latter next to the object glass, and the plane sides of both the lenses outwards. The lenses are mounted in a suitable length of brass tubing, with a small diaphragm, having an aperture about equal to the diameter of the eye-lens placed midway between them; after which the eye-piece is slid into the draw tube of the telescope, with a small wooden cap, lastly, fitted on to the outer end. This cap should be furnished with but a small aperture, as it is only the centre of the lens that is used. The interior of the tubes, including the cells of the lenses, should receive a coating of dull or dead black. An eye-piece of this description will have a magnifying power equal to a single lens of 1½ in. focus, so that the telescope will magnify forty times. Although this telescope is extremely simple, it will be capable of doing good work, and will show Jupiter's moons, and, probably, some traces of his belts, as also Saturn's rings. As you ask to be referred to some articles on telescope making, mention may be made of the article on "A Four-draw Telescope," which appeared in WORK, No. 142. Opinions differ as to the relative merits of refracting and reflecting telescopes; but the latter will be found the cheapest to make—if this is any advantage. Messrs. Lancaster & Son, of Colmore Row, Birmingham, used to supply amateurs with sets of lenses for the construction of astronomical telescopes, together with lithographed diagrams and instructions for mounting. As above, with a 3 in. object glass of 50 in., from 5s. 6d.; or, with an achromatic object glass 2⅝ in., £2 15s.; and 3 in. object glass, £4 10s. You could also procure the lenses cheap from Prof. Caplatzi, Chenies Street, London, W.C. I quote the following from an old list: Ordinary chromatic object glass, 3 in. diameter, 3s. to 4s.; eye-piece lenses, 1s. each; achromatic object glass, 2¼ in., 25s.; 3 in. ditto, 40s. to 50s. Wholesale firms do not care to supply amateurs; otherwise, some of these lenses would cost considerably less.—C. A. P.

**Telescope.**—T. M. (*Liverpool*).—You probably require a short monocular telescope. The object glass would be 1¾ in. in diameter, and be fitted with a pan-centric eye-piece. A glass of this description would be capable of showing the time by a church clock at six miles, or a flag at twenty miles. The lenses would, however, be expensive. A full set of lenses, including an achromatic object glass and erecting eye-piece, for a telescope of a more simple form, to do what you require, would cost between 3s. and 4s. Full directions for making telescopes of either form would occupy too much space in these columns, and must, therefore, remain until space can be spared for a series of papers on the construction of telescopes of various forms. In the meantime, you might write to The Science Exchange, Chenies Street, London, W.C. Write fully, stating your wants clearly, and they will be able to supply you cheaply, and, moreover, give you advice if needed.—C. A. P.

**Metal for Gilding.**—T. R. (*Sheffield*).—For all descriptions of leaf metal for gilding purposes, write Mr. James Smith, Bridge Street, Manchester. I am not familiar with "bundles" of German metal, as described by you; but it is probably put up in that form for some particular class of work. All metal—either pure or base—that I have handled has been in books. Respecting the keeping qualities of imitation gold, this chiefly depends upon the atmosphere. If well lacquered over with a solution of shellac in spirits, it will keep its colour almost as well as gold-leaf; but for picture frames and fancy articles for our personal service and use, it is well worth the extra money for the genuine article. The specimen you send is of the commonest quality. A very good imitation gold—or "ducat," 'tis often called—can be bought for 3d. and 4d. per book. Picture frames (German) are gilded with "white metal," and lacquered with a yellow-stained spirit solution. All articles appertaining to gilding, Mr. Smith (as above), or Pavitt & Sons, Southampton Row, London, will supply at fair prices, and of reliable quality.—F. P.

**Bunsen Gas Burner.**—T. M. (*Liverpool*).—The great mistake in your query, and what makes it impossible for me to answer, is that you have not stated *how much glass you want to melt*, and whether you use a furnace or not. I cannot by any means tell how to arrange one, and what size to make it, until the above is answered. The amount of heat given out by a burner is proportionate to the size of the flame when burning properly. There are only so many units of heat in the flame of a burner of a given size; but this flame can be concentrated, by means of a blowpipe or the blast in a furnace, so that it will melt objects which, without this means, it would not have much effect on. Do you want to use it in a specially constructed furnace, or otherwise? as I am afraid you will not be able to melt glass in any quantity without the aid of a furnace. A very small size of burner, or even a candle or lamp flame, in combination with a blowpipe, would be ample, I should say, if the amount of glass was very small. If you want to use it in a furnace, a great deal lies in the design of the furnace itself. The best thing I can do is, therefore, to give a sketch of a Bunsen burner furnace for metals, with crucible in position, and the position and size of the top of the burner. From this and Fig. 2, which shows an ordinary burner, you should be able to design one to meet your requirements, making the diameter of the burner tube proportionate to the crucible, as in Fig. 1. You must first get a crucible that will hold the amount of glass you want to melt, and proportion the top of burner to it. If the flame alone from the burner does not melt the glass in crucible, perhaps

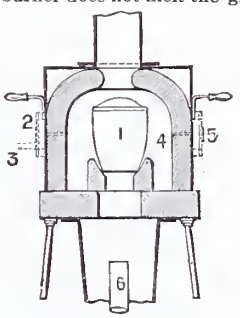



Fig. 1.—Section through a Bunsen Burner Furnace—1. Crucible; 2, Air Chamber round Cupola; 3, Entrance for Blast; 4, Slits round Cupola; 5, Small Door; 6, Burner Top.

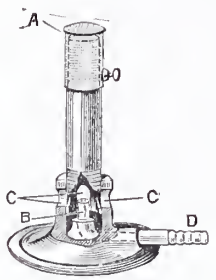



Fig. 2.—Bunsen Burner, Perspective View, partly in Section—A, Removable Perforated Metal Cap; B, Brass Burner; C, Air Inlet; D, Pipe for Indiarubber Tube.

by concentrating the flame on to it by means of a blast you might be successful. This could be arranged, as shown by dotted lines, Fig. 1, by cutting slits at intervals (the longer the better, if the furnace will stand it) round the cupola: these slits to be from $\frac{1}{16}$ in. deep and upwards, according to the size of the furnace. A narrow chamber, shown in dotted lines, Fig. 1, might be formed, completely encircling the cupola and enclosing the slits. By having this chamber rather deep, the blast is heated to a certain extent before entering the furnace proper. The blast, if the furnace is no greater than 6 in. by 6 in., might be produced by a pair of ordinary house bellows; if larger, by bellows worked by the foot or a small fan. At intervals round the outer casing, and opposite the slits, it is as well to have small doors, to clean out the slits should they get filled up by dirt. Perhaps it would be as well to have the slits slightly inclined upwards, by which means the flame will be blown both against the sides of the crucible and upwards, thus creating a draught as well. Fig. 2 shows a perspective sketch of a burner, partly in section, to show more clearly the method of distributing the gas and the position of the air-holes, of which there are four, placed at right angles, passing through both stand and tube, which is threaded to screw into stand; and by this means the admission of air can be regulated to a nicety by turning the tube round. Suppose perforated cap removed, as it is only a useful accessory: then you turn on the gas, which passes up the tube, taking with it air for its own consumption. If there is too little gas passing up, it will not burn at the top of the tube when a light is applied, but descend and burn below. This will show you that there is too little gas. The quantity being sufficient, the flame will remain burning at the top. Should there be too little air, the flame becomes golden; when burning correctly, it should be blue. When the finely perforated cap is used, a very inflammable mixture of gas and air can be thus burned, as the gas, whatever its pressure quantity or quality, cannot light below. By this means a burner can be made from 1 to 2 in. in diameter, and capable of burning 40 cubic feet of gas per hour. I have only mentioned this as a useful accessory. The proportion of a small tube in a burner should be from 4 in. to 5 in. long by ⅜ in. to ½ in. in diameter.—P. B. H.

**Whitewash from Wall.**—W. H. (*London, S.W.*).—The only recipe for removing this that I am aware of is a stiff brush and plenty of hot water and "elbow grease." I should say the simplest way to rid yourself of this eyesore would be to give it a coat of paint. Any old stuff, or even common tinned paint, would answer, so long as it dries well. Some dry Venetian red and common black, mixed with linseed oil and driers, would also make a cheap mixture, and of suitable colour.—F. P.

**Folding Picture Screen.**—A. H. B. (*Stalybridge*) should get No. 89, and in it, at p. 600, he will find answers to his queries. I imagine that he will find the varnish sold at the oilman's as "paper varnish" sufficient for his purpose; but if he is particular, he can get the more expensive "mastic varnish" from the artists' colourman's.—S. W.

**Making a Chess-Board.**—R. W. M. (*Carbury*).—I am sorry your query was overlooked. Even now I cannot tell you "how to remove scraps from screen" without knowing what the scraps are made of, or what the screen is, or how they are stuck on. If they are paper scraps, can you not soak them off? Since you ask the price of eight numbers of WORK and an index, I can only say they are one penny each; and if you will weigh nine of your own numbers, you can easily tell what the postage will be. To make a chess-board, you will require thirty-two squares of dark and thirty-two of light wood—holly, say, for the light, and then almost any coloured wood will do for the dark squares: say, rosewood. The squares may be about ⅛ in. thick. Prepare two pieces of wood, one of light wood and the other of dark wood, each 6 in. long, and exactly square in section—say, 1½ in. square—for a board one foot square. Now, if you have a circular saw you can saw off the thin squares one after another; if not, make a kind of trough of wood, with the sides cut through, perfectly square with the length; lay the prepared blocks of wood in the trough, and saw them up. Then have a board of sound wood ready to glue them down on; glue on strips round the edge, and smooth the top by rubbing down with coarse sand-paper; then smooth with fine sand-paper, and finish with French polish.—F. A. M.

**Violoncello.**—J. D. (*Glasgow*).—You would be wasting your time in making a 'cello from the outline pattern you send. The corners are very weak indeed; the *ff* holes have also a decidedly "amateurish" look about them. The measurements you desire are as follows: thickness of belly at jointing edge, 1½ in.; thickness of back, 1 in.; width of ribs, 4½ in.; thickness of ditto, $\frac{3}{4}$ in. The dimensions of the neck have already been given.—B.

**Lancaster Camera.**—F. M. (*Liverpool*).—The reason is *insufficient* exposure. To take portraits with magnesium, it is necessary to have a fairly quick-acting lens—say, an ordinary portrait combination—working with a wide aperture. With landscape lenses, the stops are necessarily small; therefore, much more light is required, also quick plates and strong development, to get a properly exposed picture. There should also be plenty of white reflectors about—as sheets, paper, etc.—to throw light into the shadowed parts of the subject. A good deal of skill is required to make *satisfactory* portraits with magnesium light, even with the best lenses.—D.

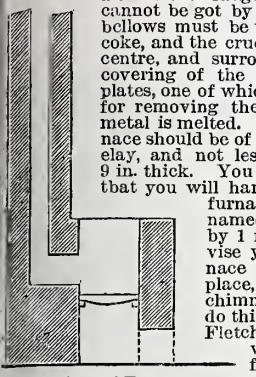
**Musical Instrument.**—A. B. (*Basford*).—The instrument, of which you send a drawing, belongs to the time of the Empire, and is known as a harp-guitar, from the shell or body being shaped after the harp fashion. I regret I cannot tell you the correct way of tuning it, as that is a matter of great uncertainty; but most likely it was tuned as the ordinary guitar, with the additional outside bass strings an octave lower than the fourth, fifth, and sixth. These instruments have gone quite out of date, and are now of no particular interest or value except to a collector. I should think it would be useless trying to get an "instructor" for it, it being, as a musical instrument, obsolete.—R. F.

**Varnish for Zither.**—CLERICUS.—Varnish does not give very satisfactory results; the instrument should be French polished, as this admits of a very much better finish, especially if the belly is of maple or rosewood. Varnish, especially spirit varnish, shows every little scratch or chip, and soon wears rough; and, from its drying so quickly when applied, it is difficult to get a good finish with it when spread over a flat surface. The breaking of the strings can hardly be attributed to one specific reason, but may proceed from one of many. Thus, the slot in the saddle may be rough; the holes in the wrest-pins may be sharp on the edges; or the angle of tension between the wrest-pins and the upper bridge-pins may be too great; or the fault may lay in the strings themselves. If the breakage results from the first of these causes, it would occur at the saddle; examine it, and if any roughness exists, smooth it away with a fine file or piece of folded glass paper. The second would cause the breakage at the pin; the third, at the upper bridge; and the fourth, just anywhere in its length, between bridges. Finally, it may proceed from the fault of the tuner, in mistaking the pitch, and so trying to pull the string up above the note for which it is intended.—R. F.

**Fortune-Telling Card.**—AMATEUR.—This is in hand, but, being too lengthy for "Shop," you must wait until room can be found for it in the body of WORK.

**Electro-motive Engine.**—POINTSMAN.—It would be impossible to tell you in a few sentences how to make one. You should read an elementary treatise on electricity, and then get "Electro-Motors: How Made, and How Used," by S. R. Bottone, price 3s.—F. A. M.

**Small Furnace.**—T. A. E. (*Clapham*).—I send sketch of furnace, such as is generally used for melting brass, and which I suppose will be what you want. The air is admitted under the bars, and a flue of 15 ft. or 20 ft. in height is required to cause a sufficient draught; when the draught cannot be got by a chimney, a fan or bellows must be used. The fire is of coke, and the crucibles are set in the centre, and surrounded with it. The covering of the furnace is of metal plates, one of which is arranged to lift for removing the crucibles when the metal is melted. The walls of the furnace should be of fire-brick set in fire-clay, and not less than one brick, or 9 in. thick. You will see from this that you will hardly be able to get a furnace in the space named by you—viz., 2 ft. by 1 ft. 6 in. I should advise you to build the furnace in front of the fireplace, and use the flue as a chimney, or if you cannot do this, write to Mr. Thos. Fletcher, of Warrington, who supplies small furnaces for this purpose, which are heated by gas, and which will be much cleaner in a house.—M.



Section of Furnace.

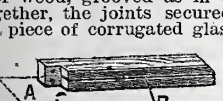
**Working Alabaster.**—R. N. (*Grays*).—There is some information in Holtzapffel's "Mechanical Manipulation." In Vol. I., p. 164, I find that alabaster is sulphate of lime, or compact gypsum, found near Derby. But few tools are required for turning it: point tools for roughing out, and ordinary strong carpenters' chisels, ground straight for straight work, and rounded for turning hollows. Of course, the cutting angles would be more obtuse, and stronger, than for wood. Alabaster may be finished by fish-skin or Dutch rush. On pp. 1033 and 1034 of Vol. III. there is further information as to polishing; but I do not see if it should be turned wet or dry. Alabaster may be polished in the lathe by soft sandstone and water, rubbed in with a rag; then, after washing, by putty-powder and water applied in the same way; finally, with putty-powder and soap and water. It is also worked by the methods of the lapidary. It is about as hard as jet, copper, or soft brass; and, therefore, the dust would injure a soft steel mandrel, working in gun-metal collar, but should not have much effect on a hard steel mandrel. Perhaps someone will supplement this who can speak from experience.—F. A. M.

**Design.**—A. N. (*Horwich*).—I have sketched you a simple design, occupying one corner of the square you send; but whether it is "nice" or not, it is for you to say. I do not pretend to do much in this way, and would refer you to numerous designs, and their parts, in back numbers, such as "London Decorator's" portrayals of ceilings, etc. Surely it is not difficult to discover something suitable in the vast quantity of matter contained in WORK and your fret-work catalogues! If not, I fear that, unless you specifically state in what direction your taste lies (whether for scroll-work, flower or geometrical patterns), difficulty will be experienced in pleasing you.—J. S.

Design.

**Boot and Shoe Repairing.**—H. B. (*Accrington*).—Papers on this subject appeared in WORK, Nos. 12, 117, 122, 126, 130.

**Enlarging Cameras.**—E. C. (*London, S.E.*).—In an article on "Photographic Appliances," now being published in WORK, full directions for constructing wooden dishes of any size will be given. Zinc dishes or metal dishes of any kind unless gilt or silvered are quite unsuitable for photographic development. Wooden ones answer every requirement, and for large-sized work are best of any. For small work, papier-mâché, ebonite, or porcelain are to be preferred on account of their being less cumbersome; otherwise they are equally good. Strips of wood, grooved as in diagram, are framed together, the joints secured with white lead, and a piece of corrugated glass slipped in the groove, and the whole, when screwed together, varnished two or three times over with shellac varnish, one coat being thoroughly dry before the application of the next. A dish thus formed will answer every purpose, and last well.—E. D.




Enlarging Cameras — A, Glass; B, Groove; C, Corner.

**Improved Bicycle Spoke.**—C. H. (*Liverpool*).—In the sketch and description submitted by your correspondent I fail to see anything new, as almost every conceivable kind of spoke and nipple have long been in the market. Neither do I see any of the advantages mentioned that are not already in use. We have wheels with hollow rims, where the spokeheads or nipples never interfere with the tire, being in the hollow between the two sections of the rim. These hollow rims are made so light, that it is neither wise nor necessary to desire them lighter. As to using nipples and nuts at the rim, the thing has been patented, as far back as 1878, by a John Samuel Smith, and many makers have used the same or similar arrangements since. As to greater facility in building, a wheel can be built and tied up in fifteen minutes by the methods at present in use.—A. S. P.

**Bicycle Wheel.**—WHEELER.—In Fig. 1, if the wheel, A, is double the size of B, which is the driver, the power is increased and the speed diminished by one-half. In Fig. 2, where the larger wheel is the driver, the speed is increased and the power diminished in the same proportion. To put it more clearly, say the two wheels in Fig. 1 are each 6 in., and they are geared together by a band or chain, it should be clear to the dullest intellect that, when driven, they both would have the same speed. Increase A to double the size of B, and one revolution of B will only be a half revolution of A, and will only require half the power to do it. Drive the larger wheel as in Fig. 2, and one revolution will be two of the smaller wheel, C, and will require double the power to accomplish it. See pages 34 and 100, Vol. III.—A. S. P.

**Patents in Bicycles.**—V. L. (*Newcastle-on-Tyne*).—Anyone beginning cycle building has a large field to work in without infringing any patent. There is no patent cycle. There are patent parts or fittings, such as bearings, saddles, etc.; but these are usually bought by makers from the patentees or dealers at the prices they put upon them. Get the *Cyclist*, where many dealers and makers advertise, where you will find addresses, and can get catalogues and information from any maker of a machine you wish to copy. Or, if you wish to avoid being a copyist, and design for yourself, then you are independent of all makers. To get some information regarding nearly every machine made, write to the publishers of the *Cyclist*, Iliffe & Son, Coventry, where you can get the "Bicyclist's Indispensable Annual" for 2s. 10d.—A. S. P.

**Freezing Mixtures.**—J. R. W. (*Portsmouth*).—There are a great many ways of reducing the temperature of water and other substances to a point considerably below freezing; but some of them are not admissible for the purpose you require, as they give off an offensive smell; and others, again, are too expensive in use to be of any service to you. I should have thought that the usual freezing mixture of coarsely pounded ice and salt would not have been too expensive for you; 2d. per lb. is not an unusual price; for a single lb., in fact, I have paid 4d.; but, surely, you could buy a larger quantity at a much cheaper rate. However, as you ask for a freezing mixture, here is one that will give you 30° below freezing point: Take 1 lb. of muriate, or chloride of ammonium, commonly known as sal-ammoniac, and 2 lbs. of nitrate of potash, or saltpetre; pound each separately, and mix; to use, take equal parts of this mixture and of best soda, also pounded; place them in the vessel in which you have your ice pot, and pour cold water on the mixture. A little less water than it will take to dissolve the salts is the proper quantity. For 2 lbs of each, a quart of water will be sufficient. If too much water is used, which is a common fault in making these mixtures, the power of the stuff is wasted in cooling down the surplus water instead of the substances that you want to freeze. It is of no use trying to freeze with 2 or 3 ozs., and everything used should be as cold as possible at starting. The container for the mixture should be of wood, and the inner vessel of pewter, and well packed round with the mixture.—R. A.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Luminous Paint.**—R. R. (*Upholtand*) writes:—"Could any reader kindly inform me how to make luminous paint, or where it could be purchased?"

**Japanese Fiddle.**—J. M. B. (*No Address*) asks any correspondent to kindly inform him how to make a Japanese fiddle.—[This is a toy instrument.—ED.]

**Bois-Duré.**—J. S. (*Hampstead*) writes:—"Can any reader inform me what is *Bois-Duré*, and how it is made, and its application as a substitute for papier-mâché?"

**Brass Lacquering.**—L. M. (*No Address*) writes: "Will some kind reader of WORK tell me where I can send a pair of iron hames of horse-collar to be carefully re-lacquered in brass?"

**Carvers' and Gilders' Society.**—J. B. (*Bristol*) wishes for the address of secretaries to above trade societies and their branches. Perhaps professional workers in this craft will oblige with any particulars relating to London and provincial branches.

**Skates.**—JACK FROST writes:—"Will any reader kindly give me instructions for grinding my skates at home? Also, is it worth my while to do so?"

**Size.**—ONE IN A FIX writes:—"Will some reader of WORK kindly give me the ingredients for making builders' and paperhangers' size, and shoemakers' size, in proper proportions? I want to make a great quantity. I have every number of WORK since it first came out on March 23rd, 1889, but cannot find what I require."

**Hearthrugs.**—C. F. C. (*Oldham*) writes:—"Will any reader kindly tell me, through 'Shop,' where I can buy designs for hearthrugs? Also the address of the manufacturers of the Auto-Copyist copying apparatus?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Saw.**—W. W. (*Caverton*) writes, in reply to TOP SAWYER (see p. 478, No. 134):—"The wood spring for saw is about 8 ft. by 4 in. by 1¼ in., and should taper a little towards the point, and is fixed to the rafter in the manner shown in Fig. 1. As to support for upper end of saw G (see p. 347, No. 126), I am not able to give any stated length, for that all depends

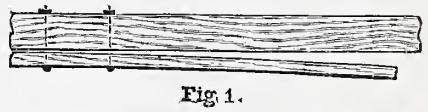


Fig. 1.

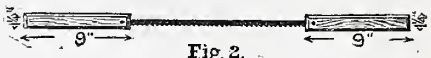



Fig. 2.

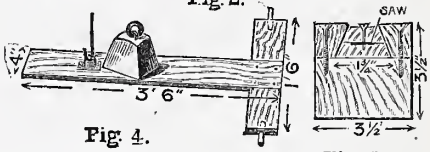



Fig. 4. Fig. 3.

Saw: Rafter, Treadle, Slide, etc.

on the height of your strap—mine is 9 ft. long, and 3½ in. by 2¾ in. thick, and is fixed to both upper and under rafters, and must be perfectly perpendicular and firm. The saw is 2 ft. long by ¾ in., and is mounted in slides as in Fig. 2; the slots the slides run in must be double their length—18 in. The weight on the treadle strains the saw, and makes it heavy and powerful, and is placed immediately behind the wire which connects the under slide and the treadle. But all the same, the wood spring must be able to pull both treadle weight and saw to the top for the workman to get the downward stroke. It should not fall too hard against the top—just nearly balanced, of course; that can be regulated by the weight being placed either backwards or forwards. The wood is all larch, except the sides, which are ash. All the iron about it are the upper and under wires, and the staples, which are fixed in a piece of plate iron, and then fixed on to the slides and treadle. The height of bench is 2 ft. 10 in. All the wood must be perfectly dry."

**Dovetailing.**—E. H. H. (*Chatham*) writes, in reply to L. E. W. (*Hutt*) on dovetailing (see p. 669, No. 93):—"I always cut the mortises first, and then

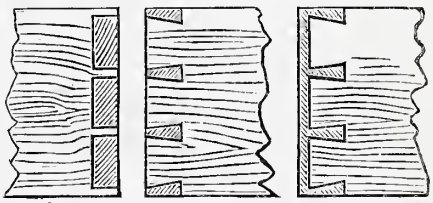
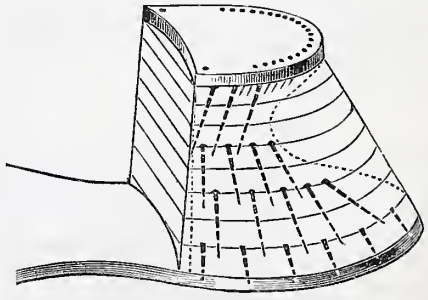


Fig. 1. Fig. 2.

Dovetailing Examples.

place them in position on the end of front or back, and mark the lines in with the dovetail saw, and then cut slightly outside the lines so as to ensure a tight fit. L. E. W. would understand the work better if he got some of his joiner friends (I presume he has some) to show him, or by examining a drawer or box. Fig. 1 shows how two pieces of equal thickness are dovetailed together. Fig. 2 shows how drawer and box front are dovetailed together where it is desired to keep the end grain out of sight on one side or the face."

**Wurtemberg Heels.**—H. G. (*Bishopsgate*) writes, in reply to T. R. (*Ripon*) (see p. 747, Vol. I.):—"I send this sketch, which I think speaks for itself.



Wurtemberg Heel.

The dotted lines show where the leather is to be cut away. The heel when built should be placed against a straight bit of wood, and see that it is level with sole; if not, hammer the heel until it is."

**Fountain Driven by Engine.**—M. (*Bishop Auckland*) writes, in reply to C. A. P. (*Ealing*) (see p. 510, No. 136):—"You will require a force pump with an air vessel on the delivery pipe, and a very fine jet for the fountain. The pump will be worked by the engine. It should be a double-acting pump, or you might use two single-acting pumps. Without more particulars I cannot give you any sizes."

**Boiled or Unboiled Oil.**—G. P. (*Elgin*) writes, in reply to A WEEKLY SUBSCRIBER (see p. 454, No. 133):—He says he has WORK from the beginning; then let him look up 'House Painting' (Vol. I., p. 659); he will find there full information regarding the various oils used in painting. Again, on p. 125, Vol. III., of WORK, he will find a reply by F. P. to W. S. (*Inverness*); let him read this also. He will then have as full information as it is possible to give about the use of *raw* and of *boiled* linseed oil. It comes to this: both oils are glossy when applied in sufficient quantity; boiled linseed oil has more body and is more brilliant than raw linseed oil; raw linseed oil is lighter in colour, and is not so liable to blister as boiled linseed oil; boiled linseed oil dries quicker than raw linseed oil."

**Polishing Pebbles.**—T. F. (*London, S.W.*) writes:—"If SPES MEA (see p. 542, No. 138) will turn to Vol. VIII. of the *Boys' Own Paper*, he will there find not only full instructions as to the cutting of pebbles, but also instructions for polishing them after they are cut."

**Locks.**—W. L. (*Wolverhampton*) writes, in reply to J. G. (*Bloomsbury*) (see p. 478, No. 134):—"I beg to say that Mr. J. J. Wakeman, St. John's Square, Wolverhampton, is a good and cheap maker of letter locks. J. G. says he believes they are made 'somewhere abroad;' but I should certainly advise him to buy at home, as there is not a great demand for these things; moreover, the trouble and expense of getting them are considerable, and I doubt if J. G. would get any pecuniary advantage in the end. One thing he would get, and that is inferior workmanship. I have bought them for export for years, and had them made to foreign patterns; but I never yet bought a foreign make, and, what is more, I never intend. If J. G. prefers, I can give him the name of a foreign maker; but only if he *much* prefers it."

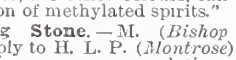
**To Preserve Stone.**—In reply to H. L. P. (*Montrose*) (see p. 526, No. 137), B. B. (*Deptford, S.E.*) writes:—"In answer to your query, I would recommend you to try Szerelmey Stone Liquid."

**Colouring Bright Steel Surfaces.**—LIFEBOAT writes, in reply to BARIUM (see p. 542, No. 138):—"Messrs. B. Newham, of Slude Lane, Sheffield, make a speciality of a spirit varnish suitable for this purpose, in gold, vermilion, and blue colours, for which they claim that it will not chip, and in the case of the blue, a deep, brilliant, and intense blue colour. They are made specially for edge toolmakers. Prices range from 8s. to 10s. per gallon for gold and blue to 16s. for vermilion, wholesale price-list; samples sent free. The intensity of the blue, and, I presume, the other colours, can be reduced by the addition of methylated spirits."

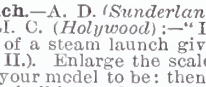
**Preserving Stone.**—M. (*Bishop Auckland*) writes, in reply to H. L. P. (*Montrose*) (see p. 526, No. 137):—"You can procure solutions for coating stone work, to preserve it from decay, from the Silicate Paint Company, Cannon Street, London; or from A. T. Morse & Co., Ward Road, High Street, Stratford; either of whom will give you all particulars respecting it."

**Waterproof Fluid Glue.**—THE WATERPROOF GLUE COMPANY write, in reply to LONDON (see p. 542, No. 138):—"Our glue can be obtained from Messrs. Moseley & Son, High Holborn, Messrs. Crowden & Garrod, or Messrs. W. B. Fordham and Sons, Ltd., London."

**Steam Launch.**—A. D. (*Sunderland*), writes, in answer to A. M. C. (*Holywood*):—"I should say, follow the plan of a steam launch given in No. 71 of WORK (Vol. II.). Enlarge the scale of it to the size you desire your model to be: then make a full-size model of the hull in wood, but do not hollow it out; then take two sheets of tin and block it on that pattern in two halves (starboard side and port side). Have the stern-post, keel, and stem of brass. I should advise it this shape:

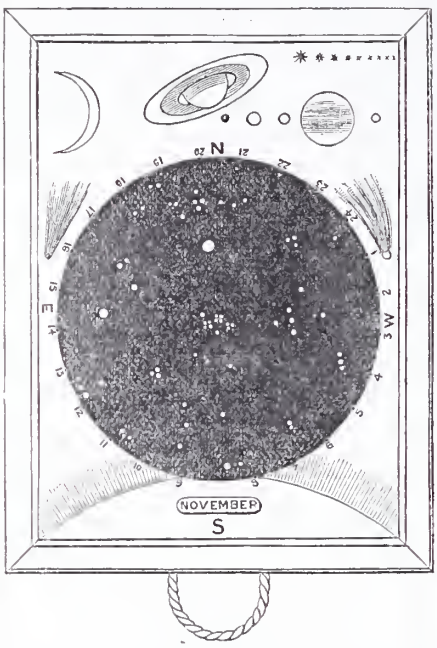


and of one piece. Then solder your two sides on to it; bend some stout brass or other wire the shape of the sections given, and solder them in the inside. To take the place of frames in an iron ship, bend a long strip of tin, say ½ in. wide, at right angles, so:



and solder it round inside to form stringers to rest deck on. I leave the deck fittings and masts to A. M. C.'s judgment, and also the painting. A. M. C. can write to Stevens' Model Dockyard, 22, Aldgate, London, for illustrated catalogue, price 3d., and he can choose the engines he would like from it."

**Plan of the Heavens.**—F. H. (*Battersea*) writes, in reply to M. D. C. (*Liverpool*) (see p. 510, No. 136):—"I beg to offer my idea to utilise the plan of the heavens given with the first part of 'The Story of the Heavens.' Take two pieces of stout cardboard, 24 in. by 20 in.; on one piece paste the blue sheet, and when this is dry cut the circle out, allowing it to be ¾ in. larger than the blue centre. On the other sheet of cardboard draw a circle, the exact size of the ecliptic on the blue sheet, and let the line of the circle come within 2 in. of the bottom end of the cardboard. Divide this circle into twenty-four parts, cut out the circle, and also a small hole between the division at the bottom. These divisions are now numbered—mine is set for between eight and nine o'clock at night: that is to say, eight is marked on the right-hand side of the slot, and nine on the left, then ten, eleven, twelve, and so on round the ecliptic to the left. Around the blue sheet on the white margin, paste the names of the twelve months cut out of an old almanac, November at 24, December at 2, January at 4, and so on round the margin. At the back of the blue sheet, a small grooved wheel is glued in the centre. Around this wheel is an endless cord, reaching 3 in. below the outside of the blue sheet; through the centre of the blue sheet and wheel a hole is bored, to fasten it with screw or nail to the wall. The white sheet with ecliptic cut out is fastened over the blue sheet in such a manner that when the blue sheet is turned round, the name of the month can be seen through the slot at the bottom of the ecliptic. The best way




Plan of the Heavens.

to do this is to have the word August at the bottom, and adjust the opening to the circle of the ecliptic on the blue sheet. Before fixing, both sheets are sized, and varnished with spirit varnish. To use the star map, suppose you want to see what stars will be visible (on a clear night) on November 3, turn the blue map round with the cord until the word November is shown through the slot. The stars visible on the blue map will be the same as the heavens at about eight o'clock in the evening; if earlier, a little to the left; if later, a little to the right. The stars overhead are on the line bisected by the circle marked 60. The horizon is round the ecliptic, looking to the north at the top, to the south at the bottom, to the east or west at the side. I have suggested how some of the cuts given in the work may be utilised round the white sheet. The whole might be framed and glazed with a stout batten at the back for the blue sheet to work on, and a slot cut in the rabbet at the bottom for the cord. This frame then could be turned about, on its side looking to the west, or upside down for the north, and so on, which will be more convenient than if it be fixed to the wall."

**Glass Blowing.**—M. (*Bishop Auckland*) writes, in reply to SPES MEA (see p. 542, No. 138):—"You will require a Bunsen burner or blow-pipe, a bellows worked by the foot, two pieces of indiarubber tube to connect gas and air (these should have taps at one end to regulate the supply), a few files, some pieces of charcoal with conical ends for expanding tubes, some cotton wadding for annealing the articles, and a supply of glass tubes and rods: these are sold by wholesale chemists, but any local chemist would procure them. The bench or board at which you work should be covered with sheet iron."

### V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—BRASS; KILDON; S. T. (*Oughtibridge*); M. H. T. (*Birmingham*); F. B. (*Leek*); J. S. (*Newcastle, Co. Down*); TINNER; E. A. J. (*West Bowling*); DAMP WALLS; SCRIBBINS; E. P. B. (*Penge*); J. McB. (*Yair*); J. N. (*Perth*); A. G. (*Sheffield*); G. T. (*Oldham*); R. D. T. (*Marylebone*); H. G. H. (*Sheffield*); A. J. T. LE G. (*Guernsey*); C. S. (*South Shields*); T. P. (*Frodsham Bridge*); MELTON CONSTABLE; LEGHORN; ART T.; A. P. S. (*Hyde*); W. J. T. R. (*Hamilton, N.B.*); F. R. W. (*London, N.W.*); H. C. (*Surbiton*); T. C. F. (*Coalbrookdale*); YOUNG CABINET; F. H. B. (*Halifax*); W. T. (*Llantrisant*); F. T. C. (*East Finchley*); TYRO; SIRIUS; W. W. (*Keighley*); J. C. (*Bristol*); J. T. S. (*Sheffield*); A. S. (*Glasgow*); AMATEUR TURNER; ANXIOUS ONE; NO NAME; T. W. (*Accrington*); E. L. (*Wednesbury*); W. W. (*Stamford Hill*); J. W. H. (*Edinburgh*); G. E. M. (*Downton*); M. J. C. (*High Wycombe*); A. B. (*Salford*); C. J. A. (*London, N.*); T. S. (*Bognor*); J. W. T. (*Deptford*); A. E. M. (*Cheshire*).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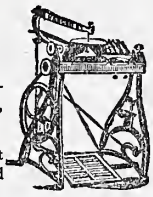

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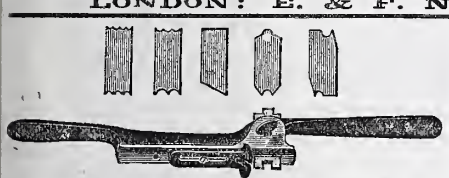

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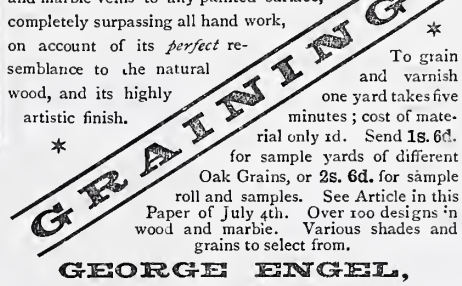


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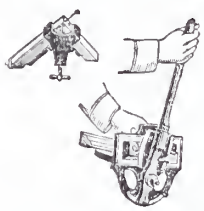

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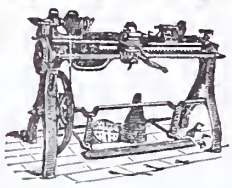

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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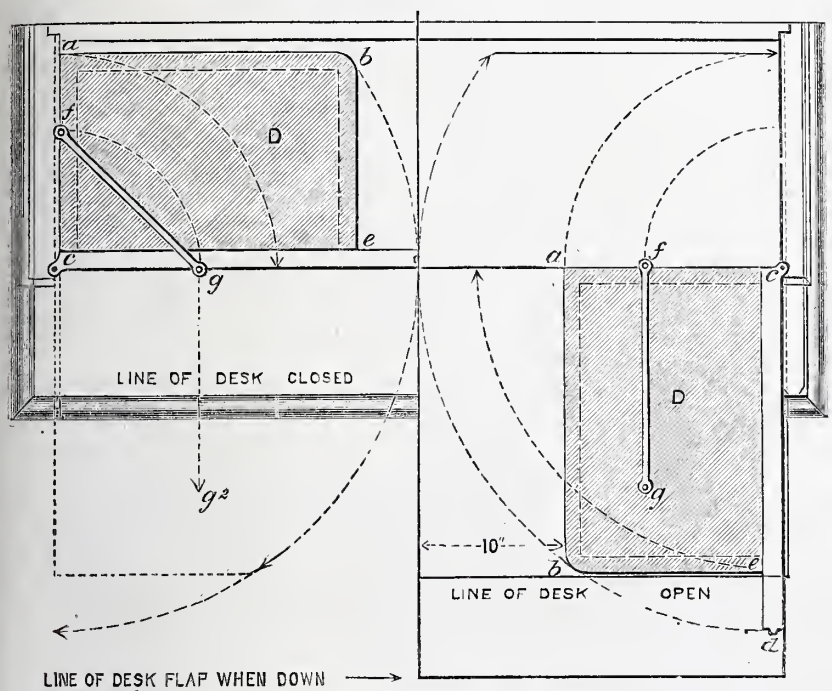
VOL. III.—No. 145.] SATURDAY, DECEMBER 26, 1891. [PRICE ONE PENNY.




LINE OF DESK FLAP WHEN DOWN →

Closed. ← Fig. 1.—Half Plan of Automatic Folding Secrétaire. → Open.

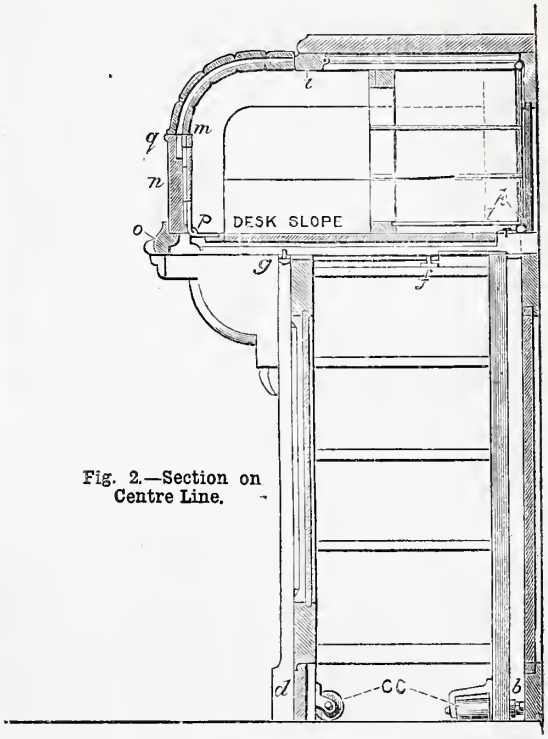
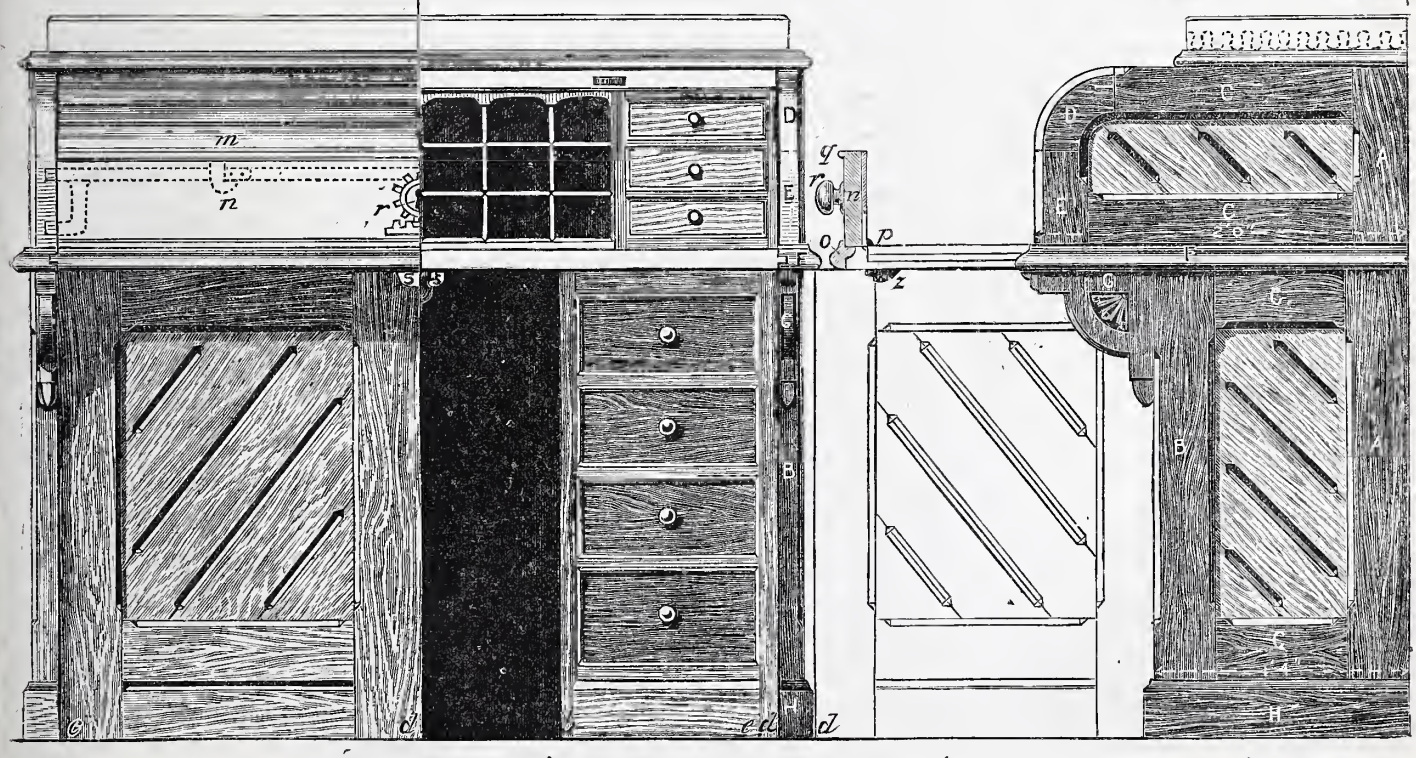



Fig. 2.—Section on Centre Line.




Closed. ← Fig. 3.—Half Elevation. → Open. Open. ← Fig. 4.—End View. → Closed.

## AUTOMATIC FOLDING SECRÉTAIRE FOR HOME OR OFFICE.

BY J. WHITFIELD HARLAND.

Economising Space and Time, and Attractive Appearance—How to Scheme Improvements—Methods of Assisting the Faculties—Occupation of Space by Movement of Parts otherwise Wasted—Actuating several Movements by the same Motion and Force—Conical Casters—Locking up Various Parts by a Single Motion of One Knob—Style of Design—The Main Construction—End Frames—Back Frame—Top—Bookcase above, if Preferred—Fittings in Carcase, the Movable Desk-Table and Slope, the Pigeon-Holes and Drawers—Frame of Drawers to act as Strut to Stiffen the Carcase—Front Hinged Desk-flap and Locking Apparatus—The Desk-Shutter—Under Portion—Doors and Drawer-Nests—How to fix Pivots—Connecting-Rods—Inner Plating with Steel—Converting Secrétaire into Fire- and Burglar-Proof Safe.

Having been consulted as to the best way of designing a secrétaire or writing-desk for office or home use, which should take up the least possible space consistent with utility, and at the same time form a decorative piece of furniture at a comparatively low price, and which should be capable of being instantly closed without disarrangement of papers, etc., I thought out and designed the automatic folding desk, of which the illustrations and the following constructive description may, I hope, be interesting to readers of Work.

The desiderata are to economise (1) space and (2) time, with an exterior sufficiently attractive in appearance. As to space, the ordinary office desk, with pigeon-holes, drawers, etc., with semi-circular shutter and nest of drawers at each side underneath, takes up about 4 ft. in length by 3 ft. or more in width or depth—*i.e.*, about 12 superficial feet. As to time, there are eight or ten drawers to lock up separately, besides closing and locking the desk itself. It will be noted that a space necessary for the legs and feet of a person using the desk—namely, the hollow under centre of desk—is always wasted, or, at most, is a receptacle for the "W. P. B."

When the desk is in use, we cannot dispense with room for the legs—say, 20 in. wide. The space is then necessary, but when not in use this space is useless—that is, it is simply wasted—and by the conditions, should be utilised when not in use, and still be available when required. I prefer to jot down the train of reasoning, that others may get an insight into the practical process of designing (or inventing, if preferred) means to an end expressed in the conditions which, technically, might have a greater value than the mere design now under consideration. Thousands who will never carry out the subject of this paper may deduce from it the way to carry out similar problems in other directions. Analogy and individual taste and requirements run on the lines suggested may result in improvements unforeseen to me, from other data, from other exigencies, and for indefinitely other objects; hence I prefer to show the brain action wanted, not merely for the present purpose, but for all other parallel or similar cases. In a few words, it is this: First examine thoroughly existing models; next criticise their shortcomings, and try to devise methods of utilising waste space, and to see if time be wasted in their use or not, and if so, to obviate the need for such waste of time as may exist.

Parenthetically, I have never seen mentioned in any text-book, or seen in practice, a valuable use of the hinge of the every-day "two-foot rule." I have a habit, when thinking out the three dimensions (length, breadth, and thickness), of playing with my rule-hinge to aid my imagination, and convey to "my mind's eye" an idea of relative proportion, putting my thumbs at certain points on each limb, and setting the joint at right angles. It may be put down as a foolish trick, but it does at times help the mind in its conceptions on every point, especially of leverage, change of position, etc., and saves making *model drawings*—that is, drawings where portions are cut out and are movable, in order to see where, in their orbit, they will clear other points of probable contact without clashing with other movable points at certain parts of their passage when in motion.

Returning to the means of economising the above-mentioned space: Let us suppose the usual nest of drawers on each side, which ordinarily support the desk, and are about 10 in. wide by 16 in. deep, and imagine them fixed to a door on hinges so that they could revolve into the space under the desk lengthwise across, thus occupying, including casing, only about 12 in. deep by 18 in. long, and partly utilising the 20 in. space between the nests when open. A glance at the plan (Fig. 1), which is divided so as to show position of one half open and the other half shut, and the front elevation (Fig. 3), similarly drawn, will show the working of the two nests of drawers on the pivots, *c*, *c*. Here the flap or door forming the side of the drawer casing (*c d* in plan) is, of course, made to extend to the centre line in each case, so as to fully close the aperture, whilst the casing (*a*, *b*, *c*, *e*) when swung open leaves 10 in. clear space on each side of centre line for the legs and feet of the writer using the desk. When closed (see end view, Fig. 4), the case with drawers folded inside measures only 1 ft. 4 in., and the desk above it 2 ft., or when open, 3 ft. 5 in., from back to front. The only motion required to open the secrétaire is to draw forward the desk-table, after unlocking, 12 in., which actuates two connecting-rods fixed by pivots at one end to the top of each drawer-nest, and at the other to the underside of the desk-table (see *f*, *g*, $g^2$ in Fig. 1). These rods being drawn forward 12 in.—*i.e.*, from *g* to $g^2$—cause the nests of drawers to turn on their hinges or pivots until they are at right angles to their former position, and face outwards. The same motion of the desk-table forward draws a cord fixed at *l* (Fig. 2) over the pulleys, *k*, *j*, and attached to the desk-shutter, *m i*, at *i*, and draws it back from *i* to *j*, thus fully opening it. The desk-flap, *m n*, with its covering moulding, hinged at *p*, can now be let down flat, giving 18 in. instead of 12 in. extra depth of desk space. It should be noted that the sides of desk and the drawers and pigeon-holes forming its interior fittings do not move—merely the table. By using spiral springs, the desk-shutter will close automatically when the desk-table is pushed back, and the flap turned upright to meet it. Conical casters are fixed to support the weight of the drawer-nests whilst revolving, so as to take the strain off the hinge pivots, and render the opening and shutting very easy.

It will be seen from the foregoing that one operation is all that is required to open or close the whole thing, and that therefore one lock is all that is necessary to secure the whole of the eight drawers, the desk itself, and its contents; and (as will be now described) this is a spring lock. By merely shutting up the desk, everything is locked up instantly. On referring to Fig. 3, the dotted lines on the desk-flap show the bolts for locking by means of a quarter turn of the handle or knob shown in half elevation, and a toothed wheel attached to the knob working into racks on the bolts, which also carry snugs to fit into the gudgeons fixed to the front bar of the desk-shutter.

To prevent unlocking, it is only necessary to lock the handle or knob so that it cannot turn. This is effected by having a spring bolt in the neck of the knob, which fits a hole in the plate through which it passes. In front of this spring bolt, and in the knob itself, is a five-lever lock—very small, of course, but inaccessible: the proper key alone being capable of drawing back, lever by lever, the stops and the spring bolt. The keyhole is shown in the front of the knob at *r* (Fig. 3), whilst at *s* is shown a stop which prevents the nests of drawers or the doors underneath from being opened so long as the desk is locked. If desired to be made extra secure, a lock can, of course, be also fitted to the stiles of the doors, but this is, in my opinion, unnecessary. A sliding shutter made in the knob to cover the keyhole could also be fitted, thus fully concealing the means of opening the lock. As there is no bottom, the whole thing should be fixed firmly to the floor, inside, with snugs and coach screws.

In order still further to save space, and to give the secrétaire a handsome look as a pieces of furniture, a bookcase could be fitted to part of the top, or it could be finished, where a bookcase is not desired, by a small balustrade and cap-mould, as shown in Fig. 4 in dotted line.

Having thus described the automatic working of the various parts, I will now give the main construction; but I do not give minute details, as it is unlikely that a tyro would undertake the making of so important a piece of furniture; whilst those amateurs who attempt it with any chance of success will have had the experience that will suggest these minor points. My design is semi-Gothic, but can be just as well carried out in Queen Anne or in Renaissance by modifying characteristics and mouldings. The construction in the main will be the same—viz., frame together the ends (see Fig. 4), consisting each of a long stile, A A, to finish 3 ft. 5 in. high, a short stile (front), B, to finish 2 ft. 4 in. high, two short and two longer rails, C, C, C, C, mortised and tenoned together, with a stile, E, and curved rail, D, to finish upper part. In drawing, the long stile, A, is cut narrower at upper part, to suit the narrower rails. The same width might be kept throughout to save trouble, if desired, but appearance is best consulted by reducing. The bottom stiles and rails are to finish 4 in. wide, the upper ones 3½ in. wide; all are 1¼ in. stuff, panelled with ¾ in. diagonal, jointed, stop-chamfered boarding well fitted into ½ in. grooves in framing, showing ⅜ in. reveal to face side, the framing stop-chamfered ¼ in. where shown, and having to front a carved bracket, G, 1 in. thick, centred and screwed and glued thereto, and finished with a moulding, F, and a plinth, H, as shown. On inner face, just behind and in line with the mould, F, a groove should be cut for the desk-table to slide in, and under it runners should also be fixed; another groove on inner face, curved to same radius as D, and straight along C, should be cut for the desk-shutter ends to work in. The upper end of the stile E, it should be noted, will tenon into a mortise in lower rail of the upper portion, which

involves driving the long stile on last, after fitting in all the panelling.

All the rails should be tenoned and wedged right through the long stile, which should be also rebated ½ in. each way inside to receive back frame, upon which a good deal of the rigidity of the casing depends, as there is neither bottom nor rail, and the top itself does not go across the full width. For this reason, at the foot of each stile an iron bracket of L shape should be screwed, to give fixing for coach screws, to the floor, and during its making a piece of stuff should be screwed to these brackets—at any rate, at the front—to hold it rigid.

When all this has been done, the back frame should next be made, and in order to give the rigidity just spoken of, should consist of two rails (top and bottom), with a centre stile or mounting—or even two, if preferred—tenoned and mortised into them; and these should be tenoned into mortises cut in each end stile right through them. The stiles and mountings should be 3 in. or 3½ in. wide by 1 in. thick, at least, rebated ½ in. by ½ in. to receive ½ in. matched boarding for filling of panels, which should be fitted, glued, and nailed to rebates from inner side. The stiles should also be rebated to fit rebates in the long stiles of ends, and should, when fixed in place, be glued to them and skew-nailed from within, and screwed in two or three holes to them from behind, and also from the ends under the plinth and under the mouldings, which afterwards conceal the screws.

The top should be of 1 in. stuff, 13 in. wide, either veneered or solid, and screwed down firmly at each end to the upper rails of the ends, and finished, front and ends, by a mitred moulding at edges; and if the bookcase is not desired, should have a thin narrow piece or strip laid upon it as a finish along ends and front to conceal the screws, forming a sort of ledge to carry balusters.

The casing, or carcase, being thus completed, the desk-table and flap should be made and fitted to slide freely in grooves cut in the ends to receive it. It should be framed of 1¼ in. stuff, with four transverse and two longitudinal pieces 3 in. wide, 3 ft. 10 in. long, exclusive of runners, and 1 ft. 9 in. wide. The two end panels should be filled in with ½ in. stuff in ½ in. rebates in the framing made to receive them, and finish flush with upper side. They will be 7 in. wide each and 1 ft. 3 in. long, leaving the centre panel 20 in. by 1 ft. 3 in., which is to be a loose desk-flap hinged to under side at front edge to the framing, so that it can be sloped as required for writing upon. This desk-flap should be clamped at ends, and be fitted into ½ in. rebate in the framing, so that it can lie flat therein when not required as a slope. If preferable, it might be framed and flush-panelled, and may be covered with cloth, leather, velvet, etc., glued down to its face, and finished according to taste; a 4 in. flap hinged to its back edge underneath would afford means for propping it up behind, the rebate being cut deeper, to allow of the flap folding down, as seen (*a b*, Fig. 2), so that it may slide under the pigeon-holes. There is an alternative which would save time in rapidly closing the desk—viz., that of leaving a 4 in. space in the pigeon-hole compartment, so that the flap could slide underneath whilst up. In the slope, holes for ink-wells and hollow for penholders, etc., could be made at the back. By this means the desk could be pushed back and closed without moving anything; or a fixed desk, the slope forming a lid, could be fitted to the sliding desk-table of the dimensions given—perhaps the best plan. The drawers and pigeon-holes in the desk portion should now be made, modified according to the above intentions.

As it is an object to obtain rigidity, the front framing of this portion—which, be it remembered, is immovable—should be strongly made and fitted tightly into the carcase, and well screwed thereto from inside, thus forming an extra rail across, and preventing end frames being forced either in or out, and keeping the grooves therein, in which slide the desk-table runners, close to their work. As no rail can be found room for below, owing to the folding of the drawers underneath, it is very important that this frame should be utilised in this manner—stiffening everything.

The desk flap (*n*, Fig. 2), which must not be confused with the slope and flap mentioned above, forms the front of the secrétaire when closed, and contains inside it the locking bars or bolts, carrying the knob with lock inside, or, if preferred, a lock of the usual kind, throwing a bolt into the knob spindle; and the tooth wheel that, actuated by the knob, throws the bolts should be made as follows (see Fig. 5, lettered to correspond with other Figs.).

The face of it should consist of a solid piece of stuff 3 ft. 10¼ in. long by 6 in. wide, ¾ in. thick, planed perfectly true and flat, upon which, on inner face, set out and fix the bolts and other parts of the locking arrangement, filling in with ½ in. stuff all the intermediate portions, which are shaded over in Fig. 5. This shading also shows the direction in which the grain of the wood should lie; which is important. This being done, and the working of the parts being ascertained to be perfect, the plate for the knob being screwed in its place, hinges fitted, and lock, if separate, fixed and found to act, the lining may be glued on. It should be of ⅜ in. stuff to finish out the total thickness to 1¾ in.—*i.e.*, same as the sliding desk-table. On its outer upper edge a small bead, *q*, should be planted for finish where the desk-shutter, *i m*, Fig. 2, joins it. At its lower edge a moulding, *o*, of the section shown should be planted, when rebated, partly on the face and partly on lower edge, which, when down, acts as a stop to the flap, and whilst up conceals the joining of the flap itself to the desk-table.

The only portion of the upper part of the secrétaire left to describe is the shutter, which, made in either of two ways, will complete this portion. In either case it consists of seven—or more, if preferred—strips of wood, hinged together, and chamfered or rounded off at edges, to permit of its following the curve like the well-known shop shutters.

It can be made of 1 in. stuff glued on to canvas at the back, as is often done, or, as I prefer, mortised through centrally in three places for bands of spring steel, ¾ in. wide by $\frac{1}{32}$ in. thick, to pass through; one mortise being central, the other two, say, about 6 in. from each end. For an extra strong job five steels might be used. As they require no fixing beyond being tightly drawn through the mortises, and turned over at each end and screwed, they could not so easily be broken into as if gluing on to canvas is resorted to. Clarke's patent shutter hinges could also be made available as an alternative. To the back of the last rib or lath should be attached the cord at *i*, passing over the pulleys fixed in the carcase, *j* and *k*, and the other extremity made fast to the desk-table at *l* (Fig. 2), which pulls the shutter up out of the way when the secrétaire is opened. To the first or front rib should be attached the catches into which the locking bolts of the front flap throw snugs to hold it down when closed.

I now come to the underneath portion of the construction. The sides of the nests of drawers, which form virtually a pair of doors, should be framed up of 1¼ in. stuff 4 in. wide, and panelled with ⅜ in. diagonal panelling, consisting of five 5 in. strips, all stop-chamfered ¼ in. as shown. These doors should be fitted exactly to close the aperture when shut—*i.e.*, each half of 3 ft. 10 in.—viz., 1 ft. 11 in. full. Into the hanging stiles of each (*c*, *c*) the back framing, *a*, *e*, of the drawer-nests should be dovetailed nearly through, and the front framing, *b*, *e*, should also be fixed to both top and bottom rails of these doors at 1 ft. 7 in. from back to front at *e*; the other side frames, *a*, *b*, being tenoned and mortised to the front and back frames. The drawers, runners, etc., can then be made and fitted. The doors, *c d*, *c d*, should not be hinged in the ordinary way, but hung on pivots at *c*, *c*, as shown, which consist of V fixings, like centre punches, working into plates having taper holes in them, so as to secure absolute accuracy of working as they move on their centres. A notch, *z*, must be cut for moulding, *o*, when flap is down. The exterior corners at *b*, *b*, can be rounded off so as not to remain sharp enough to bruise the knees or shins of the writer whilst seating himself or rising.

On the top edge of the back frames, *a c*, *a c*, at the points *f*, *f*, fix two pivots on which two connecting-rods, which may be of iron or brass, 13½ in. long, may work (see *f g*, *f g*), their centres being 12 in. apart. To ascertain the points *f* and *g*, you have only to lay the rod, *f g*, at an angle of 45°, and scribe on *f* the centre hole, and whilst the desk-table is closed, scribe on *g* the

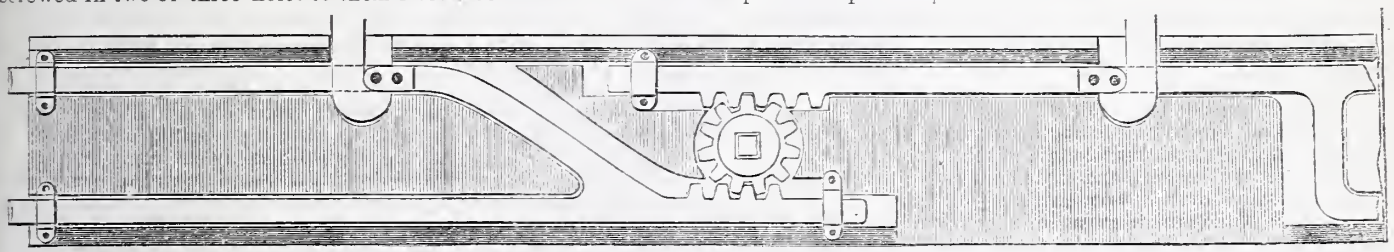


**Fig. 5.—Desk-Flap enlarged, showing Arrangement and Lock Bolts. (Scale, 2 in. to 1 ft.)**

centre hole, and when the pivots are in place and the desk is drawn out to its full extent, it will be found that the nest of drawers will swing exactly to its place square with the casing, and will allow the projecting part of each door beyond the drawer fronts (*c*, *d*) to act as a support for the desk front or flap to rest upon when down. To prevent the latter being scratched thereby, a piece of thin rubber may be nailed on the top of door at *d*. The doors should have a dumb plinth, as shown.

Should it be desirable to render this secrétaire more secure as a receptacle for valuable papers, etc., the whole of the inner surfaces of the carcase, doors, etc., may be lined with thin steel plates screwed to them, which would prevent their being cut through burglariously. It might also be made to act as a safe by being made of iron and steel throughout, intersected so as to break drills, etc., and made fireproof also. The exterior could be then enamelled to imitate wood of any preferred grain and colour to suit a library furniture—its instanter action rendering it valuable against sudden surprise when in use.

## HOW TO MOUNT CANVAS FOR PAINTINGS.

BY A. CONWAY.

ADVANTAGES OF MAKING FOR OWN USE — STRETCHERS — MATERIALS AND DIMENSIONS —FITTING OF JOINTS —WEDGES—COVERING —CANVAS—SUBSTITUTES.

I IMAGINE there are few readers for whom this article will have any attractions who need to be told that oil paintings are usually done on prepared canvas, and that this has to be stretched over a wooden frame or "stretcher." Still, there may be a good many who would willingly make their own stretchers and mount the canvas if they knew how. The work is simple enough, and they only want a few practical directions what to do and how to do it. Artists of the ordinary stamp are not above commercial considerations as to the cost of their materials, and to many of them the saving to be effected by doing what is suggested will not be unwelcome any more than to others. But perhaps this may seem false economy to some readers, for they may assume that the artist's time could be more remuneratively employed in painting than in making stretchers. Well, if an artist could always employ all his time profitably in painting, no doubt this might be the case, and those who can do so will, no doubt, prefer to get the canvas all ready to their hands. After all, though, the great majority have plenty of leisure—too much sometimes—and perhaps some may be glad to fill up their time profitably. Youngsters just beginning to paint may find every penny of consequence to them, and I hope the hints about to be given may be of use to them as well as to others. True, in London and many other places canvas all ready to work on can be had at such low prices that one wonders how it can be sold; but in many country districts it is by no means easy to get what is needed locally, and even when it is met with, the price is comparatively high. However, whether the user elects to make his own stretchers and mount the canvas on them or not, must be left to his own tastes. I can but direct him how to do what is necessary.

The stretchers or frames on which the canvas is to be mounted may as well first engage attention. Nothing need be said about their size, except that they may be anything. The construction is practically the same in all, with a slight addition, which will be named later on, for the largest sizes. These, however, the maker is not advised to begin with, as they may be too unwieldy. The material may be any kind of wood, though pine is generally used for the purpose, because it does as well as any of the more expensive kinds. In thickness it should be about 1 in.—that is, it is nominally of that thickness when in the rough, and before it is planed smooth. When this is done, it will seldom be more than ¾ in. thick, which is quite enough for small pictures, say, up to 30 in. by 20 in., and even for much larger sizes. If preferred, thicker wood may be used for all, but there is generally no object in doing so, and, of course, the greater the quantity used unnecessarily, the greater the amount of material wasted. The width of each piece may be from about 1 in. to 2½ in. or 3 in., according to size. The narrowest named is, however, only suitable for very small stretchers and for ordinary cabinet pictures. About 2 in. may be named as generally about the width which will be best.

Four pieces will be necessary for each stretcher—viz., two for the ends and two for

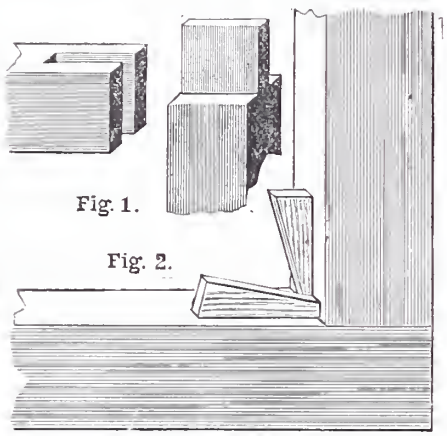


Fig. 1.

Fig. 2.

Fig. 1.—Mortise and Tenon Joint for Stretcher.
Fig. 2.—Cover of Stretcher with Wedges inserted.

the remainder. All must be cut of the full length required, and the ends be properly squared. They are fastened, or, rather, fitted together with a plain mortise and tenon joint, as shown in Fig. 1. Beyond saying that the tenon should be of about one-third the thickness of the stuff, it is unnecessary to make any remarks about this joint, as it is of the simplest kind. The parts should fit fairly well together, though the accuracy which would be expected in good cabinet work is not essential. In case of some workers not being quite so skilful as they might be, it may be desirable to remind them that the surfaces of the front—or that portion of the stretcher which is to be covered with canvas—must be level. The back is not so important, but if there is an inequality at the joiuts in front, it will make itself evident in the picture.

The stretcher might be covered with canvas now, but the wooden support would be rather a frame than a stretcher, for no provision has been made for "stretching" the canvas and taking up any slackness which may occur later on. The parts of the stretcher it must be understood, are only put together dry—*i.e.*, without glue and without any fastenings in the way of nails or pegs—so they can be pulled apart at auy time till bound over by the canvas. This being so, two wedges inserted in each corner, as in Fig. 2, afford a ready means of forcing the pieces of the frame somewhat apart, and in so doing, of course, tightening or stretching the canvas.

The wedges are usually of some hard wood about ⅛ in. thick, and for their reception spaces must be cut, one slightly prolonging the mortise, and the other alongside the tenon of the piece which fits to it.

The stretcher is, after the parts have been put together, ready for covering with the canvas. This should be cut at least sufficiently large to cover the edges of the stretcher, and if a little extra is allowed to lap over behind, so much the better. In doing this part of the work, a pair of the wide-jawed pincers as used by upholsterers will be found a convenience, but the ordinary kind may be used instead, or even they may be dispensed with, and the necessary pulling be done with the fingers. Whatever is used, care must be taken to get the canvas evenly stretched, so that puckers may be avoided. Evenness is even more essential at this stage than tightness, though this should be as great as convenient, otherwise, when the canvas becomes slack—as it probably will—there may be too much looseness to be taken up by the wedges. No specific directions need be given about the way to proceed in fastening the canvas, but probably the most satisfactory plan will be to fasten each edge down with one tack and then gradually work round. If this be carefully done, there is very slight risk of uneven stretching. The tacks are driven into the edge of the stretcher at intervals of, say, a couple of inches. The corners should be neatly folded over and each fastened with a tack. Any canvas projecting over the edge should either be neatly cut away or, better, be folded behind and tacked down there. The canvas should now be fairly tight—*i.e.*, presenting a flat surface sufficiently firm to be worked on. If it is not, or becomes slack, a tap or two on each wedge will make it as "tight as a drum," and nothing more is wanted. The whole of the work is much more easy, even to a novice, than it may seem to be from any description, and as "single-primed" canvas is purchasable at 4s. 6d. per yard 84 in. wide, it will be seen that the cost of canvases on stretchers need not be great when the amateur maker values his time—as he probably will—at *nil*. The addition referred to for large canvases is a cross-bar to keep the stretcher rigid, but will seldom be required.

Perhaps it may be well to say that canvas is to be had in various widths, and that unless some discretion is used in cutting it up, there may be more waste than is desirable or necessary. The prepared canvas is sold by the yard, and is obtainable at any good artists' colour shop. It may also be suggested that, in the absence of the real thing, various fabrics of similar substance may be used—coarse calico, holland, or anything of that kind. Something suitable can always be found in any country draper's shop, so that the would-be painter need never be at a loss in this respect. If he does not care to paint on the unprepared surface, he can easily prime it with some white paint thinned down with turps.

To show any painter-reader of WORK what apparently unpromising material can be used, I may say that I have an excellent picture by one of the ablest of the North Wales artists now living, painted on the back of a piece of glazed table baize. I may fittingly conclude the present paper by suggesting that this fact shows that it is the work, "layin' on the paint," and not the canvas, which makes a picture. Still, it

is not everyone who has the skill of the painter referred to, even among artists, and the beginner may as well use ordinary artists' canvas instead of some substitute for it. This brings to my recollection the saying that a "bad workman always finds fault with his tools," and the converse of this is equally true—namely, that a good workman will make a good job of whatever he takes in hand, even with poor appliances and unpromising material. That this is true is amply illustrated by the fact I have recorded above, in which a master of his art pressed into his service and made available for good work a piece of stuff which, in the hands of a less skilful artist, would have led to failure.

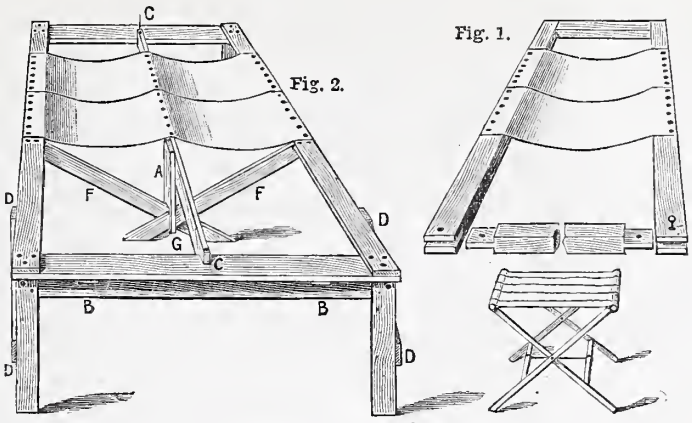


Fig. 2.


Fig. 1.

Fig. 1.—Single Bed. Fig. 2.—Double Bed.

## BEDSTEADS FOR EMERGENCIES AND FOLD-UP BATH.

BY JOHN CHARLES KING.

The handy man who made the Hat-rack described in No. 137 of Work, at the request of his friends at their stay in Paris during the Exhibition, 1889, was asked to knock up a bedstead or two for three friends who came in unexpectedly. Here we at once see the wide difference between an amateur who makes to conventional forms and fittings, and the man making one without having seen, heard, or thought of a ready knock-off bedstead, who on the instant evolves a new plan to meet means and requirements, using a chair for a bench, a camp-stool for a trestle, and some tools borrowed from a workman who was good enough to spare them for the novice.

Perhaps it was because he was not a bedstead maker or carpenter that his notions of work were untrammelled. "Bedsteads for three in an hour," was the laughing order of the young lady—his sister—though she little expected to see the order so promptly executed. They were done within two hours, and are still in use, as firm as when they were made.

The first one consisted of a square piece of deal, 2 in. by 2½ in., made up into a long frame, as shown by Fig. 1 (cheap and common deal). The open mortises were made by boring four holes 2½ in. from each end of the two long pieces; two saw-cuts into these holes made the mortises in very little more time than it takes to write about it.

The tenons on the two cross-pieces, forming the head and foot of the bedstead, were cut to suit the mortise notches. These tenons were about ⅞ in. thick, to stand the strain on them. Stout canvas was nailed on the top of the frame with large clout-headed nails. The canvas lapped over an inch at joints, held in the middle by a strong safety-pin. Two of these pieces are shown nailed on, to indicate the method. Screws secured the tenons in their mortises, which, when removed and the stiles taken out, allowed the canvas to be rolled round the long pieces for stowing away when not wanted.

A large camp-stool at head and foot served to support it, instead of legs. A mattress was not wanted; the canvas was sufficiently yielding. A little over half an hour was the time taken to make this single bed. The wood, canvas, screws, and nails cost 3s. 4d.

A double bedstead, on legs of some sort, was requested.

Lighter material was brought in for this one. Common deal, as for the single one, but only ⅝ in. thick board, served the purpose for all the parts—top, legs, and stays, or brace-pieces.

Fig. 2 is a double bedstead, made so as to take apart easily, so as to be carried on the arm in moving from the lodging.

The board was cut to the uniform width of 4 in.—the sides and mid-rib were 6 ft. 6 in. long; the head- and foot-boards 5 ft. long; the braces or side-pieces to support the legs 4 ft. long; the legs 2 ft. 3 in. long; the middle diagonal braces 6 ft. 6 in. long. An upright middle leg supported the mid-rib of the frame, and was fixed to the diagonal braces by their passing through a long notch in it. For the convenience of fixing the vertical toe- and head-boards to the horizontal ones, four sliding butts were used. These are marked at B B. This angle form of frame stiffened head and foot of bedstead. The mid-rib, A, was notched so as to clip the flat toe- and head-boards, and was secured by long screws at C, C. The legs were screwed to the vertical head- and toe-boards, and to the long sides of frame. The diagonal leg-braces were fixed to legs and sides of frame by screws, as marked at D, D, making them unyielding.

To prevent the canvas when weighted drawing in the sides of the frame, and bending down the mid-rib, the diagonal braces, F, F, were halved up under the side frames, with a shoulder to the edge of each, and screwed there as shown. These braces were screwed together at G, and notched through the lower part of the middle leg of the bedstead, and screwed to it. Canvas served for a mattress, as in the single bed, the joints overlapping, and held by safety-pins.

It was easily taken apart, and occupied but little space when rolled up in the canvas. It is still in use in Paris, and likely to be for many years as an extra makeshift bedstead for two. The wood, canvas, screws, butts, and nails cost only 6s. 8d., and the time to complete it—an hour and a half.

The sanitary necessity called for a bath, and it was as quickly made up, though there was less of the makeshift and contrivance about it than the bedsteads, but the same aim was in view—economy of time and cost in making, and portability and packability, so as to occupy little space when folded-up—an essential thing in the rooms of a Parisian dwelling.

Some good yellow deal board, ⅝ in. thick, was bought and ripped into 3½ in. stuff, 740 ft. run. This was enough for the frame of a bath—50 in. long, 30 in. wide, and 30 in. deep.

It is made up in four parts—the sides and the ends separate, as shown by A and B, Fig. 3. The top and bottom of sides were screwed on to the uprights without lapping the joints. The ends had uprights screwed on to the top and bottom pieces, as shown in the sketch. These ends had cross-braces, shown at C C, screwed at the joints to the uprights.

This stuff had to be planed smooth, and all the edges well rounded off on the outsides and top inside edges, where the canvas was drawn over the edges or came in contact with them. For fixing the ends on to the sides to make a bath parallelogram shape, eight 2 in. brass sliding butts were used, one of which is shown at Fig. 4, and are shown fixed at J J J J, Fig. 3. These lock the ends to the sides immovably, yet are lifted apart and put together so easily.

The canvas was the stout sort used for fire-buckets. The dotted line shows the two ends and the bottom in one piece of canvas, into which the sides had to be sewn with a double-handed stitch of waxed threads, a thin ribbon of gutta-percha, ½ in. wide, laid between making a thoroughly water-tight joint, even for indifferent sewing, which was candidly admitted by the needleman. The top edges of the canvas had twenty-four button-holes worked in the canvas folded double. These took hold of twenty-four extra stout brass round-headed screws fixed in the upper part of the bath frame, as shown.

The canvas of the bath rested on the floor, so that to soften the resting-places for bathers a roll of carpet or wrappers laid down adds to the bather's comfort.

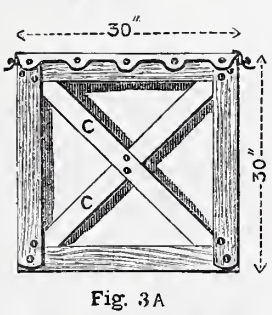


Fig. 3A

Fig. 5.

Fig 4

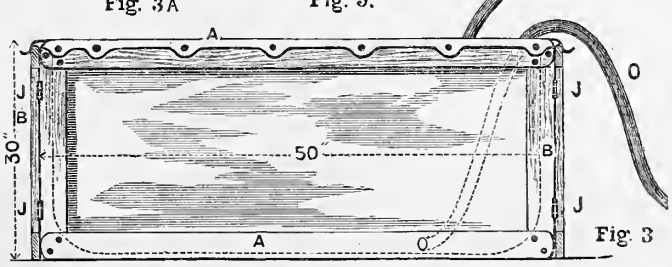


Fig. 3

Fig. 3.—Folding Bath: Side Elevation. Fig. 3 A.—Ditto: End Elevation. Fig. 4.—Butt Hinge Connection. Fig. 5.—Bath Complete: Folded.

Paris houses are mostly well supplied with water-taps, for supply by hose, if necessary; and for emptying the bath a flexible hose, with a low outfall, would act as a syphon, as it did with this bath. These are shown in the drawing of the bath.

To keep the bath sweet and clean, it must be wiped out well, and be dried before it is folded up and put away in an airy cupboard, or any odd corner of the room.

Instead of plain canvas, indiarubber dressed canvas might be used, and would be quickly cleaned and dried—the edges of lap-joints being cemented instead of being sewn together. The bath-frame is shown folded up in Fig. 5.

In the absence of fire-bucket canvas, closely woven canvas, dressed well with hot boiled linseed oil, and dried before making up, makes it waterproof, and answers the purpose.

What was serviceable in an emergency in Paris might be usefully so in England, in dwellings where room-space is contracted. The contrivances to supply the place of the real articles are certainly ingenious, and show considerable readiness of inventive power. There are not many, probably, who would have exhibited the same aptness in dealing with difficulties, and met so quickly and promptly the imperative call for beds and bath.

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### The Feed-Pump and Governor.

An Injector—Considerations Affecting Capacity of Pump—Making the Pump Eccentric, Plunger, and Rod—Chucking and Boring Pump Body—Making and Grinding in Valves.

We have now completed the most important parts of the engine, and we might stop here, simply connecting the steam-pipe with the boiler, and conducting the exhaust steam away by another pipe. Our engine would, however, be deficient in two respects: it would have to be regulated as to its speed by hand, and it would possess no pump for supplying to its boiler the feed-water necessary to make up for what is boiled away. Of course, if steam is obtainable from the boiler of another engine, or if it be preferred to employ an injector to supply the boiler with water, no feed-pump would be necessary. I will tell my readers where they can obtain a small and very simple injector, suitable for supplying our engine boiler, in case they should prefer it, and will then describe the force-pump designed for this engine. A small injector can be obtained from Mr. E. Powell, of 12, Grove Hill Road, Tunbridge Wells. No. 1 size will supply a one or two horse-power boiler; it is quite a little thing, and very simple, having no adjustment, but only requiring the steam and water turned on: it costs £1 1s. I have seen one of them at work, and believe that though so small they are quite reliable.

As to the capacity required for our pump, if we relied on theory alone we might turn to a table showing the comparative volumes of water and steam at 40 lbs. pressure per square inch, when we should find that one cubic inch of water would give about 500 cubic inches of steam at 37 lbs. pressure above the atmosphere, and we might proceed to argue from this that, as the pump, being single acting, throws one barrel full to every two cylinders full of steam, therefore the pump would require to have a capacity of $\frac{1}{250}$ part of the cylinder. Suppose the steam cut off at $\frac{3}{4}$ of the stroke, then we have a length of 6 in. of the cylinder filled with steam for the double stroke, or one complete revolution; add another inch for leakage and call it 7 in.: now, the area of 2 in. being 3·14 square in., 7 in. by 3·14 in. gives 22 cubic in. of steam expended for each revolution. Our pump has a diameter of $\frac{1}{2}$ in. and a stroke of $\frac{3}{4}$ in., its area being ·2 square in.; ·2 in. by ·75 in. gives for the cubic in. of water thrown per revolution ·15. No pump will throw its full capacity, so we will only reckon on $\frac{2}{3}$ of this, and call the quantity of water delivered by the feed-pump per revolution ·1, or $\frac{1}{10}$ of a cubic in.: $\frac{1}{250}$ of the capacity of the cylinder; the actual amount thrown by the feed-pump, therefore, should be greater than what is theoretically required by as much as $\frac{1}{250}$ is greater than $\frac{1}{250}$.

This will perhaps be the place to explain that it is convenient to be able to regulate the amount of water thrown by the pump so as to balance as nearly as possible the quantity extracted from the boiler by evaporation. This is done in a very simple way by means of a "return cock," which is either fitted as a branch on to the delivery-pipe, or else is screwed into that part of the valve-box of the pump from which the delivery-pipe springs. By looking at the back view (Fig. 6, page 328), such a cock will be seen; it serves a double purpose; acting as a pet-cock, it will release any air that may have accumulated, and, by gradually adjusting it, it can be made to let out and allow to return to the supply tank any quantity of water forced by the pump and not required by the boiler. It is also convenient to have a pump of a little more than the size absolutely needed, because, when about to stop work—at dinner-time, for instance—we can, by filling up the boiler, both ensure its safety from burning while we are away, and also lower the pressure by the introduction of a considerable quantity of feed-water. These practical considerations make it desirable to have a pump of more than the theoretical capacity. Some, too, prefer to have both the pump and the injector, as they are sure then to have one available; also the injector can be used when the engine is standing still, provided only there is steam in the boiler, so that it could be used to fill up the boiler during the stoppage for meals.

Having now taken a little rest from the details of construction, let me direct my readers' attention to Figs. 4. 5 (page 260), where the pump appears in section and plan; also to Fig. 6 for end view, and to Figs. 20, 21, 22 (page 328) for the eccentric, plunger, and rod. A second pair of straps will be required exactly the same as those before described; when these are finished, the eccentric (Fig. 20) would be undertaken; the two holes for the screws may be bored first of all, and through these holes wood screws may be passed into C, Fig. 56 (page 581), which can then be adjusted upon B, so as to bring true first the hole to be bored, so as to fit upon the boss of the main eccentric; and then the outer rim to fit the strap; also, if the screw-holes are countersunk and the heads of the two screws do not project, the face of the eccentric can be turned; if not, a narrow band only can be turned round the edge, and the remainder might be finished by the file: then the other side would be either turned up flat or filed. Notice, however, that the eccentricity is in this case only $\frac{3}{8}$ in., and not $\frac{1}{2}$ in., as in the valve eccentric. We now pass on to the plunger and rod, about which there is little to say, except that the small end of the rod containing the hole for the pin should be case-hardened, and the pin itself must be of hard steel, and driven firmly into the eye of the brass plunger. The plunger itself is made in two pieces, for which castings are supplied, and the two parts are to be soldered together when the joint has been fitted, and cannot then be separated without unsoldering again; this, however, will most likely never be required.

Turning now to the pump itself, the casting for the body has on it a foot, or flange, best seen in Fig. 6, by which we may chuck it on the angle-plate on the face-plate chuck. This foot must first be brought flat and vertical, so as to be parallel with the centre line in Fig. 6, in such a way that, when standing on its flange upon the face-plate, the scriber point will come to the centre of the four holes—namely, the suction, the delivery, the top of the valve-box, and the barrel. To ascertain these centres, plug them up temporarily with wood, file off the wood level, and find the centre with the dividers. There should have been a facing on the bed against which the pump flange would have bolted, but none was made because some might not wish to have the pump at all, and the flange can be well enough fitted to the casting by rubbing the place where it is to go with red marking to try the flange upon it. First, however, we must have the flange upright, and not slanting, as it appears in Fig. 6; also it must be brought into a plane parallel with that in which the centre lines of the pump lie, as before described; when this is done, it can be clamped upon the angle-plate, and each of the three centre lines can be brought true with the centre of revolution one after the other. Let us begin with the longest part—the valve-box. Set this carefully true in the lathe by adjusting the flange upon the angle-plate, and clamp it firmly; then bore out the inside to $\frac{13}{16}$ in., $\frac{1}{2}$ in., and $\frac{5}{16}$ in., taking care to bring the valve-seats perfectly true and smooth; cut the thread for the cap that closes the top, and turn the mouth of the hole true; we might, if we wished, turn the outside as far as the delivery branch, but that would involve getting up the whole of the outside bright, and it may as well be painted. Now take off the face-plate chuck without disturbing the setting of the pump body, and turn the two small conical valves. These valves are made from two little castings. Taking the large one first, centre it, and bore the little hole up the wings, which receives the reduced spindle of the lower valve; countersink this hole slightly, put the carrier on the small end, and put the little casting between the centres; or it might be grasped at the small end by a universal chuck, and supported at the other by the back centre point in the drilled hole; turn it up, bringing the three flat wings to fit into the bored part of the valve-box, and bringing the part that fits the seating to exactly the same cone, rubbing red marking on the turned seat, and trying the valve in till it fits; then see that the largest part of the valve does not exceed $\frac{3}{8}$ in. diameter, so that there may be room for the water to pass. The smaller valve is to be turned in a similar way; the top of its spindle is to go into the hole in the upper valve to steady it, but it should not fit that hole closely. The small valve should be capable of lifting $\frac{1}{16}$ in., an amount which can be regulated by holding down the upper valve and lifting the lower one with a bit of wire; put up the suction, and file off the top of the spindle till the lift is correct.

Having turned the valves, put on the face-plate chuck with the pump body upon it; make a handle for the valves by boring a hole in the end of a bit of wood, into which you can drive the small end of the spindle; then, while the pump is going round and back in the lathe (for you must not let the lathe wheel go continuously), you proceed to grind the valves to their seats. Do not try to do this with emery—never try to grind brass with emery; you can do it with some of the grit from the grindstone trough, or, better still, with a little bit of oilstone crushed up with the hammer on any hard surface, because then you get it pure. The great danger to be guarded against in grinding in valves, or plugs, is lest you get the surfaces which ought to be water-tight scored in rings and rough. This may arise through not keeping the grinding material distributed; it won't do to use force or to keep grinding on; press very lightly and withdraw constantly, to pass the finger over the surface and re-distribute the powder, and continue till you see that smooth, dull look that appears on the plug of a gas-tap if you take it out. Water will do well enough to mix with the grinding powder; you and I, reader, will not imitate those who use the product of the salivary glands, though it may be so conveniently near at hand.

The two valves being ground to their seats so that air cannot be sucked through, we may turn the pump body round on the angle-plate and set the barrel true to bore it out to fit the plunger, and cut the thread for the gland; then turn it round again, and screw and face up the delivery branch. The pump is to be strongly bolted to the bed, and the studs should fit well into the holes in the flange, that it may not move. An india-rubber pipe is to be stretched over the bottom of the valve-box for the suction. The delivery-pipe has a small ring brazed to it after the union-nut is put over it; the nut holds the pipe by this ring, and clasps it up to the face of the delivery branch. Between the two faces would be interposed a ring of indiarubber to make the joint good. The return-cock already referred to, as seen in Fig. 6, is supposed to be screwed into the valve-box, but it need not be placed there: it might be fixed as a branch downwards from the delivery-pipe.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Setting Out, involving the Use of the Square and Gauges.

We made the acquaintance of the mortise gauge in our last lesson, marking by its aid the position of the mortise and the position and thickness of the tenon. The square is needed to mark the shoulders and set out the mortise. It is important to remember that the square should always be used from the same edge and side, *unless* the wood has been prepared perfectly parallel in width and thickness, in which case it is immaterial to which side it is applied. It is for this reason, among others, that workmen always mark the prepared side and edge of all work requiring setting out. Whenever setting out anything in pairs, be sure to keep each pair face to face, or mistakes will occur. It is frequently a great advantage to fix, with a hand-screw, all the stiles—mortised members—of a job together, when the setting out can be done on the edges of each, transferring the marks as necessary to the other edge with square; in doing so, care is needed to have all the inner edges together, as well as all pairs face to face.

The gauging must also be done from the same surfaces throughout the job—that is, the marked surface of each piece—in order that the work may be "flush," or even, when put together.

If you have to buy a square be sure to look at several, and make sure of getting a good one by getting one that agrees with two that mutually agree. Formerly, buying a square was more uncertain than now, but sometimes squares (so called) belie their name. I found no difficulty, however, in getting several for a class, some time ago, all alike and correct.

If a square is, or has become, incorrect it will give different indications when reversed, but do not venture to alter a square unless you are certain that the edge by which you are testing it is accurately straight, and not then unless you have had much experience.

Supposing the work is dovetailed the setting out is different, inasmuch as the *ends* of the wood are more important, and are usually gauged from. As the lines cross the fibre of the wood a cutting gauge is preferable to a marking gauge. It is to be set, for plain dovetails, fully the thickness of the wood, so that the pins will just project a shaving when the work is finished.

This gauging pre-supposes that the ends of the work are planed accurately; this of itself constitutes a difficult lesson to be mastered, though one in which my writing without your perseverance will be of no assistance. If the work is of equal thickness, then one setting of the gauge will suffice; if not, it is better to have two separate gauges than to risk mistakes.

Opinions differ as to the best procedure in dovetailing. This is as it should be, for do not circumstances alter cases? In the great majority of instances the dovetails may be cut first, because then they can be cut in pairs, which if the pins were cut first could not be the case, though there are sometimes circumstances which make it almost imperative to depart from the usual mode of procedure.

There are, of course, several other methods of joining, the setting out of some of which shall be described in the next paper.

## MEANS, MODES, AND METHODS.

### What to do with Empty Tins.

Nowadays that so many different articles are packed in tins, it is a puzzle to many people to know what to do with them when their contents have been used, and in consequence many useful tins find their way to the ashpit.

I make it a maxim to never throw away an empty tin. Cocoa and mustard tins, if in good order and with the covers, I reserve for holding nails, screws, etc.; it is much more convenient to keep them assorted in tins than knocking about in a box. All my dry paints, plaster of Paris, and such like, I keep in square tins, and by this plan none of my colours ever get spoiled by damp, besides being to hand whenever I want them.

Large fruit tins, empty tea canisters, and all large tins, if a little battered, I hold over a hot fire—not with the fingers, mind, but with a pair of tongs—until the solder melts and the sheets of tin fall asunder. When cool, I hammer out flat with a mallet on a block of wood and put by for future use. These are but a few of the ways in which old tins may be utilised, but to an inventive mind no doubt many other means of utilising them will crop up, and what was formerly regarded as waste become useful, if not ornamental.

### How to Mend a Broken Violin Bow.

A musical friend of mine came to me one day some time ago in great tribulation. He had broken his violin bow across the middle—the result of a fall—and not being able to tackle it himself, he begged me to try my hand at it. At first I was afraid it was

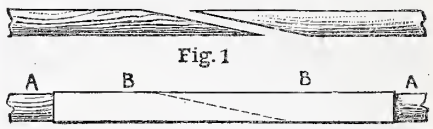



Fig. 1

Fig. 2.

Fig. 1.—How to cut Broken Ends to form Splice. Fig. 2.—Join Complete—A, Wood; B, Tubing.

done for, but after a little cogitation I hit on a plan which was very successful. The break was not straight across, but a little slanting, and with a sharp penknife I cut both ends so as to form a half-lap joint like Fig. 1. Then I got a nice piece of nickel-plated tubing—part of a pocket pencil, in fact—about four inches long, and which fitted tightly on the bow. I glued both bevels, and, about two inches above each, slipped the tubing over one half and then slipped in the other end, pressed well together, and left to dry. Fig. 2 shows join complete. It was a very good job, and stood well, the bow being in use still, and giving every satisfaction; the only fault being that it is a little heavy on account of the piece of tubing, which should be as light as possible.

### A Good Temporary Bench-Stop.

Many carpenters, when in want of a stop for temporary use—as, for instance, when working away from home—simply drive a few nails into the bench end, leaving the

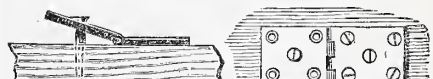


Fig. 1.—Stop ready for Use. Fig. 2.—Plan.

heads projecting enough to hold the wood. This is a bad plan, and a much better substitute can be made out of an ordinary butt hinge, one end of which should be filed into teeth so as to hold the wood better. This end should be left loose, and the other side screwed down tightly to the bench end. A long, light screw through the middle hole in the loose side will afford sufficient adjustment for thin or thick stuff. Figs. 1 and 2 will explain what I mean; it is much better than nails, and can be taken up when done with, and put away.

E. A. P.

*** This department of Work is open to the contributions of all who may be able to suggest some mode of procedure in working that he has tried himself and which may be useful to others. Considering the thousands of readers into whose hands Work goes weekly, there should be at least a column weekly, if not more, of such suggestions, etc.—Ed.

## AN AMATEUR'S READING-STAND, OR BOOK-REST.

BY F. B.

Being a tradesman, my time is broken up and into very much, and frequently when reading I am called away, and have to put my book down hurriedly. On coming back, I generally have a difficulty in finding the place.

However, I happened to have some disused brass gas-arms lying in a cupboard, and seeing these one day by mere chance, I thought of a way to make a book-rest out of them. What I thought of is shown by the drawings that accompany this paper.

It will be seen by Fig. 1 that it is well suited for reading, as it is adjustable to any height, by simply sliding arm up or down the standard. It also swings either way: which is very convenient, saving the trouble of lifting the whole concern when one wishes to get up from the chair.

Fig. 4.—Small Tray for Invalids.

I have sketched it from the back, because the different parts are seen better in that position. The parts lettered A, B, C, Fig. 1, and their accompanying joints, simply screw into each other; D was a socket which received a tapering joint. This I had to file to fit B. I next sawed 1½ in. off a 1 in. pipe, and then divided it again lengthwise, as seen in Fig. 3 at E, E. I then purchased a 1¼ in. brass hinge, D, which I soldered inside.

When I had got thus far, I thought I might as well make the book-rest so that it would take off and on—so that, if I wished to read at the table, I could do so (see Fig. 2). I cut two parallel cuts with an old tenon saw, to receive the ends of slot (A, Fig. 3), which I bent up out of a strip of brass, and fixed with solder from inside. I next took an old binding-screw from an electric battery, sawed the ends off, and drilled one so that the screw would not bite, leaving the other thread intact. These I fixed one on each half of tube, as shown at B, Fig. 3. I then cut two pieces of rubber sheeting, and fixed inside with glue. I also cut furrows lengthways, so that it would grip arm better (see C, Fig. 3). When this little contrivance is put on to the arm (C, Fig. 1), and screwed up tight, it may be raised or lowered to any angle required, without fear of slipping or altering its position, not even with a heavy book resting upon the book-rest.

I purchased next a plain band of brass, 3 in. wide by 2 ft. 3 in. long, and $\frac{1}{16}$ in. thick. This I cut into strips, ¾ in. wide, with a pair of snips. This gave me four lengths. I cut three of these again into shorter lengths, of 13 in. and 11½ in. full, so as to allow for working up into shape (see Fig. 2). I hammered them as flat as I could, and then filed them with a very fine flat file, finishing with two or three different sizes of emery-cloth.

My next difficulty was to drill the holes true, so that I could rivet them together, as shown in Fig. 2. I hit upon the plan of folding a piece of stout zinc round the end of one of these bands, so that it would slide off with a little pressure. I then drilled a small hole through both zinc and brass, and by this means I was able to measure accurately all the end holes; then, with a very little trouble, I was able to drill the others. I made my rivets out of brass wire. I next purchased a ½ in. hinge, for the back support, as shown at A, Fig. 2.

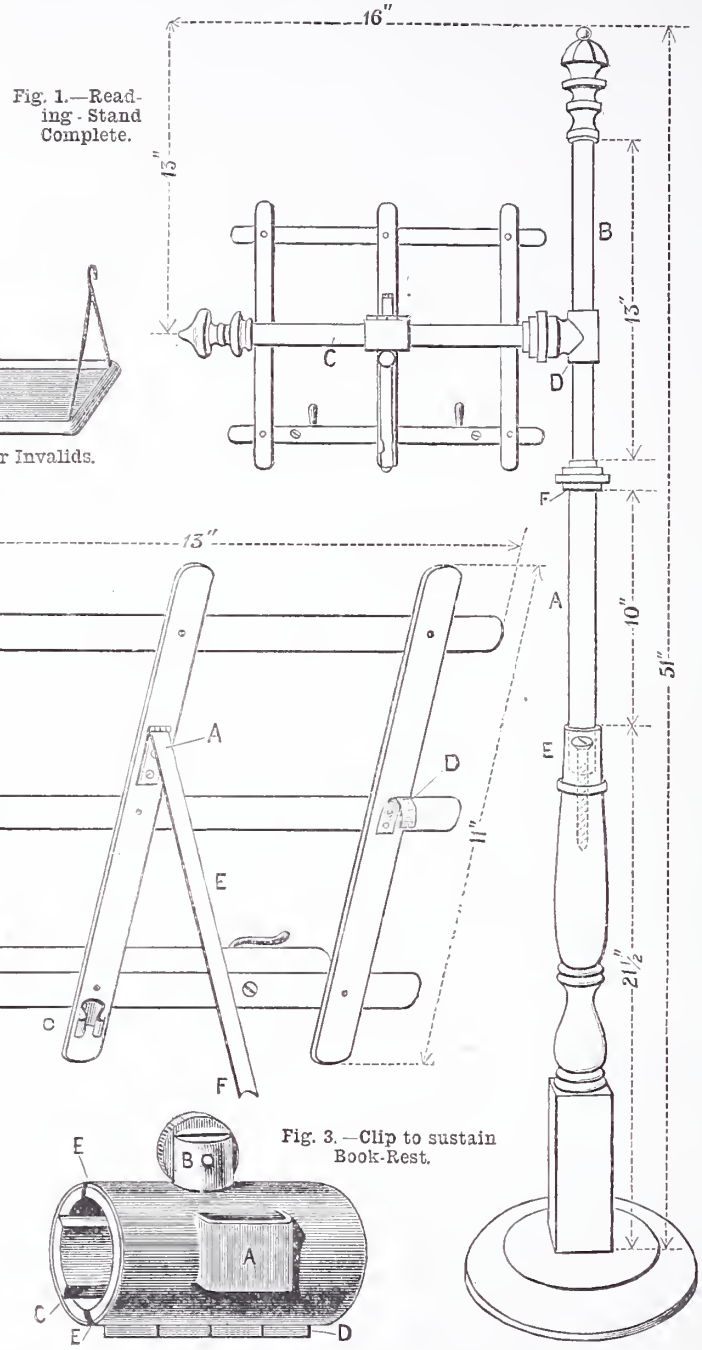



Fig. 1.—Reading-Stand Complete.

Fig. 2.—Book-Rest.




Fig. 3.—Clip to sustain Book-Rest.

My next job was to cut a piece of mahogany, to form a shelf to rest book on, 1¼ in. wide, 11½ in. long, and ⅜ in. thick. This was already polished. I fixed this on from back with screws, as shown at B, Fig. 2. I purchased hooks, for keeping the leaves of book down, at a piano maker's; but he charged so much, that if I had occasion to make another book-rest I should try my hand at making them out of an ordinary wood screw and a flat piece of brass filed into shape. I also found it necessary to make a small clip (see C, Fig. 2). This I made out of a thin strip of brass, and soldered it to centre-band, as shown. This tended to keep book-rest steady when fixed into its place. I also fixed two flat hooks, as shown at D, D, Fig. 2. This also I found an improvement in the same direction. The back support (E, Fig. 2) I made from strip of brass, ½ in. wide, and 7½ in. long, the end being filed with round file, to prevent it slipping when standing on the table (see F, Fig. 2).

Now we come to the lower portions. I had made up my mind that I should have to turn up a pedestal in lathe; but finding the leg of a common toilet table, I enlisted it into my service. The first thing was to turn it upside down, and bore a hole with centre-bit (see E, Fig. 1) 2½ in. deep, and just slightly larger than tubing, A, which it was to receive. I then took a 4 in. wood screw, and drove it in about half its length in centre of hole E: for what purpose I will explain presently.

My next difficulty was to get a base that would stand firm, and not be much in the way. This troubled me not a little, until I happened to see an old rusty tin plate, which suggested to me the plan I will now describe.

I put the plate on the fire with all the scraps of old lead pipe I could find, but I could not find enough to fill it, so I pressed a horse-shoe, a few old iron hooks, and a ½ lb. weight into my service. I was careful to put these near the edge of plate, so as to leave centre of it filled with lead. The plate measured 9 in. over all. I next proceeded to fix my plate (bottom upwards, of course) on the square end of the pedestal, taking care to have it in centre. I used a 5 in. wood screw and a washer for this purpose, and one or two nails to keep pedestal from twisting. I next cut a circular piece of wood the same size as plate. This I screwed to the bottom, after having first completed filling the plate with plaster of Paris.

There only remained to make the joint good between brass tubing, A, and the wooden pedestal at E. This I did by simply unscrewing tubing at F, Fig. 1, and placing A in position, taking great care to have it

upright. I then poured melted resin into the tube A, which flowed all round the wood screw, and filled up the space between wood and brass, making a clean and rigid joint with a very little trouble.

And that is how I made my book-rest, or music-stand. We use it also for a fire-screen, which is easily and effectively done by hanging a fancy worked banneret from the projecting arm. It is also very useful in a sick room, as the arm can be put to its full height, and a small tray suspended in front of patient (see Fig. 4). I ought to say I ebonised the wood and base, which makes a very good finish, and contrasts well with the brass-work.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

THE STUDY: THE WALLS—THE DADO—THE FRIEZE—ORNAMENTATION OF THE FLOOR—THE DOORS—SOME PRACTICAL SUGGESTIONS.

*The Study: the Walls.*—It will be remembered that I found the walls of my study covered with bare whitewash only from floor to ceiling; they were wholly innocent of cornice or skirting-board, and had, moreover, anything but an even surface. I scraped and cleaned away the whitewash, and then fell to considering how I might best render them more pleasing to the eye.

*The Dado.*—In the first place, as old wainscotting was abundant, I resolved on a dado of dark carved oak; this would be the very thing to harmonise with the woodwork of the fireplace. A few carved panels like those in the chimney corners were still remaining. I had also plenty of plain ones, so nearly of the same size that, with judicious placing, the difference would never be noticed, and these last I proposed to carve to match. Fig. 13 is one of the old panels. The ornament is a common one of the "Restoration" period, and one which requires no great skill or any long time to carve.

My panels were but some 15 in. high, and the whole strip of wainscot only about 21 in., so I had to bring my dado to a proper height by placing next the floor a skirting-board of ebonised wood, and of this I could slightly vary the width so as to bring my odd lots of wainscot to one uniform level. Along the top of the wainscot I nailed another strip of ebonised pine having a moulding on its projecting edge. This finished the dado off neatly. As I have before remarked, old dark oak and ebonised wood go exceedingly well together.

I may mention here that preparing the old oak cost some little trouble—more, indeed, than the actual carving of it. Old oak generally comes into the hands of the collector in a bad state—choked up sometimes with whitewash, beeswax, or dirt, or very frequently with paint. About the middle of last century the fashion appears to have been to paint the oaken wainscot of old rooms *white*. Some of the ancient wainscot that has come to my hands had received not less than half a dozen coats of paint. Whitewash, dirt, etc., yield to hot water, soda, and a scrubbing-brush, but successive strata of paint, which have had a century and a half in which to harden, require more serious treatment. The plan which I have found most successful is to make a strong solution of American potash, to mix it with sawdust, and to lay the poultice thus formed over the paint for a few hours; if cold water and a sponge will not remove the incrustation at a first treatment, they generally will complete the cleansing at a second. After either soda or potash the old oak loses its rich colour and looks pale and poor; but rubbing over with boiled oil, and a subsequent polishing with beeswax and turpentine, will restore it to its original tone.

In nailing the dado to the plugs which I had driven into the walls, I made use of a simple dodge for boring and nailing at exactly the right spot, which may prove a "wrinkle" to those not acquainted with it. Taking a plummet, I tied a knot in the line at a somewhat greater distance from the lead than the plug was from the top of the dado; then, adjusting the plummet so as to bring the bottom of the lead exactly to the middle of the plug, I marked a cross on the wall opposite to the knot. When my wainscot was arranged in place, I had, it will be seen, merely to hold the knot opposite to the cross on the wall and the lead would show with certainty the spot at which to drive the nail.

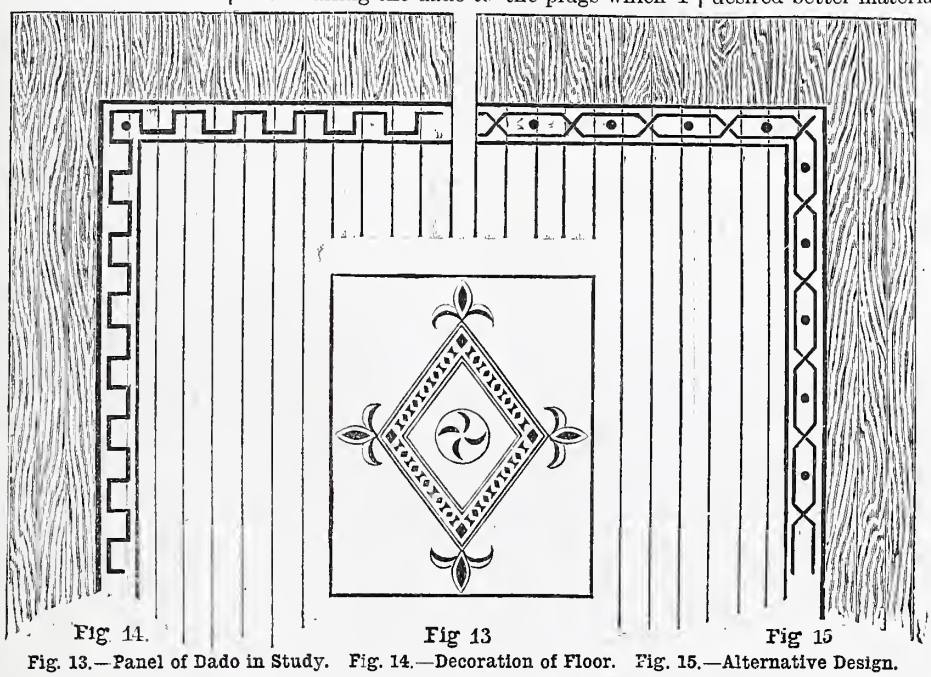


Fig. 14. Fig. 13 Fig 15

Fig. 13.—Panel of Dado in Study. Fig. 14.—Decoration of Floor. Fig. 15.—Alternative Design.

*The Frieze.*—The wall space above the line of my dado I well sized, and papered with newspapers to bring it to a more level surface. I got some steam-struck moulding of two sizes, one 1¼ in. and the other ¾ in. in width (they cost respectively 5s. 6d. and 3s. 6d. per 100 ft. run). These I ebonised, and fixed up the larger against the ceiling by way of cornice, whilst the smaller I nailed below at a distance from it of 1 ft. to form the bottom line of a frieze.

I had proposed to fill this frieze with an embossed paper about one-third gold and two-thirds maroon, but, as we all know, it is easy to imagine a paper just to one's taste, but not so easy to find it in the maker's pattern-book. I could meet with nothing to my purpose, but in the end made by no means a bad shift by using a plain maroon paper, and along its middle running a 5 in. strip of Japanese leather paper, all gold lacquer. As this paper is of extraordinary width (36 in.), three yards, at 2s. per yard, sufficed for the room.

The space between dado and frieze I papered with a plain and rather dark sage green, which went well with the other fittings, and forms an admirable background for pictures, whether in gold frames or black.

*Ornamentation of the Floor.*—The floor has been spoken of as the one good thing in this otherwise uninviting room. It was of fine heart of oak, and the century's wear which it had undergone had served only to season it. Had a floor polished throughout been the thing required, no one could have desired better material on which to operate. But, however pleasant to look upon, a slippery floor is practically objectionable. However enjoyable sliding may be upon the ice, it is not a satisfactory form of exercise for one's own sanctum. As I had no intention of laying down a carpet, I wished to preserve a firm foothold where the floor had to be walked upon. I contented myself, therefore, with oiling and polishing a width of about 2 ft. round the outsides. This strip took a rich colour and made a good ground on which to arrange my carved chests and chairs.

But the break between it and the unpolished part was too abrupt; so, to correct this, I added a line of ornament about 1 ft. in width, as seen in Fig. 14. Having drawn out the pattern on the floor I went over it with a solution of iron, the effect of which was to turn the oak wherever it was touched almost black. Iron turns new oak to a purplish black, but old oak to a very deep rich brown. The solution of iron was made by putting old nails, etc., in vinegar, and it was laid on with a small brush. If applied too freely, there is danger of the stain running along the grain of the wood, and thus in cross lines giving a blurred outline; with, however, a piece of blotting-paper kept beside the worker, superfluous moisture may be readily removed.

When dry, the stained parts should have a couple of coats of varnish; the ornament will then stand wear and tear and the scrubbing-brush for many years. This simple mode of floor decoration gives something of the effect, without the cost, of parquetry. It is one in which a simple pattern may be carried out with no great outlay of trouble, and will be sure to look well. As its inventor I may claim this for it. For an intricate design it is unsuited Fig. 15 is an alternative pattern.

*The Doors.*—To bring the doors in keeping with the old oak and ebonised woodwork, they were painted black; but as one of them led to the open air, it was desirable, for winter comfort, that arrangements should be made for covering them with curtains. Now, the brass and tapestry in vogue for that purpose would scarcely have been in keeping with the home-made fittings of my den, and, what was still more to the point, they were too costly for me. I contented myself with curtains of common green baize, but near the bottom of each I had sewn a double width of old-gold braid 1½ in. wide, and a trifle higher a single width of the same. This made handsome curtains.

For the means of hanging them I had recourse to the dismantled "four-poster" above-mentioned. Its side-rods were of the right length for my purpose, and each of them had at one end a socket, into which the foot-rod screwed. With the fret saw I cut from a bit of hard panel an ornamental javelin head of *fleur de lis* shape, gilded it, and screwed and puttied it into the socket of the rod; the rod itself I enamelled vermilion. Both my doors were in corners, so that one end of the rod in each case fitted into a socket fixed to the wall; the other, the ornamental end, had a hole punched through it and was hung on a hook. Thus arranged, my door-curtains were by no means a costly luxury.

*Some Practical Suggestions.*—In effecting the above improvements in "my den," it must be admitted that in some respects I had advantages which others who may wish to undertake similar work may not have. For instance, one does not find a good oak floor in every room. Yet I would observe that an ordinary deal floor is susceptible of decoration by the same method, only in that case, instead of the solution of iron, one of the usual wood stains must be used.

Nor may everyone have a stock of old oak panelling at his disposal. But, failing this, new match-boarding is always to be got, and is not costly. If the reader will refer to the excellent designs for ornamental arrangements of it in Vol. II., p. 627, No. 91, he will find abundant suggestions for such artistic new woodwork as might well take the place of my old wainscot, and which might be stained to any desired tone.

On the other hand, the rooms in ordinary and more modern houses will have advantages which mine had not; in the matter of windows this will probably be the case. These windows will most likely be larger, and, unlike mine, of greater height than width. Had I such a window space to deal with I should, before filling it with leaded lights, fit in a transom as well as a mullion. Say that its dimensions were 4 ft. 9 in. high by 3 ft. 3 in. wide, and that my mullion and transom each occupied a width of 3 in., I should then divide the space into two upper lights, 18 in. square, and two lower lights, 36 in. by 18 in. The lower lights I should fill entirely with white glass (plain pattern glazing), but in each of the upper ones I should introduce a coloured medallion or cartouche. I should thus get a more effective Elizabethan window than that shown in my last article.

I proceeded, however, just as I have told my readers, in the self-imposed task of turning my house, or parts of it, which at the first glance had appeared so devoid of promise, into one which, to say the least of it, was satisfactory to the eye. I have other portions yet to speak of, but the description of these I am compelled, through want of space, to reserve for future papers.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 96.—"A First Book of Mechanics.

Among the various educational works that have been published of late years by Messrs. Cassell and Company, Limited, there are few that have as good a claim to favourable consideration from schoolmasters and teachers, and acceptance and permanent adoption as a text-book, as "A First Book of Mechanics for Young Beginners," written by the Rev. J. G. Easton, M.A., late Scholar of St. John's College, Cambridge, and formerly Head Master of the Grammar School, Great Yarmouth. The value of the work itself as a text-book is much increased by the numerous examples that are appended to each chapter; but, as the book is intended for the use of schools, it is a question whether it would not have been better to have given the answers to the examples in a separate form, and, for the better assistance of pupil-teachers, to have incorporated with the answers the working of some of the more difficult problems. It is claimed on the title page that the book is "very fully illustrated," and so it is from one point of view, for it contains many explanatory diagrams in elucidation of the text; and it would have been well to have added the words "with explanatory diagrams" to those already quoted, for the popular notion of a fully illustrated work is that it contains plenty of pictures, and no publishing firm or company, perhaps, has done more to create and confirm this popular notion than Messrs. Cassell & Company, Limited. The *raison d'être* of the book itself is best gathered from the preface, in which the author explains that it has been developed from notes compiled by himself, "during a considerable scholastic experience, for the use of pupils preparing chiefly for the London Matriculation, the Preliminary Medical Examination, and the additional subjects of the Previous Examination at Cambridge. In its present form it is intended to supply the want, which has probably been often felt, of a text-book on mechanics treated with mathematical strictness and suitable for beginners whose mathematical knowledge is limited to Euclid's Geometry and to Algebra as far as Quadratic Equations." To anyone who has been brought up according to the old lines of mathematical teaching, it will naturally seem at first sight that the cart has been placed before the horse in taking Dynamics before Statics, but Mr. Easton very ably and, what is more to the point, convincingly shows that this mode of procedure is more reasonable than the old arrangement of Statics first and Dynamics afterwards, and explains that "at the present time there is a tendency to establish the science (of Mechanics) on the foundation of the Three Laws of Motion. In this course of procedure the elementary notions of velocity and acceleration are first dealt with, and next the measurement of mass and force, as involved in Newton's Second Law, is considered. The Parallelogram of Forces is shown to follow at once from the doctrine of the 'physical independence of forces' taught by that Law, taken in conjunction with the geometrical theorem of the composition of simultaneous velocities." In accordance with this, Mr. Easton divides the first part of his book—namely, Dynamics—into two sections: Kinematics, dealing with (1) velocity and acceleration, (2) linear acceleration, and (3) the composition of velocities; and Kinetics, treating on (1) force and mass, (2) Newton's Laws of Motion, with examples, (3) collision or impact, and (4) work and energy. Of these, Kinematics involves the geometry of motion, or motion considered irrespective of its causes, and Kinetics, motion, together with the causes producing it. Then follow Statics, in which the state of rest of bodies is dealt with. That Mr. Easton's book is in every way important and well conceived as a text-book is proved by the *primâ facie* evidence of its arrangement, and the clearness of the matter contained in its pages. There is but one thing that I can venture to suggest by way of improvement, and that is, a short glossary giving the meaning and derivation of scientific and mathematical terms employed in its pages. Such words as dynamics, kinematics, kinetics, velocity, acceleration, statics, etc., present no meaning that the mind can fairly grasp at first sight to those who are unacquainted with their derivation, and thus miss the force of signification that is contained in them; and it is not every teacher who can explain them to his class so as to endow them, as it were, with the life of meaning, and thus to render them better capable of retention in the mind and in the memory.

### 97.—"Condensed Mechanics."

In marked contrast to the volume just noticed, which deals with theory rather than practice, or which, in other words, is theoretical rather than practical, is "Condensed Mechanics," a selection of formulæ, rules, tables, and data for the use of engineering students, science classes, etc., in accordance with the requirements of the Science and Art Department, by Mr. W. G. Crawford Hughes, A.M.I.C.E., First Class Honour Man in Technology, City and Guilds of London Institute, etc. etc., and published by Messrs. Crosby Lockwood & Son. This book is practical rather than theoretical, although it deals, in the first part, as briefly as possible with what the author himself describes as "Condensed Theoretical Mechanics," and in the second with practical work and tables, "it having been the endeavour of the author," as he himself says, to gradually lead up in this manner to problems actually occurring in practice. The tables have been given chiefly as a reference for the student, to aid him in solving the problems presented. The tables deal with data and formulæ on various matters connected with engineering.

### 98.—"Light."

The book which bears a title well calculated to excite the interest and raise a spirit of inquiry in all those who are desirous of learning all they can respecting the wonderful phenomena of Nature, is one of a series of handbooks on scientific subjects published under the general title of "Whittaker's Library of Popular Science," by Messrs. Whittaker & Co. Briefly described, it is an elementary treatise on the subject by Sir Henry Trueman Wood, M.A., Secretary of the Society of Arts. It has been written, as its author tells us, "with the view of providing such information as an intelligent student, unfamiliar with natural science, would require;" and although it has been sought to give the information contained therein in a sufficiently simple form, no attempt has been made to go down to the level of language and style which would be looked for, and, indeed, would be used naturally enough in a book specially intended for young people. A synopsis of the chief contents of the volume may be given as follows: The modern theory of light is first set forth, and it is shown how all phenomena which are matters of common observation may be explained on that theory. The nature of colour is then described, and the mode of its production, and this is followed by an account of the construction and principles of action of the more important optical instruments. Further, an explanation is given of the chemical effects of light and its influence in producing those alterations which are so noticeable in every sun-picture or light-picture produced by photography. Lastly, a brief description is furnished of the phenomena produced by polarised light and fluorescence. In the Appendix, the names of kindred works are given which the student may read with advantage on this subject, after having made himself master of the book now under consideration. THE EDITOR.

## SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

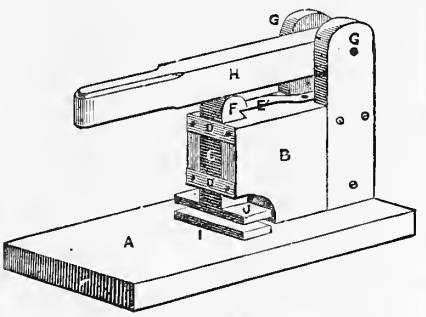
### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Lady's Ring.** — NOVICE. — You say you have bought a lady's gold ring, set with pearls, that has gone white like silver after a few hours' wear; and it also made a green mark on the finger. This ring appears, from the foregoing extract from your letter, to be a swindle—almost without a doubt. Now, to settle the matter one way or another, I should, if I were in your place, take it to another jeweller to test; or, if you have no other near but the one you bought it of, then take it to a chemist. Either will be able to give a decision almost instantly by this simple test: namely, scraping a small part of it quite clean, say one of the sides, so as not to damage it, and then applying aquafortis. If it is 15 ct. gold, there will be very little alteration in colour; but if it is 9 ct., he will find that a dark stain will come over the place that the acid is applied to. If, however, it is base metal, such as German silver, brass, aluminium gold, etc., then it will bubble up and turn pale green, and give off fumes, the acid being in a complete turmoil until its energy is expended. A better way still is by comparing it with known qualities by means of a touchstone, or a piece of Wedgwood pottery will do as well. To carry out this method, a small streak—say about ¼ in. long by ⅛ in. wide—should be rubbed off the ring on to the stone. Then get two or three other known qualities of gold, and make similar streaks with them at the side of the one you wish to test. Finally, apply the aquafortis by means of a pointed piece of glass, right across the whole row. Then, after a few minutes, wipe the acid off; one or the other will be sure to be acted on in the same way as the rubbing from the ring is, that one being, of course, of about the same quality as the one you wish to find out about. If it is base metal, then the whole line will disappear—but so it does with 9 ct. gold; so if you find the rubbing from the ring leaves no mark where the acid has been, then try the other method; but do not flood the work with acid. Now, there is a way that a gold ring can be changed to white in a very little time, and that is by becoming covered with mercury or quicksilver. Be quite sure no such contact has been made before you go further in the matter. The former condition can be restored at a cost of about 1s., I should say. If the ring is a hollow one, and has been water-gilt, it might account for this; for very often the mercury oozes out when any has been left inside, and will completely cover the article. The next thing is with regard to the Government stamp: if that is false, I shall be able to put you in possession of facts that will enable you to bring great pressure to bear on the man that sold you the ring. For that purpose, if it is necessary, you must send me a description of the four or five marks you will find inside the ring. First, the two letters or more that are together; then, is there a leopard's head, or an anchor, or a lion, or what? thirdly, what is the single letter, enclosed in a shield? fourthly, is there a crown, and the figure 15? I want to know this, so that I can find the particular town-mark that has been counterfeited. I do not think I can give you more information or advice, with only your letter before me; and you will clearly understand that nothing but an actual test, carried out by a practical man, can be relied on; so, before demanding your money back, be sure to have one made as I advise. You ought to get a light 15 ct. lady's ring, set with small pearls, for the amount mentioned. I know of no "acid" from a person's body that would cause gold to go white, and I do not believe there is any.—H. S. G.

**Mastic Cement.**—F. A. M. (*Liverpool*) does not mention the purpose, or the kind of material, for which he requires a mastic cement; which makes it difficult to give him a satisfactory answer. We believe that for such substances as will bear heat (glass, china, etc.), the gum mastic, used alone, is sufficient. When jewellers wish to unite two stones, or to mend a broken one, they are said to heat both pieces, apply a little gum mastic to the two faces, and press the two pieces tightly together, keeping them so till cold. This, if well done (with the minimum of gum), makes a strong and scarcely perceptible joint. Gum mastic, merely dissolved in alcohol, is also used as a cement for hard materials. Some cements have been called "mastic," which have no connection with that gum except its name.—M. M.

**Polishing Marble Slab.**—MARBLE.—The slab being already slightly polished, no preliminary work will be necessary. The perfect polish will be given with "putty powder" (calcined tin). This is applied, with water, on a thick felt stretched over a block of wood, which, by means of a handle, has to be kept moving over the face of the slab till the polish is obtained. Putty powder can be got at the colourman's, and if any difficulty is found in getting the proper felt at the same place, it can be had from a marble yard. It is sold by the pound. Perhaps, with the exception of sawing marble, there are few finer exercises for the virtue of patience than polishing.—M. M.

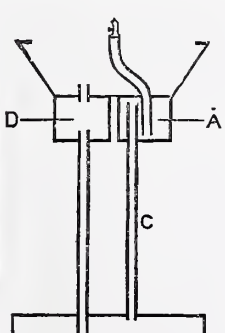
**Die.**—W. H. (*St. Leonard's-on-Sea*).—The die in question can readily be used for *plain* stamping on paper, if mounted in a wooden press made after the style indicated by the accompanying sketch, in which A is a baseboard of 1 in. wood, 12 in. long by 6 in. wide; and B a block of wood 2 in. thick, 6 in. long, and 4½ in. high, into which a plunger, C, 1 in. square and 4½ in. long, is fitted as shown, being retained in its position by two brass strips, D, D, screwed to the front edge of B, and supported by a flat spring, E, screwed to the top edge of B, as shown, and engaging in a notch, F, in the plunger. G, G, are two standards, ⅛ in. thick, 2 in. wide, and 7½ in. high, glued and screwed to B. These standards support one end of a lever, H, which rests upon the plunger, C, to which it transmits pressure, applied to the free end of the lever. The plunger should be



Die for Paper Stamping.

well fitted to B, so as to travel freely with the least possible play; and the spring, E, should be strong enough to lift the plunger and lever, H. The die, I, is fitted to the baseboard centrally, under the plunger, by any convenient means which will admit of its rapid removal and replacement. A counter-plate, J, is formed of a piece of stout sheet brass, rather larger than the die, affixed at right angles to the lower end of the plunger; the counter-die itself being formed of a piece of sheet gutta-percha, softened by heat, cemented to the under-side of the counter-plate, and strongly pressed on the die whilst still soft, the pressure being continued until the gutta-percha becomes cold and hard. If the lettering of the die is sunk, the press so arranged may be used for either plain or colour stamping. If the latter process be decided on, the die must be removed from the press and carefully inked in the letters by means of the ink sold for the purpose (and which, no doubt, the makers of the die can supply), applied with a brush, the surplus ink being removed from the face of the die by rubbing on a flat pad of soft paper. The die is then replaced in the press. The ink left in the sunk letters will be transferred to the paper when placed in position, and the lever depressed with some force. The removal, inking, and replacement of die has to be performed for each sheet of paper stamped. Should plain stamping alone be aimed at, the relative positions of die and counter may be reversed with advantage.—QUI VIVE.

**Self-acting Fountain.** — AMERCKEL. — The sketch of fountain sent (of which you say you have made four, and none of which will play for more than two or three minutes) is an illustration of how a simple contrivance like the "Hero" fountain may be mangled and complicated so as to be useless. The reason your fountains do not play is that you get but a very little water at all into your vessel, A; and, if the jet is anything just discernible, is quickly exhausted. This vessel, A, should be about the same size as the bottom one, and the time the fountain will play through a given jet depends entirely upon the capacity of the vessels, A and B. Your vessel, D, is useless and quite superfluous. There is a fully descriptive article in No. 69 of WORK upon this subject. Try a fountain upon those lines to any dimensions and you will succeed.—C. M. W.



Self-acting Fountain Part.

**Design for Alabaster Panel.**—NEMO.—With every wish to be of service to NEMO, I fear the want of particulars in his letter will forbid my being so to any great extent. He should have said whether his practice in carving makes an elaborate or only a simple design desirable. He should have said whether he wants a figure subject or mere ornament, and if the latter, what style he desires—whether Classical, Gothic, Renaissance, Naturalistic, or what not. If I know *what* he wants, I will gladly (with the Editor's permission) try to draw it for him. If (as he hints) he is in a hurry, I would advise him to try some of the designs already given in WORK. Most people like the Naturalistic style; let him refer to No. 13 (Vol. I., pp. 200-1), and he will there find some good panels of natural fruit and foliage—plum, hip, and blackberry—which he can readily adapt to his dimensions. Though designed with a view to wood carving, they are not less suited to alabaster, or any fine white stone.—M. M.

**Index.**—A. W. (*Stoke-on-Trent*).—You are a little behind date in your kind suggestion. The "good thing" you require in the shape of an index has been published for Vols. I. and II. of WORK, and a third one is in preparation for Vol. III. The price of the Index is one penny.

**Lathe Speed.**—R. T. (*Paisley*).—You wish to turn 8 in. cast-iron wheels on a lathe which gives a speed of one revolution to four treads, and you ask whether this is slow enough. Yes, certainly; it is just about right, and you should be able to turn 10 in. diameters. I cannot tell whether your lathe is strong enough, but think it is sure to be.—F. A. M.

**Spring Roller Blind.**—FIRST TIME OF ASKING.—It is quite impossible for an amateur to make a spring roller for a shop blind; but as FIRST TIME OF ASKING wants to get an idea of the kind of spring used, and of the method of fixing, we reply that the roller is made by special appliances for rolling tin in cylindrical lengths, of the length of the sheet of tin. These lengths, with a lining between each, are soldered together—"sweated," as it is termed. The ends are turned beech blocks; the spindle, an iron rod, from ⅜ to ¾ in. diameter, according to the size of roller. The spring is of wire, specially drawn for the purpose, known as "charcoal spring" wire. This is wound on a revolving mandrel by the roller-maker. The mandrels vary from ½ in. to 1½ in., according to diameter of roller. One end of the cylindrical coil of wire thus made is fixed to one end block, the other to the iron spindle; care being taken to wind the cloth, so that the coil is made tighter when the blind is drawn down. FIRST TIME OF ASKING can get a roller through a blind-maker.—B. A. B.

**Boot and Shoe Repairing.**—G. H. (*Kings Langley*).—Articles have appeared in the following numbers of WORK: 112, 117, 122, 126, 130, and 137.

**Air Pumps.**—AIR PUMP says:—"I do not altogether understand the drawing (see WORK, No. 136, p. 497) of the silk valve, Fig. 2; but I understand its action from your description. I enclose sketch of my idea of the silk valve. Is not the end of your drawing screwed so as to screw into pump barrel?" In reply, I would say that the fear of an unduly long article, together with the thought that this part of the instrument is of easy understanding, kept me from going into details. Fig. 2 represents the valve end of the horizontal tube at the bottom of the barrel in Fig. 1, where the engraver has shown, as clearly as it is possible, the valve, a short tube being soldered to the barrel, into which Fig. 2 is screwed. In the sketch sent AIR PUMP seems to think that the white parts marked C in Fig. 2 are wooden plugs. How he has this idea I do not know. Let me try to make the matter a little plainer. In the tube A a short piece of smaller tubing, B, is soldered, to take the thread; on the end of this is soldered a thick disc, C, which is undercut as shown. On the two opposite sides the undercut is filed off. Across this is placed the silk, as shown by the dark lines. This is carefully tied on, and the undercut prevents its being forced off by the pressure of the air. What AIR PUMP has evidently taken for wooden plugs is the disc projecting on each side beyond the silk. If AIR PUMP could let me know his whereabouts I should be very pleased to send the part in question for his inspection, but I think the foregoing ought to be clear enough. AIR PUMP asks which I would recommend him to make, Fig. 3 or Fig. 6. Well, what does he want it for? If great rarefaction is needed, I should say Fig. 6; but I have given, I think, the advantages of each, and it would be idle to repeat. "Please give thickness of barrel, depth of piston, and mode of packing." I use thin mandrel drawn tubing, such as is used in optical instruments. No thicker is needed. The piston may be 1 in. or 1¼ in., and packed with worsted or cotton. For lubrication do not use grease or oil, but a little vaseline, as I believe there is no acid to corrode the brass as there is in oils. "Please say if the drawing of aspirator is full size." No, Messrs. M. & S.'s in glass is about 8 in. The only fault in the engraving is that the thickness of the metal is shown disproportionately heavy, and that the taper tube, F, should come to a very fine point, the opening simply being a pin-hole.—O. B.

**Tips.**—F. S. (*London, N.W.*).—The inquirer is Mr. Jupp, Wardour Street, London, W.

**Violin Making.**—T. H. C. (*Stroud*).—Articles have appeared in the following numbers of WORK: 105, 110, 114, and 118.

**Graining.**—SOLDER POT.—Articles appeared in the following numbers of WORK: 55, 58, 62, 65, 69, 72, 76, 79, 84, 93, 95, 98, 100, 103.

**Æolian Harp.**—J. H. (*Newchurch*).—An article on this subject appeared in No. 55 of WORK.

**Printing on Bindings.**—CÆSAR.—For printing the title on the backs of books in gold, brass letters are generally used. These have long wooden handles. The letters are sold in boxes or sets containing the alphabet and figures, etc. The process has indeed been given many times in WORK, and very fully in the articles upon bookbinding in Vol. II. You should really look these up, as you will get full instructions of the process, more than I could possibly give here. However, a general idea may be given in a few words. Wash the books with paste water, and after they have become perfectly dry give the title, and other parts where you want the gold to appear, two coats of glaire, allowing the first to dry before applying the second. After both are dry, lay on the gold leaf, using lard or olive oil to make it adhere while working. Lay out the letters to be used and heat them in a gas flame, or otherwise; lift them one by one and press them on the cover upon the top of the gold; the heat of the tool will make the gold to adhere. After the whole title is finished, rub off the superfluous gold with an oily rag. This may help you, but see the articles on the subject already mentioned.—G. C.

**Leather Desk.**—LEARNED.—You want to know how to ornament desks which you have covered with leather and American cloth. There is no book upon the subject that I know of. If you read the articles upon bookbinding in Vol. II. you will get all you require, for the method of treatment in the case of books is the same as you want for your desks. You will require a number of rolls, corners, sprigs, etc., as we call these tools. They are made of brass with wooden handles. When working with them they must be heated. I would advise you not to put gold upon the American cloth, as only those who are well up in this class of work can do it; besides, it is seldom done, as the cloth is used for cheapness. Look up the articles mentioned, and if you require any other instructions write again.—G. C.

**Four-Jaw Chuck.**—R. C. (*Glasgow*).—You may obtain all the information you require in No. 1324 of the *English Mechanic*, with drawing—far more than the Editor would like to put into the "Shop" columns. I will only say, then, that the proportions of the dog as you have them are correct, but that you should certainly have them *forged* and case-hardened after fitting.—F. A. M.

**Picture Framing.**—A WOULD-BE PICTURE-FRAMER.—Articles on Picture Framing appeared in Nos. 5, 8, 70, 106, 109, and 121 of WORK. Your bookseller or the publishers, Messrs. Cassell & Co., London, E.C., will supply them at one penny each, or by post three halfpence.

**Cracked Ball Cups, etc.**—A. T. (*Canonbury*).—The frame must be twisted, or the cups are not put in true. To bell out tube for lap joints: The tube is slit down on opposite angles with a saw as far as you think sufficient. The belling is done by beating and working out on the nose of an anvil if the tubes are large; if tubes are small, a pointed mandrel screwed in the vice is used, or a tinman's stake will do. It is a somewhat difficult job to do satisfactorily, and requires some experience. Bending handle bars: This also requires some experience, as they are usually bent by heating, without filing. To ensure against the tube flattening, ram the part to be bent with dry sand, driving a wad of paper into each end to hold the sand in place; heat the whole of the part to be bent equally, and bend round a curved surface, such as an iron post, or the nose of an anvil, otherwise grip the heated part gently in a vice and bend upwards by putting a rod in each end of the tube to use as levers. When a tube shows oval after being bent, it is brought by heating to a red hue and hammering carefully on the round surface used in bending. Wheel making: Full instructions on wheel making are given in the papers, "The Practical Construction of the Safety Bicycle." Tricycle drawings: The type or style of trieycle would have to be indicated before a drawing could be given.—A. S. P.

**Tandem Tricycle.**—J. B. (*Clapham*).—A tandem tricycle with 24 in. wheels is something out of the common, unless for children. The width should not be less than 33 in. over all. With 30 in. wheels it should not be less than 36 in. wide. To bend a tube, if only a slight bend, heat it to a bright red—that is, the part to be bent. When hot, place a smaller tube in each end and bend gently over a round surface, such as the nose of an anvil. The tube will *oval* slightly at the bend, but that does not impair it in strength.—A. S. P.

**Canvas Cycle Tires.**—RETRENCHMENT.—I am quite unacquainted with the manufacture as well as with the materials of pneumatic tires. Sail-cloth is certainly not one of the materials. It is not at all likely that repairers of cycles will give information regarding the mending of pneumatic tires, for the reason that very few of them possess it, and those who do have paid for their learning, and are not likely to give it away to all and sundry. The repairing of these tires is, I understand, a very ticklish job, and it is useless for your correspondent to try it unless he gets initiated into it by those in the secret, and learns what the proper materials are from them. Altogether, I regard these as a passing fad, that will be a thing of the past in a year or so hence.—A. S. P.

**Wood for Zither.**—B. W. R. (*Liverpool*).—I should think you would be able to obtain what you require in Liverpool at J. Byrom's, 3, Deane Street. He is a violin maker, and most probably would have exactly the kind of stuff to suit you. Failing him, try the organ builders, whose addresses you will find in the directory.—R. F.

**Corner Bookcase.**—J. T. W. (*No Address*).—You do not state whether you require a hanging corner bookcase, or one to stand upon the floor. If the present design suits you, my advice is to construct it in some light, strong wood, the choice of which must be left to your judgment. You will see that my arrangement is somewhat fresh; and by adopting it you will have more space for the disposal of your volumes than would be the case were you to place your books straight across the corner. For instance, one storey in the article shown will afford 30 in. accommodation; whereas, if intended to be *across* the corner, the accommodation would be but a little over 24 in.—unless you made the outside dimensions of the job excessive. A plan is shown in Fig. 2 of the upper carcase. The square space in the corner will be useless, but it is unavoidable; and

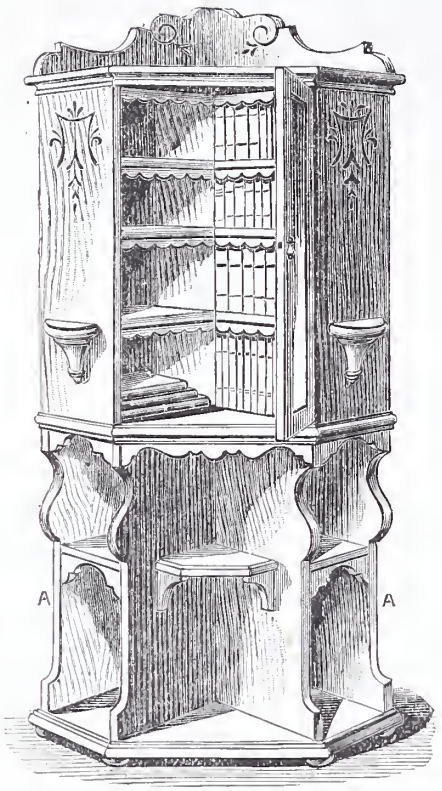



Fig. 1.

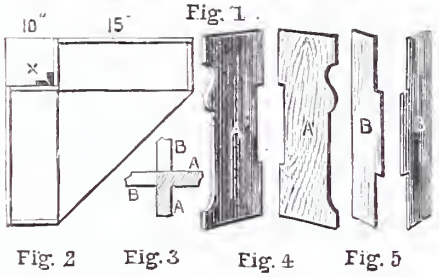



Fig. 2 Fig. 3 Fig. 4 Fig. 5

Fig. 1.—Corner Bookcase. Fig. 2.—Plan of Upper Carcase. Fig. 3.—Plan of United Corners of Boards, A, B, Lower Carcase. Figs. 4 and 5.—How to Shape Boards A and B (in addition to Dovetailing them) to secure the Unison shown in Plan, Fig. 3.

a larger space would be the result of the other arrangement. About the best way to construct the under carcase will be to shape boards, A (Figs. 1 and 3), as shown in Fig. 4, and boards, B, as in Fig. 5, previous to cutting the dovetails. When each pair is then joined together, there will be a corner projection formed by the angle of boards, B, which will fit into a space provided for it by the angle of boards A; and, in like manner, the external angles of A will fit the two spaces in boards B, and appear as in plan (at the corner which unites) in Fig. 3. To secure them thus, it will be necessary to screw stout uprights in the back corner (× in Fig. 2) the whole length behind, to both the portions of A and B which are there exposed to them. Of the upper carcase, two upright boards, 10 in. wide each, will provide the back angular portion; and two 15 in. back boards (to which are united the extreme front boards), joined to them, will complete the carcase, with the exception of all horizontal boards. There should be four corner boards, shaped as in Fig. 2 (the top one only, necessarily extending completely to the corner of the room)—viz., two as bottom and top boards for upper carcase, and two for the same purpose in the lower one. Screw the two carcases together. If other details are not comprehended, refer to back numbers for suitable particulars. You will find a very good design of corner bookcase (hanging) in No. 36, Vol. I.—J. S.

**Bookcases.**—A READER OF WORK.—Designs and particulars of these have been given in WORK, Nos. 15, 36, 44, 48, 52, etc.

**Back Numbers of WORK.**—E. M. (*Blackheath*).—You should address the publishers of WORK, Messrs. Cassell & Co., London, E.C., and not the Editor, for back numbers; and when applying for same, forward stamps for the cost of the numbers and postage.

**Concertina Keys.**—MUSIC.—All English concertinas have the keys about the same distance apart, of whatever make they may be. In the German concertina each key gives two tones; in the English instrument only *one*. English concertinas are not made to be held in the same way as the German instrument. The keys in the instruments made by Jeffreys are the same distance apart as in those by Lachenal.—G.

**Musical Box Comb.**—WHITEFIELD.—The steel comb of a musical box can be repaired, but no estimate of the cost could be given without examining the damage. Messrs. Nicole Frères, 21, Ely Place, London, are makers of Swiss musical boxes, and would doubtless inform Whitefield as to exact cost of repair if he will send his musical box up to them for examination.—G.

**Cornet Valves.**—U. H. (*Sunderland*).—The castings required can be obtained from Messrs. Gautros, 90, Rue d'Angoulême, Paris.—G.

**Watch.**—J. P. (*Liverpool*).—Did the watch keep good time before you had it cleaned, or had it always gone so uncertain? as this makes all the difference; also, have you anything to do with any electric apparatus, or wear an electric belt, or ever go near a dynamo? Your letter is so vague that I am afraid I cannot help in the time-keeping part without further information. Are the hands perfectly tight, or does the minute hand drop occasionally? Did the hour hand always get out, or only since it was cleaned? If so, I should say a tooth has been either bent down or broken off, and this will cause it on the other; if it has always gone wrong, it is possible that the hour wheel has not the right number of teeth in it. I have found this fault more than once; and, on the other hand, I have myself broken or bent a tooth in the hour wheel in trying to move a hour hand which fitted too tight. I am sorry I cannot assist you in the timing of it without further particulars or examining it. I had a difficult case a little while ago, in the timing of a very expensive lever; with me and others it kept excellent time, but two days after delivering it to the owner, he would bring it back ten minutes slow; and quite by chance we found he wore an electric appliance, which, of course, accounted for the mischief.—A. B. C.

**Graining Tooler.**—D. O'S. (*Kerry*).—For any paint brushes, apply to Messrs. Brodie & Middleton, Long Acre, W.C.

**Bookbinding.**—G. W. L. (*Salford*).—The articles on bookbinding appeared in Nos. 6, 9, 57, 61, 65, 69, 72, 75, 80, 85, which can be had of any bookseller, price 1d. each.

**Electric Bell.**—J. H. J. (*Birmingham*).—Instructions how to fit an electric bell appeared in Nos. 12, 18, and 20 of WORK, which can be had of any bookseller, price 1d. each.

**Talking Magpie.**—M. L. C. (*Leicester*).—Your question scarcely comes within the scope of WORK, although you have no doubt been well exercised in endeavouring to make your bird talk. Your proposal to cut its tongue would scarcely tend—would it?—to give the magpie a colloquial turn; but write to the Editor of *Cassell's Saturday Journal*, London, E.C.

**Engine and Boiler Management.**—J. P. (*Darlington*).—These articles appeared in the following numbers of WORK: 119, 123, 127.

**Collie Dog Kennel.**—J. H. M. (*Manchester*).—Consult WORK, No. 90, p. 617, and modify the sizes there indicated to suit your large dog.

**Xylonite.**—E. W. (*Cupar, Fife*).—A full description of this composition appeared in WORK, No. 101, p. 787.

**Puffs of a Locomotive.**—J. D. (*Bradford*).—The answer to your question in my hands is, with its illustrations, too long to appear in "Shop." You must be patient therefore until space can be found for it in the body of WORK, when it will probably appear under some such title as "Compound Engines."—ED.

**Patent Saw Set.**—WOODCUT.—This saw set can be obtained of Messrs. Churchill & Co., Cross Street, Finsbury, E.C., I think, for 7s. 6d.—M. P. B.

**Density of Negatives.**—AMATEUR.—The density of a negative depends on both *exposure* and *development*. A much *over*-exposed negative is nearly always thin unless the development has been suited to the increased exposure. In your case most probably over-exposure is the cause. Try less, and use a well-restrained developer; one with a very small quantity of alkali and large quantity of pyro. The fault may also proceed from light getting to the plate otherwise than through the lens, and so causing a fog effect. Examine your camera and ascertain if it is light-tight. If your plates are good

and your apparatus in good order, the following developer will give plenty of density—with a proper exposure. If you have any difficulty in the matter, the fault lies with yourself. Take for developer: 2 grs. pyrogallic acid, 2½ grs. of ammonium bromide, and 4 grs. of liquor ammonia, with 1 oz. of water. If you get weak images with this and a proper exposure, there is something wrong in your working; but in all probability it is over-exposure.—D.

**White Wood.**—SHOPITE.—For white wood try Cobbett, of Hackney Triangle, E., who can supply it at 2½d. per foot, 1 in. thick; or Latham, 124, Curtain Road, E.C. Be careful to get it dry, as it will be useless for your purpose without.—A. J. H.

**Thermometer.**—AMATEUR.—If you heat the glass tube sufficiently at the point at which you desire to close it, bend it at right angles, and twist off, I do not see how you can fail to close the hole. You say, "I can only succeed in closing it up every time I get it hot enough and then blow down." I confess I do not understand what you mean. If you succeed in closing it up *once* that is all you want. As to where you can "procure ½ lb. of tubes at 6d." I cannot answer, but imagine you should have no difficulty in getting what you require in Liverpool if you look about and inquire.—OPIFEX.

**Wooden Mole Traps.**—R. G. S. & Co. (*Wellington*).—You should advertise your address and goods in the "Sale and Exchange" column of WORK.

**Bent Iron.**—B. H. (*Budleigh Salterton*).—An article on "A Hall Lantern in Bent Iron" appeared in No. 125 of WORK.

**Astronomy.**—ASTRO.—Your question does not come within the scope of WORK. Send the query to one of the educational papers, or to *Cassell's Saturday Journal*.

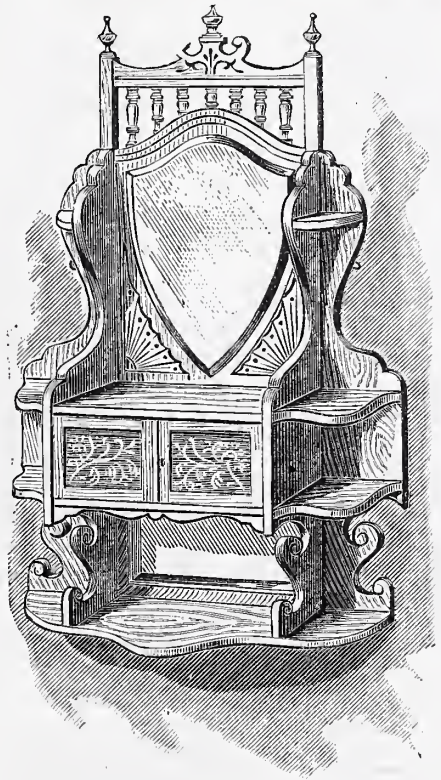
**Spot Lens.**—TOM.—A spot lens is used when it is desired to examine structural details, which might be invisible by direct light. If you take an ordinary condenser and block out the centre rays with a circular patch of paper or varnish, you have a rough-and-ready spot lens. The patch should be fixed on the flat side of the plano-convex lens, and this side should be turned towards the object when the lens is attached to the under-stage of the microscope. By the use of the spot lens with semi-transparent objects, dark grouud illumination is secured. The object is viewed only by the aid of the light rays refracted from the marginal zone of the lens, and these rays are so bent by refraction that they fall on the object without entering the objective. In the best instruments a parabolic illuminator takes the place of this lens.—E. A. F.

**Polishing Fretwork.**—N. R. (*Yeovil*).—Fretwork polished by inexperienced hands is seldom satisfactory; it requires much previous practice on plaiu surfaces. The difficulty is rendered doubly so by trying to do it with new rubbers; the uneven surface of these will give fat edges, and will oftimes catch in and tear out delicate parts of the fret. A plan sometimes adopted, and one which has mueh to recommend it, is to well "body up" the plain surface previous to cutting the fretwork; the surface may then be made to look fairly respectable by carefully applying with a camel-hair brush a coat of spirit varnish. I know of no book on French polishing that I can so strongly recommend as the series of articles on the subject by Mr. Denning, the first of which—"How to French Polish"—appeared in WORK, No. 105, March 21st; and "The Rubber in French Polishing," No. 108, April 11th; followed at intervals by others, which, if followed up by steady practice, will put you on the right track.—LIFEBOAT.

**Estimating.**—GRANT.—I think you would find "The Student's Guide to the Practice of Measuring and Valuing Artificer's Work" would be of great assistance to you. I have a great many questions on this subject, and it really seems to me that the inquirer appears to think that there is some royal road to estimating; but I can assure you there is not, and you will never succeed in finding a book that will give you exactly what you want unless it is a four-panel door or a common sash and frame; and even such simple things as these give a lot of trouble to the beginner, if he has no other knowledge to fall back upon except what he can get from a price-book. There must be some experience beforehand, but a little thinking will help a great deal; for instance, let us suppose you have a shop front to estimate for, of a general thickness of 2½ in.: now, what can you buy 2½ in. stuff for? What will they charge at the mill to cut it out to the sizes required? (You will find they charge this at so much the dozen feet.) Next, what do they quote in Laxton for planing-up stuff at per foot run? How long should a man, in your estimation, take to make such a front when he has the stuff brought to him? Now look in your price-book and see what they give as the price for 2½ in. sashes or shop fronts, and compare their price with your estimate and draw your own conclusions. You must feel your way, as it were—no tradesman or estimating clerk trusts blindly to price-books; there are some things he finds by practice he can do cheaper than at the price given; and, on the other hand, he knows that if he takes the work out at the price quoted for some class of work, he must lose money. I have just made a shop front out of 4½ in. mahogany, 10 ft. high, 12 ft. wide, with a return end 13 ft. high by 6 ft. wide, with horizontal and two upright bars out of 2½ in. by 4½ in., with a 2 in. door and fan over door, all heavily moulded, partly polished, ready for fixing; and this cost £23. Perhaps this may help you, but I doubt if you could find this in any price-book.—E. D.

**Razor Strop.**—G. W. B. (*Cockermouth*).—Make the body of the strop 12 in. long and 2 in. thick in the middle, tapering as shown in the cut (Fig. 2, p. 390, No. 129). You can make the handle any length you like—say, 4 in. This strop will suit admirably for hollow ground razors; better still, perhaps, if of greater convexity than suggested above.—OPIFEX.

**Hanging Mirror.**—D. B. (*Perth*).—I appreciate mechanical talent, and I feel certain that you would grant me the permission to view the result of your skill and labour if I asked; but the fact of your dwelling at so great a distance from me precludes all intention on my part of beseeching this permission. As it is, I believe many a reader would be glad to know how you have devised the brackets and feet of your article to spring out automatically when the flap is opened. Why not send sketches and particulars through the first columns of "Shop?" Now, don't say you cannot draw—that's all nonsense; for, judging by your sketches handed to me, I should say that you could manage it near enough. I give you here what you ask for—a design for a hanging mirror, with drawer or cabinet. I think it is somewhat fresh, and I hope it will meet with your approval. I will not state any dimensions, but



A Hanging Mirror.

merely say that it is advisable for any intending maker, if unable to decide as to size, to rough-sketch an elevation of it on a large sheet of paper, until satisfied as to proportions. If the shaping of the top glass will be too costly, have a square one. I must refer you and other makers, if ignorant upon any point in the joining, to back numbers. I may say, however, that it is preferable to have a post running the entire length at each side. Each shaped piece, too, would be best if made in an entire length. Those at the back, and those projecting, should be the same exactly. Two serpentine-fronted shelves, and a small quadrant shelf at each side, will be effective. I should say, let the bottom board terminate the job, as you will not want to hang the article high enough to show anything underneath it. This board could be in one piece, and serewed from underneath. As a change, I have shown different-sized spindles at the top. Of course, I am aware that spindles are turned, with a view to their being dowelled into *straight* rails, but you will have little difficulty in fitting them as shown. If this doesn't please you—well, alter it.—J. S.

**Cog-Wheels.**—T. J. W. (*Ystalyfera*).—You cannot do better than write to Messrs. Grimshaw and Baxter, Goswell Road, E.C., who are the most likely people to supply your wants. If they cannot, you should write to some model maker, whose address you will get from advertisements in WORK.—P. B. H.

**Saw Maker.**—R. M. B. (*Glasgow*).—You will get good band saws from Messrs. Eadon & Sons, President Works, Sheffield, or from Messrs. Aublet & Co., Curtain Road, London, E.C. I have for some years worked Aublet & Co.'s saws, and, as a rule, they give satisfaction; but I have not had any from Messrs. Eadon since they have had improved machinery for making band saws; although I hear they are now turning out really good band saws. I can highly recommend their circular saws. In reference to the usual pace of band saws, the speed when running over wheels from 36 in. upwards in diameter is from 4,000 to 6,000 ft. per minute. But as your wheels are very small, I would advise you not to run your saws much above 2,500 ft. per minute. The turn being quick, the saws would break quickly if driven at any much greater speed. The gauge of your saws should be about the 22nd gauge—at any rate, not stouter than 21st gauge. If stouter than these gauges, the saw will break after a very little working on such small wheels; and saws at the above gauge cannot be expected to do the amount of work they would do if worked on larger wheels before they break.—A. R.

**Casks.**—J. S. (*Longsight*).—The price for putting a new stave in above would be about 2s. 6d.; for a new hoop, 9d; and a new piece in head, 1s. But surely you have some friend who could make inquiries at a neighbouring cooper's as to what he charges, and compare his prices with those given above, and act accordingly.—E. D.

**Polishing and Staining.**—J. M. (*Manchester*).—The light bay wood can be made to match the darker by wiping over with a weak solution of bichromate of potash dissolved in hot water (½ oz. to 1 pint of water); it may be used cold, and be applied with a piece of rag or sponge, but it is well to try its effects on odd pieces of wood first till you meet with the required strength; or a rather strong solution of common soda-water may be used. It, when dry, the whole is afterwards wiped over with red oil and allowed to stand over-night, it will have a richer appearance. Red oil is made by soaking 2 oz. of alkanet root in 1 pint of clean linseed oil. Use rose-pink as the colouring medium for the "filling in;" it should also be used in the filling for the teak wood, which, by the way, if it requires matching, will be found a more difficult task than the bay wood; it would have to be done by the aid of dyed polishes. If required darker, vandyke brown or black would be needed; or, perchance, a tinge of black and red; if required a red shade, a red polish would be used, but this requires tact that can only be gained by practice. The present Vol. of WORK abounds in information on this subject. Articles have appeared in Nos. 105, 108, 115, 117, 119, 122, 123, 126, and 130, and the answers given in "Shop" touch upon points and difficulties such as you may meet with, and which in writing articles on the subject it is impossible to foresee and explain without rendering the subject unintelligible to the average reader. You will do well to obtain through your newsagent all the back numbers, weekly or monthly.—LIFEBOAT.

**Oil-Coloured Photographs.**—H. W. (*Stockport*).—The photographs are sized with gelatine before applying oil colours. In the pictures alluded to, aniline colours have been probably used, in which case the photograph would show through, which is not the case in oil painting, for in it the colours being opaque hide nearly all the photographic basis. Aniliue colours are merely put on as flat washes of different degrees of strength, but are more adapted to drapery than flesh painting. At one time there was a large sale of aniline colours mixed with albumen of various tints, expressly designed for colouring photographs, and would most likely produce the effects you have seen. Try some of Judson's dyes with a little albumen.—D.

**Grinding Skates.**—H. F. (*Ramsbury*).—I regret to inform you that I have been quite unable to trace any book on the subject of skate grinding, and do not think there is one published.—T. W.

**Throw of Slide-Valve.**—J. W. (*Gateshead*).—If you want to know how to proportion the slide-valve, you should read the papers on that subject in No. 110 of WORK. The whole action must be properly understood to make one aright; the stroke will depend upon the width of the port and the amount of expansion adopted. For instance: suppose your ports are 1 in. wide, if you wish to cut off steam at ¾ of the stroke you will require 1 in. of lap, then the throw of the valve will be twice the port and lap added together—that is, 4 in.—and the eccentricity of the eccentric will be 2 in.—F. A. M.

**Mail Cart.**—W. T. T. (*Houghton-le-Spring*).—An article on this subject appeared in No. 30.

**Overmantels.**—R. B. (*Eltham*).—You will find full particulars of these in WORK, Nos, 2, 3, 5, 22.

**Picture Framing.**—R. B. (*Eltham*).—The following numbers of WORK contain much information upon picture framing: 5, 8, 10, 70, 106, 109.

**Wood-Turning Class.**—WOOD TURNER.—Instruction in wood turning will be included in the subjects of the Finsbury and City of London Guilds and Technical Institute, Finsbury, E.C. Write to the Secretary.

**Electro-Plating Apparatus.**—J. C. (*Heywood*).—You will require a vessel to hold the plating solution. This may be of stoneware, porcelain, or glass, holding from 1 quart to 10 gallons, as required. From this size up to vats holding several hundred gallons, you may get vessels of enamelled iron, wood-lined iron, or lead-lined and match-lined wood. You will also require metal rods placed across the vessels to hold the anodes and the articles to be plated. These may be of copper, brass, brass tube, or brassed iron. From these you must have wires or cables of sufficient size to carry the current from the generator of electricity to the plating solution. The generator of electricity may

be a Wollaston, Smee, Daniell, or Bunsen battery, or a dynamo machine. The battery cells must be large. You will also require such appliances as hair-brushes, scratch-brushes, polishing bobs, and burnishers. Stoneware vessels, containing various acids and alkaline solutions for cleaning the articles, will also be required. The solutions for plating should be those of double cyanide of silver and potassium, and double sulphate of nickel and ammonia. As you are quite ignorant of the art, I should advise you to first read a good text-book on the subject and the articles appearing in WORK.—G. E. B.

**Electrical Shock.**—J. S. H. (*Kirkcaldy*).—"Medical electric shocks" are given by means of an apparatus named a "shocking coil," worked with current from a strong galvanic battery. Illustrated papers on the construction of such coils will be given when space can be spared for their publication. As there is scarcely a back number of WORK in which there is not something about "electrical apparatus," I should advise you to get the whole.—G. E. B.

**Blue Prints.**—A. B. (*Bow*) uses the solutions too concentrated. Use instead 70 grs. of the potash salt and 100 grs. of the iron salt, and only mix the two solutions just before use; they will not keep mixed. Apply evenly, and dry in the dark.—D.

**Half-Plate Camera.**—G. L. (*Halifax*).—If G. L. will refer to the first volume of WORK, he will find instructions for making a whole-plate camera. He must bear in mind that a half-plate, so called, is rather larger than the half of a whole-plate, measuring 6½ in. by 4¾ in. In making the camera, the substance of the wood may be nearly as great as for the whole plate. The length of the bellows need not exceed 12 in. The only important differences are in the size of the dark slides and frame of camera and focussing screen, which must be made to suit 6½ in. by 4¾ in. plates. The baseboard, being so much less, need not be made so strongly as that recommended for the larger size. Of course, this applies to the whole apparatus. In examining the diagrams given, it will be seen that so long as the *principle* of the apparatus is not violated, many little alterations may be made in the construction to save labour, but not interfere with its working.—D.

**Refracting Telescope (Huyghen's Achromatic Eye-piece—Magnifying Powers).**—J. T. S. (*New Brompton*).—Your letter has interested me very much because of its genuineness. Persevere with your experiment. If, as you say, your object lens is 48 in. in focus, and you use for eye-picce your ½ in. plano-convex lens, then the magnifying power must be: $\frac{48}{\frac{1}{2}} = 96$; it cannot be anything else. If you use the ¼ in. for eye-piece, then the power is $\frac{48}{\frac{1}{4}} = 192$. But in either case you will not get a satisfactory result; for your object glass, being common, is non-achromatic—*i.e.*, uncorrected; and the using a single lens for eye-piece increases the error. I presume that you do not see your way clear to buy an achromatic object glass in place of your common one. An ordinary achromatic object lens, 2½ in. in diameter and 36 in. in focus, costs, at a good London house, 18s.; and, therefore, the best thing that you can do is to make for yourself a proper eye-piece. To do this, proceed as follows:—Procure two plano-convex lenses, having their respective focal lengths in the proportion of 1 to 3, thus: ¼ in. and ¾ in., or ½ in. and 1½ in. Place these at a distance apart equal to one-half their joint focal lengths, $\frac{\frac{1}{4}+\frac{3}{4}}{2} = \frac{1}{2}$ in. in the first case; $\frac{\frac{1}{2}+1\frac{1}{2}}{2} = 1$ in. in the second case. The plane sides should be towards the eye, to which, of course, the smaller lens should be the nearer. Between the two lenses, and in the focus of the first, should be placed a stop. The central hole, which defines the field of view, will need to be slightly smaller in diameter than the smaller of the two lenses used. The magnifying power of this combination will be about twice as great as the power which the larger of the lenses, used alone, would have. Thus, you may calculate easily what lenses will give you a fixed power. For example: with lenses ¼ in. and ¾ in., placed ½ in. apart, the power would be, with your 48 in. focus object glass: $\frac{48}{\frac{3}{4}} \times 2 = \frac{48 \times 4}{3} \times 2 = 64 \times 2 = 128$. This is quite high enough for you to attempt to use. The better plan, indeed, would be for you to get a plano-convex 1½ in., and with this and the ½ in. that you have, to make an eye-picce of power—

$$\frac{48}{1\frac{1}{2}} \times 2 = \frac{48 \times 2}{3} \times 2 = 32 \times 2 = 64.$$

This power would show you the belts and moons of Jupiter, and even the rings of Saturn. Your idea that the power you have so far obtained is only 10 is perhaps due to over-strained expectation. A telescope is always disappointing to a beginner. Get used to it, and learn all its faults, and then you will be able to see a great deal more. As for Venus, it is the most trying object of them all. Many a good telescope shows faults when it is turned on to Venus: she is so bright and so dazzling. When you would observe her, first stop your object glass down to about 1 in., and then you will see her phases. Do not aim at high magnifying power. As a young student, lay this to heart: that more pleasure and profit can be obtained with a telescope *firmly mounted* (how important is this!), and armed with a low power, than with a loosely mounted instrument armed with a higher power. Experienced astronomers, as a rule, use low powers, except for very special work. I should not advise you to attempt to make an achromatic object glass for yourself; and if you were to attempt it, a lathe would have very little to do with it. Lenses are not made on lathes. But you might make a reflecting telescope; and when this 48 in. of yours is in working order, and satisfies you, if you write to the Editor again, he will send your letter to me, and I will tell you more about it.—E. A. F.

**Wood-Carving Book.**—F. G. P. (*Walsall*).—"Hints on Wood Carving," by E. Rowe, is the cheapest, best, and certainly the most practical manual on the subject I know. It can be obtained, post free, for 1s. 1d., from the School of Wood Carving, City and Guilds of London Technical Institute, Exhibition Road, South Kensington. It contains much useful information respecting tools, designs, etc. Fred Miller's book is published by Wyman, Little Queen Street. Its price is 5s., or 4s. 6d. It treats of wood carving from the historical standpoint rather than the practical. The number of tools required depends entirely on the character of the carving you intend to do; but very little can be done with less than eighteen, or twelve at the least. They cost from 10d. to 1s., depending on whether they are sharpened or not. They can be bought at the above-mentioned school ready for use, or from Buck, 242, Tottenham Court Road. Their sizes vary according to the work they have to do.—M. E. R.

**Books on Electric Bells.**—J. W. (*Homerton*).—"Electric Bells, and All About Them," by T. R. Bottone, and "Practical Electric Bell Fitting," by F. C. Allsop, are the only books on this subject. If you are in a fix, let me know the particulars, and I will try to help you out of it in the columns of WORK.—G. E. B.

**Tool for Cutting Screws in Wood.**—W. H. N. (*Oldham*).—You can purchase screw boxes and taps for cutting screws in wood, manufactured by Messrs. Peugeot Brothers, through any dealer in tools, of their agent, Mr. Alexander von Glehn, Idol Lane, London, E.C. The sizes range from ¼ in. to 3¼ in. You had better write to Mr. Von Glehn for a price-list.—ED.

**Ground Glass Imitation.**—R. M. (*Glasgow*).—I am sorry that you have failed to obtain satisfactory results when following my directions in No. 9, Vol. I. Perhaps you would succeed if you enclosed the lump of white-lead putty in a piece of rather coarse muslin. Your glass may have been damp or dirty, or your putty too wet or too dry. As you say, common salts (Epsom), dissolved in water, and applied to glass, produces a frosted appearance; or a saturated solution of alum produces the same effect; but, for this method the glass must be placed in an horizontal position until crystallisation takes place, when the frosting must be protected by the application of a coating of gum-water. This is, of course, a very temporary kind of work. You might try sugar of lead, rubbed up in boiled oil, and applied with the end of the bristles of an ordinary hog-hair brush, dabbing the surface of the pane lightly, until the whole is evenly muffed. When perfectly dry, a pattern may be made by drawing in the design with a fine brush dipped in a strong solution of caustic potash, and then wiping off with a soft cloth. This will last for a long time, and needs no protection.—OPIFEX.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Fretwork.**—W. M. (*Brixton Hill*) writes:—"I have so far been using a hand fret saw, but wishing to work more expeditiously, thought of investing in a treadle machine. Can you or any reader tell me if there is any such machine capable of practical work, as I have been told all such machines are useless, being only made for selling to inexperienced amateurs."

**Mangle Rollers.**—LEARNER writes:—"I shall be glad if any reader would give me a description of the method of turning mangle rollers, and the different sizes of tools required (rest included); and if it is possible for me to turn them in a 5 in. centred lathe."—[LEARNER might have said whether he required wood rollers.—ED.]

**Tailoring.**—APPRENTICE will feel obliged to any reader who will tell him where he could get good books on cutting.

**Alarum Clock.**—A. S. (*Lavender Hill*) writes:—"Can any of my fellow readers tell me where I can obtain a continuous alarum clock?"

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. B. (*Kent*); S. L. (*London, N.W.*); C. F. C. (*Lincoln*); M. M. F. (*Spenshaw*); ENGINEER; M. M. (*Rosecea*); J. T. H. (*South Shields*); E. M. (*Rainham*); CIRCULAR WINDMILL; WORKITE; NELSON; A. R. (*Scorrier*); W. E. D. JUNR. (*King's Lynn*); D. (*Kilmarnock*); E. J. (*Plumstead*); J. M. (*Glasgow*); A. V. S. (*Westbourne Park*); DUMMY; R. G. (*Settle*); J. W. W. (*Chesterfield*); J. W. H. (*Edinburgh*); F. C. (*Cardiff*); G. T. (*Liverpool*); F. C. S. (*Manchester*); A. R. T. (*Birmingham*); H. R. (*Chasewater*); A COUNTRY CABINET MAKER; NOVICE; F. J. (*Exeter*); T. M. (*Liverpool*); W. A.; N. M. (*Norwich*); J. T. (*Kensington Barracks*); J. W. (*Forebank*); C. F. W. M. (*Enfield Lock*); ERIC; G. R. D. (*Chatham*); W. C. A. (*Ware*); G. T. (*Hollinwood*); CUTTER; V. (*St. Helen's*); M. B. (*Brighton*); C. R. (*Birmingham*); J. H. (*Bury*); PATIENCE; T. P. (*Duckinfield*); J. G. (*Glasgow*); CANTAB; JOINER; E. J. A. H. (*Portslade-by-Sea*); A. R. R. (*Redcar*); ELECTRIC LAMP; J. P. (*Handsworth*); R. W. C. (*Oxford*); A. B. C. (*Arbroath*).

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**Six Large Comic Fretwork Designs,** 1s. 1d.; sample, 3½d. Forty Small Designs, 7d.; Sample Sheet of Six, 2½d. Eiffel Tower, 1s. 1d.; all free.—TAYLOR'S Fretworkeries, Blackpool. [25 R

**¼ h.-p. Horizontal Steam Engine,** as described in the pages of WORK by F. A. M. All the castings, forgings, and other materials required in the construction of these excellently designed Engines, may be had from H. MILNES, Ingleby Works, Bradford. Prices on application.

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**Inexpensive and Artistic Materials** for all classes of decorations. Send for detailed lists.—W. T. CRAIG, Wick. [27 R

**Turning Designs** accurately drawn. First and second series, 1s. 7d. each, free.—WALKER, 41, St. Helen's, Ipswich. [1 S

**Fairy Bell Pegs.**—6d. dozen, postage 2d., or three dozen post free. Wire, 4d. per ring.—MARSH, Temple Street, Bristol. [2 S

**Violin.**—Splendid copy Amati, rich brilliant tone, fine preservation, complete, with baize-lined case and silver-mounted bow. Only 15s. 6d. lot; great bargain. 20s. worth of good unsoiled music given in gratis. Most genuine bargain obtainable.—Write, GRAHAM, College Building, Ipswich. [3 S

**Try Bolton,** Burmantofts, Leeds, for Fretwork Materials. Lists free. [28 R

**Christmas Presents.**—Splendid fretwork outfits, complete, 1s., 1s. 6d., 2s. 6d., 2s. 9d., 4s., 4s. 6d; and magnificent outfits in polished beechwood boxes, 9s. 6d. 6 foot fretwood, 2s. 6d.; 12 foot, 4s. Saws, 1s. 6d. gross. All free. Good designs from 1d. each. Sample designs, 1d.—TAYLOR'S Fretworkeries, Blackpool. [29 R

**Goodell Lathe,** Fretsaw, attachment, drill and tools, for sale. CHILDS, 42, College Street, Islington. [5 S

**½ h.-p. Horizontal Engine,** wants finishing. Workmanship guaranteed. Price 30s.—Particulars of G. HINGE, High Street, Hanwell, W. [7 S

**"Electrical Engineering"** (Slinger and Brooker), "Domestic Electricity" (Hospitalier), "Electro-Plating" (Urquhart); all clean, 12s.—J. ROBISHER, Ogden Street, Ardwick, Manchester. [6 S

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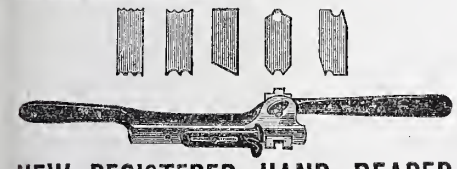

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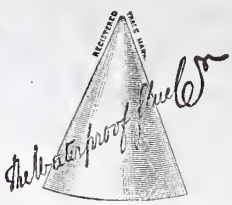


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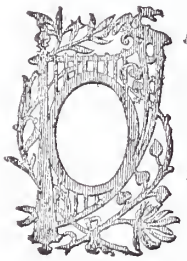

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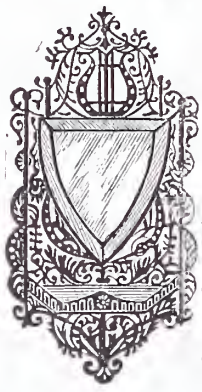

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# WORK

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VOL. III.—No. 146.] SATURDAY, JANUARY 2, 1892. [PRICE ONE PENNY.

### DECORATION OF FIREPLACE IN REPOUSSÉ WORK, TILES, OR PAINTING.

BY J. EADIE-REID.

THE designs for panels to be used in the decoration of a fireplace which are here submitted to the notice of our readers, although they are intended primarily for execution in copper, are equally adapted to reproduction in tiles or painted decoration.

The drawings themselves are intended rather as suggestions to the workman than as actual copies. In carrying out such a design, I would advise the designer to work it carefully on a small scale—say, inch scale—determining the place of every detail before commencing his full-size cartoon. By acting on this hint he will save much time and patience. For painted decoration I would use some simple harmony of contrasting colour, outlining the principal forms with a rich dark brown. The ornament will require a similar treatment. Whatever method may be adopted in carrying them out, see that there is breadth in your masses and clearness in the drawing of your forms.

The figures, as will be noticed, represent Summer and Winter, and may be taken as being fairly characteristic of these seasons of the year. They will be found useful for the ornamentation of articles of furniture and other things, as well as the decoration of a fireplace. Thus, for instance, they may be utilised for painting the panels of the doors of a sideboard, or for windows in painted glass, or pieces of glass that are often seen hanging in windows. A clever decorator will be at no loss as to any use to which they may be put.

Design for Decoration of Fireplace in Repoussé Work, Tiles, or Painting.

## THE WINTER ELECTRICAL MACHINE AND ACCESSORY APPARATUS.

BY CHAS. A. PARKER.

SLOW DISCHARGE OF LEYDEN JAR—ELECTRICAL CHIMES—IMAGE PLATE—STAND FOR DANCING FIGURES—INSULATING STOOL—ELECTRIFIED HEAD OF HAIR—BUTTERFLY NET—ELECTRICAL WHIRL—ELECTRICAL INCLINED PLANE—LUMINOUS EGG STAND—APPARATUS FOR FIRING ETHER—FIRE HOUSE—THUNDER HOUSE—VARNISH.

IN the previous article description was given of an arrangement whereby a Leyden jar might be slowly and imperceptibly discharged automatically. By the following slight modification of the apparatus previously described, this slow discharge of a Leyden jar may be made the means of ringing a couple of bells until the charge is finally exhausted, as will be understood by reference to Fig. 34, which is an illustration of the apparatus about to be described.

*Slow Discharge of a Leyden Jar by means of Bells.*—First prepare the wooden base, which may take the form of a mahogany board, 9 in. by 12 in., supported on four feet. These feet may be turned in a lathe similar to the supporting feet of the machine previously illustrated in Fig. 18 (p. 465); but they must, of course, be smaller, or, if preferred, they can be sawn from a suitably moulded piece of mahogany, cut in the form of Fig. 35. When the stand has been prepared, it should be polished or varnished, according to taste, after which a disc of foil, a trifle larger than the jar to be employed, is pasted on to the upper surface of the stand near to one end, with a 4 in. narrow strip of foil projecting from one side of the disc across the base to nearly the opposite end, as will be seen by reference to Fig. 36, which represents a plan of the top of the stand. A turned wooden socket, about 1 in. in diameter and 1½ in. or 2 in. high, is now prepared and affixed to the stand immediately over the outer end of the strip of foil. When this has been done, a 10 in. length of stout brass wire should be pointed at one end slightly, and then bent to the form of a hook, with a smaller hook turned up at the extreme point, something afer the fashion of a shepherd's crook. Now procure a couple of small bells, such as are used on alarum clocks, and slide one of these on to the wire support just prepared, holding it near to the curved end whilst a small brass ring is being soldered to the middle of the wire, in order to retain the bell in position. Thus prepared, the wire is tightly fitted and cemented into a hole bored through the small socket, after which a small ball of metal is suspended from the hook of the support by means of a silk thread. The stand being completed, the second bell is now supported on the stem of the Leyden jar at a corresponding height to the other, by means of another wire ring soldered round the stem in a similar manner to the previous one. If the jar is now charged and then placed on the table over the circular disc of foil, it will attract the small clapper, and cause the latter to swing backwards and forwards, ringing the bells until the charge is exhausted.

*The Electrical Chimes* (shown in Fig. 37) will be found a much more convenient method than the foregoing for illustrating the phenomena of attraction and repulsion as applied to bells. A 6 in. length of brass rod is first bent into the form of a hook at either end, in order to form the cross-bar from which to suspend the bells, and another piece of slightly thinner wire is then twisted in a loop in the middle, and bent in the form of a hook at either end, of sufficient size to grip the central bar just prepared, after which the two are joined together by means of a touch of soft solder. Now cut off a couple of 7 in. lengths of moderately stout brass wire (or brass chain), and having first turned up one end of each in the form of a small ring, slip one of the bells previously mentioned on to the wire, so that it may rest on this ring, and then turn up a similar loop at the other end of the wire, but do not close this until the bells have been slipped on to the end of the cross-bar. The bells are shown suspended by chains in Fig. 37, and A represents the alternative plan above described. For the clappers, a small block of brass about ⅜ in. long is filed up to a neat form, and then threaded on a piece of silk, which is put through a hole drilled in the metal. Thus prepared, a third bell is suspended from the centre of the cross-beam by means of a piece of silk thread tied to the latter, and from the underneath of this bell, a suitable length of brass chain should be hung, in order to make provision for the escape of the electricity into the earth. Lastly, the two clappers are hung from the cross-beam, one on either side of the central bell, and midway between the others, care being taken to see that the bells and clappers are all on the same level. The bells are now hung from the prime conductor, with the piece of chain from the centre bell in communication with the earth. On the machine being put in motion the outer bells will become charged with electricity, which will attract the two clappers, and cause them to fly backwards and forwards from the centre to the outer bells during the time that the machine is worked. Any dealer in watch and clock makers' materials will be able to supply small alarum clock bells, similar to those shown in the illustration, for a few pence.

*The Image Plate*, for dancing figures, represented in Fig. 38, is a very amusing piece of apparatus for exhibiting the effects of attraction and repulsion by means of a couple of small pith figures. The usual description of image plate takes the form of a pair of thin discs of tin or brass plate. The top one is suspended from the prime conductor by means of a short length of chain attached to a hook or collar soldered to the plate, and the lower disc, which is called the table, is supported on an ornamental turned wooden pillar, provided with a circular base. The figures employed for the purpose are carefully cut from elder pith by means of a keen knife or razor, being afterwards painted in as life-like a manner as possible.

*A Stand for Dancing Figures*, which is far preferable to the above, is illustrated in Fig. 39. A piece of mahogany about 12 in. square is carefully planed and moulded to form the base, which should be slightly raised from the table by means of four mahogany supporting feet. A couple of ¾ in. holes are now bored through the base on opposite sides, in order to receive the stems of a couple of sockets for the supporting rods. These supporting rods take the form of two short lengths of glass rod, ⅝ in. in diameter, cemented into a pair of suitably turned wooden sockets, which are furnished with short projecting pins, in order that they may be fitted into the holes prepared for their reception in the base. A couple of hollow brass stool balls, which will just fit over the tops of the glass rods, are now soldered to the ends of a 12 in. length of stout brass wire, which is afterwards bent in the form of a loop round a perfectly sound cork, in the manner shown in Fig. 39. When this has been done, a 9 in. disc of tinfoil is very carefully cut and pasted on the centre of the base in the position indicated in the illustration, after which the sockets carrying the supporting pillars should be glued into the holes in the base, and the knobs of the wire arch afterwards cemented on to the tops of the glass pillars. A 3 in. or 4 in. brass disc is now soldered to the end of a 6 in. length of brass rod, which is then pushed through the cork fitted into the central loop of the arched wire, after which a small brass knob is soldered on to the upper end of the brass stem, and when quite finished this apparatus may be varnished or polished, according to taste. By means of this arrangement the upper plate can be readily adjusted to suit any kind of pith figures or pith balls, and if desired may be worked at some distance from the machine by means of a chain led from the prime conductor and hooked on to the upper knob of the stand.

*The Insulating Stool*, illustrated in Fig. 40, will be found a very useful accessory for use when it becomes necessary to insulate any large conducting body. For the table top of the stool prepare a board of sound dry mahogany, to measure about 12 in. by 10 in., and 1 in. or 1½ in. thick. It will be found to add greatly to the appearance of the stool if the edges of the board are moulded by means of a moulding plane. Exact measurements are not important, but the above size of top will be found very convenient for all ordinary purposes. When the top has been prepared, four wooden sockets will be required to receive the glass supporting legs, each of them measuring outside about 2 in. in diameter and 1½ in. thick, with an internal diameter of ⅝ in. As soon as the sockets are ready, they should be glued and secured to the under-side of the top, after which a 6 in. length of ¾ in. glass rod may be cemented into each one by means of electrical cement or a mixture of plaster of Paris and glue. Before cementing the glass rods into the sockets, it will be necessary to round off the lower ends of each one on a grindstone, afterwards levelling the stool carefully, and lastly polishing or varnishing the woodwork.

*The Electrified Head of Hair*, shown in Fig. 41, takes the form of a small wooden doll's head, which is cut off short at the neck, and mounted on a brass stem inserted through the neck well into the brain—that is to say, the cranium. A knife slit is now made across the middle of the head, and the slit having been filled with glue, a hank of coarse hair is folded over a piece of card and inserted in the groove. The stem of the rod is made to fit into a hole in a turned wooden base, on which the head may be supported when not in use. If the head is fixed into the prime conductor by means of the metal stem, and the machine is put in motion, it will cause the hair to stand on end, as if with fright.

*The Butterfly Net* of Professor Faraday, represented in Fig. 42, is a very useful appliance for demonstrating the diffusion of electricity over the surface of a conductor. A piece of tolerably stout brass wire is bent into the form of a ring about 4 in. in diameter, with about 2 in. of wire projecting in order to form a stem, which is now cemented into a 6 in. length of glass tube of small bore, in order to insulate it; after which the glass rod is cemented into a convenient turned wooden supporting base. Thus prepared, a piece of starched book muslin is now cut and sewn into the form of a small conical bag, about

8 in. in length, which is then sewn on to the brass ring of the supporting stand, being finally completed by attaching a couple of threads of silk (each about 12 in. in length) to the apex of the bag. These threads should be arranged one either way, one inside and the other outside, as will be seen by reference to Fig. 42.

*The Electrical Whirl*, shown in Fig. 43, will be found very useful for exhibiting the phenomena of repulsion. From a circular disc of very thin sheet brass, mark and cut a cross to the exact form of Fig. 44, being particular to see that the extreme points are quite sharp. A slight depression is now made in the exact centre of the metal in order to form the axis upon which it turns, and each arm should be slightly bent out of the flat near the centre, in the manner shown in Fig. 43. Thus prepared, the whirl may be supported on the point of a darning-needle fitted into the prime conductor of the machine. Upon the plate being put in motion it will cause the whirl to turn round on the point of the needle, in consequence of the electricity being rapidly given off from the points.

*The Electrical Inclined Plane* is a slight modification of the above, which forms a very interesting piece of apparatus of simple construction, as will be seen by reference to Fig. 45. A good sound piece of dry mahogany should be suitably planed and moulded to form a base 12 in. by 6 in., which is then mounted on four turned wooden feet, or the moulded supports previously described. A couple each of 4½ in. and 3 in. lengths of ½ in. glass rod are now cemented into small turned wooden sockets provided with short projecting pins, after which they are glued into holes bored for their reception by use of a suitable centre-bit at the four corners of the baseboard, the pillars being located in pairs at either end of the base. A hollow brass ball of fair size is now cemented to the upper end of each of the glass pillars in order to form a cap, and a couple of pieces of stout brass wire (perfectly straight) are then stretched from end to end of the base by being sprung into holes drilled for their reception in the inner faces of the brass balls. The whirl is cut from a piece of thin sheet brass, the same as before described, but in this instance it will require to be soldered to the centre of a perfectly straight piece of tolerably stout brass rod, the two outer ends of which should be provided with a small brass ball soldered to them. Upon the insulated glass knobs being connected with the machine, with the whirl arranged in the manner shown in Fig. 45, the latter will be seen to slowly roll up the inclined plane when the machine is put in motion.

*The Luminous Egg Stand*, which is illustrated in Fig. 46, forms a very useful and convenient support for eggs when a charge of electricity is passed through them. A sound dry mahogany base is first prepared to measure about 6 in. square, being provided with four supporting feet in the usual manner, after which a couple of 7½ in. lengths of wood, ½ in. square, are mortised into the stand on opposite sides, with a cross-bar of the same thickness over the top. A stout piece of wire, bent to the form of Fig. 47, is now tightly fitted into a hole bored for its reception in the middle of the cross-bar, a small brass knob being afterwards soft-soldered to the outside end of this. Another length of the same wire is now pointed at one end and then bent in the form of a ring at the other extremity, with a small loop near to the pointed end, similar to Fig. 48, and when ready, the point is driven securely into the baseboard immediately under the cross-bar. We shall now be ready for the supporting discs for the eggs, which may be sawn from a portion of a cigar-box cut to an oval form, with a 1½ in. circular opening in the centre of each, and a small slot the width of the uprights at either end, as shown in plan in Fig. 49. A small piece of wood is now nailed and glued to the inside of each upright in a suitable position to support the shelves at an equal distance from each other. The first egg put into the stand is supported on the lower connection with a shelf brought down over the top of the egg in order to retain it in position, after which the second and third eggs are arranged in a similar manner with the upper conducting-rod brought down on the top of the upper egg. A chain in connection with the outer coating of the jar or battery is now suspended from the loop of the lower conducting wire, with a director attached to the upper conducting stem by means of another length of chain. Upon the latter being brought in contact with the inner coating, the charge will pass through the eggs, which are rendered luminous during its passage, presenting a novel and beautiful appearance if the experiment is performed in a darkened room.

*The Apparatus for Firing Ether*, which is shown in Fig. 50, is very useful for demonstrating the inflammable effects of the discharge. For the base, a piece of sound dry mahogany, measuring about 7 in. by 5 in., is carefully planed up on the face and edges, and then mounted on four small supporting feet, after which a ¾ in. hole is bored through the wood at either end to receive the pins of the sockets which support the glass pillars. A 4 in. length of ½ in. glass rod is now cemented into a small turned wooden socket, which is provided with a short projecting pin, in order to allow of its being fitted and glued into one of the holes in the base. When this has been done, another 3 in. length of ½ in. glass rod is next cemented into a similar socket, which is then glued into the hole at the other end of the stand. A small metal saucer to contain the ether must now be attached to the upper end of the shorter glass pillar. For this purpose an ordinary small size mince-pie tin will be found to answer very well. A slight depression should be made in the centre of the under-side by means of a punch, in order to mark the path to be taken by the spark, after which a small piece of tin, bent in the form of a collar, of sufficient size to pass over the glass rod, should be soldered to the under-side of the saucer, thus forming a socket by which the latter may be cemented to the glass support. It will be necessary for a small hook to be soldered to the under-side of this collar, from which to suspend the conducting chain, or if preferred, the collar may be formed by bending a strip of tin round the glass rod and then punching a hole through the two ends, which are afterwards brought together and soldered, thus forming a socket similar in appearance to Fig. 51. The saucer being finished, the other glass rod must now be provided with a gas-fitter's brass cap, which is soldered to one end of a short length of stout brass rod, a small brass ball being affixed in a like manner to the other extremity, after which a brass hook is soldered to the back of the cap in order to make provision for the connecting chain, as will be seen by reference to Fig. 52. The cap, with the arm attached, is now cemented on to the end of the glass support, with the arm curved over in such a manner that the ball will come immediately over the depression in the ether saucer and within sparking distance. When in use, a piece of chain in connection with the outer coating of a charged Leyden jar is hooked on to the under-side of the saucer, and another length is suspended from the bent arm and attached to a director. Thus arranged, a few drops of ether are poured into the saucer at the last moment, and the ball of the director is rapidly brought in contact with the knob of the Leyden jar, which will thus cause a spark to pass and inflame the ether. The ether should be kept in a tightly corked bottle, and only poured into the saucer at the last moment, as it is extremely volatile.

*The Fire House*, illustrated in Fig. 53, is a very effective modification of the apparatus just described, in which the ether is enclosed within a small wooden representation of a house or cottage. A small model of a dwelling-house or shop is first procured from a toy dealer, and a brass knob and stem are then arranged to lead from the chimney-stack into the interior of the dwelling, where it terminates in another brass knob. A small shallow tin saucer, similar to the one used for the last piece of apparatus, is now soldered to a suitable length of brass rod, which is inserted in a hole in the side of the house, and then bent in the form of a hook outside, as will be understood by reference to Fig. 54, in which the front of the house has been removed, thus showing the interior arrangements. Thus prepared, a piece of cotton-wool, saturated with ether, is placed in the saucer, with the upper rod brought down over the saucer until within sparking distance. A short length of chain is now hung from the outside hook, and placed in contact with the outer coating of the Leyden battery, after which another length of chain is hooked on to the knob of the chimney and attached to the director. On the latter being placed in contact with the inner coating of the Leyden jar, it will cause a spark to pass which inflames the ether and produces the effect of a house on fire. The front, back, or one of the sides of the house must be removable, in order that access may be gained to the interior.

*The Thunder House*, shown in Fig. 55, is a similar piece of apparatus to the foregoing, but is employed for the purpose of illustrating the necessity for lightning conductors. In appearance the thunder house takes the form of a long, low building, with a factory chimney. For the two ends, plane up a couple of boards to measure 4 in. wide and about 6 in. in height from base to apex, and then prepare a couple more boards to form the sides, measuring about 9 in. by 4 in. each. Two more pieces will also be required for the sloping roof, each measuring 9 in. by 2¾ in. One of the long sides of each of the latter will now require to be bevelled on the inside, in order that the roof may join together close along the edge. Thus prepared, the building may be put together with glue and brads, with the two pieces forming the roof placed just below the edges of the sides and ends, thus forming a slight parapet, as shown in Fig. 55. The factory chimney is now turned in a lathe from a piece of sound dry mahogany, to measure, when complete, about 10 in. long and 1½ in. square at the base, tapering to 1 in. at the top. One side of the base must now be cut off at an angle, in order to adapt it to the slope of the roof, to which it is then glued near to the end of the building, in the position shown in the cut. Three or four small windows must now be painted along the sides of the building, and one of these,

immediatcly under the chimney, must be pierced by means of a fret- or keyhole saw. A small wooden shutter (A) is now made to fit loosely into the aperture thus formed in such a manner that a slight touch will cause it to fall out, the woodwork surrounding the aperture being bevelled inwards, so that the shutter will always fall outside. A length of brass wire is brought from the top of the chimney along the wall of the building until it reaches the open aperture, where it is continued in a diagonal line across the shutter, after which it is carried to the ground from the lower corner of the aperture, terminating in a small loop or hook. It should be affixed to the woodwork by means of short lengths of brass wire pointed at either end, and bent in the form of small horse-shoe staples, which are driven into the wood over the wire. The upper end of the lightning conductor, as it may be called, should terminate in a small brass ball, which may be soft-soldered to the end of the wire. When the building is ready for use, the shutter is pushed into the aperture of the window, with the diagonal wire in conducting communication with the remainder of the wire. The hook at the base of the building is now connected with the outer coating of the Leyden battery, and another similar chain is brought from the knob at the top of the chimney to a director. Upon contact being made in the usual manner, the charge will pass without disturbing the shutter, but if the experiment is repeated in the same manner, with the shutter placed in a reverse position, so that the contact is broken, it will cause the shutter to be violently thrown out.

The above form of apparatus may be made in a more simple form by cutting a piece of mahogany to represent the gable end of a house, and then mounting this in a vertical position on a substantial base. The upright board is now pierced with a couple of apertures, and fitted with shutters and conducting wires in precisely the same manner as above described.

*Shellac Varnish.*—As the ordinary glass supports used for electrical apparatus are almost invariably bad insulators, it becomes advisable to coat them with shellac varnish, which will effectually prevent the condensation of moisture upon the glass, owing to shellac being a first-class insulator. A useful shellac varnish for this purpose may be made by pouring bulk for bulk of methylated spirit on to shellac of good quality, which is placed in a tolerably warm place for about a day, being well shaken occasionally until dissolved, when it should be diluted with two or three times as much spirit, and then bottled ready for use. Ordinary shellac varnish, sold by shops, forms an excellent insulating varnish, provided that it is of good quality. It is also possible to obtain this in a bleached form, which will be found a great advantage when it is required for glass work. The varnish should be applied to the surface of the article previously warmed, otherwise, if it is applied to a cold surface, it will form a dull whitish film; but on the other hand, the glass should not be sufficiently hot to cause the varnish to bubble and hiss, or the glass will be apt to crack. The brush should only be drawn once across the surface whilst the varnish is moist, otherwise the previous coat will be dragged off.

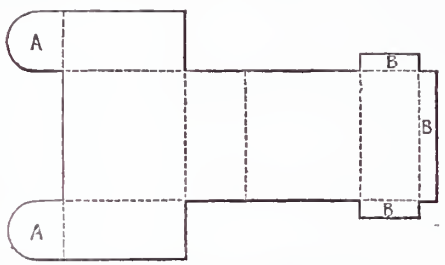
The illustrations to this paper are placed on a right-hand page, as in this position they are more convenient for reference when reading pages 658 and 659.

## HOW TO MAKE A CHEAP CAMERA CASE.

BY WALTER E. WOODBURY.

A few months ago I was badly in want of a case of some kind to hold my camera and slides when travelling, or when out photographing. On searching the various trade catalogues, I was much surprised at the high price charged for them; and so, after a little deliberation, I decided to attempt the construction of one myself. Having met with great success, I willingly give the particulars to readers of Work who may be placed in the same position. The case I have succeeded in making is wonderfully strong and durable, has a very good appearance, is remarkably light, and the cost is but a fraction of that charged by dealers.

We will first of all, then, suppose we have a camera and slides, and all the other necessary paraphernalia used by the amateur photographer when out photographing. This will include camera, slides, lens or lenses, diaphragms, and focussing cloth. The stand, or tripod, should be carried separately or in another case. The first operation, then, is to arrange the required articles on a table in the most convenient and compact form possible, and this done, to take the outside measurements and obtain the necessary




Flat Pattern of Cheap Camera Case.

length, breadth, and depth of the case to be made.

We next procure a stout sheet of millboard, free from dents or cracks. The size of the board required is, of course, according to the size of the case. The length of the board should be rather more than twice the depth of the case and three times the breadth added together, and the breadth of the board should slightly exceed the length of the case added to twice its breadth.

The accompanying diagram shows how the board is to be outlined and cut out. With a knowledge of the required breadth, length, and depth, it will not be difficult to mark this out in pencil, taking great care that all the measurements are exact and the right angles true. The two inner flaps, A, A, can be made any size and shape, to suit the fancy. The overlapping sides, B, B, B, of the lid should be about two inches. In making large-sized cases, when a millboard sufficiently large cannot be obtained, the lid can be made separately, and fixed on as afterwards described.

The diagram having been carefully drawn out, and every measurement ascertained to be correct, the shape is cut completely through the board where marked by the continuous lines, and then half-way only through the thickness of the board along the dotted lines marked in the diagram. These half-way cuts should be made carefully, endeavouring, as far as possible, to cut through the same distance all along; if parts be cut deep and others only slightly, the bend is uneven and unsightly.

Having made the necessary cut, the next operation is to bend the board along the dotted lines, and thus form the case and lid.

Next procure some long strips of calico or linen (broad tape will answer the purpose very well), and glue them along all the joints. It is advisable to get someone to hold the two sides together while you glue the strips along: by this means a tighter and neater joint is made. If additional strength is required, strips of the calico can be glued along the joints on the inside as well. The edges of the box and its lid should also have some of the cloth glued along them.

We have now our camera case in the rough. It can, of course, be used as it is, but its appearance is decidedly improved by a suitable covering. This will depend, of course, upon the fancy and pocket of the amateur case-maker. A good waterproof material is, perhaps, the most suitable. Bookbinders' cloth, leatherette, or thin leather can also be used. Imitation Russian leather will, of course, serve to give a handsome appearance to the article, and even this may be surpassed by using the real thing.

For a first attempt, however, I should not advise this extravagance, as a good waterproof cloth will be found to answer the purpose very well. A little care must be taken in covering the case with the material: all the joints and edges should be made to come in the least conspicuous parts.

It has already been stated that the lid can, if preferred, be made separate. This is often an advantage, as the constant opening and shutting will soon break through the millboard, and then the lid relies entirely for its support upon the material used for the outer covering. If the lid is made separate, and before covering the case be joined to the binding with a strip of thin leather, glued tightly half on to the lid and half to the back of the box, a much firmer job is made.

In order to prevent the inside of the case from scratching the polish of the camera, it is a very good plan to line it with a suitable lining. Green baize is very convenient for this purpose, as it is very soft and inexpensive. The lining can be glued on after the case is formed, or the baize can be glued to the back of the millboard before the shape is cut out. A suitable lining certainly gives a more finished appearance to the article, and will prevent damage to the camera and appliances.

If the case be of large dimensions, and is inclined to have an infirm appearance, it can be made much firmer and stronger by fixing in a wooden bottom. This should be done before lining by cutting a piece of board about a quarter of an inch thick to the requisite size, and gluing to the bottom of the case inside.

A few drugget tacks or ornamental coffin nails, driven into the bottom of the case outside, gives a finished appearance underneath, and also protects the material with which it is covered when the box is rested on the earth or other rough place.

The only thing we require now for our case is a handle whereby we can carry it, and a strap to fasten it. If required, a suitable lock can of course be purchased from any leather case manufacturers, and fitted on to it. The cheapest plan, however, is to purchase a cheap luggage or cloak strap. The handle of this is sewn or wired firmly to the centre of the lid of the case, and the two straps

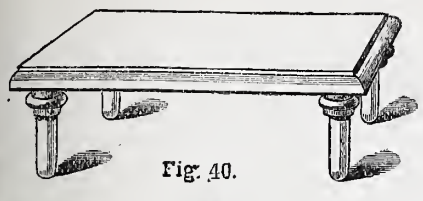


Fig. 40.

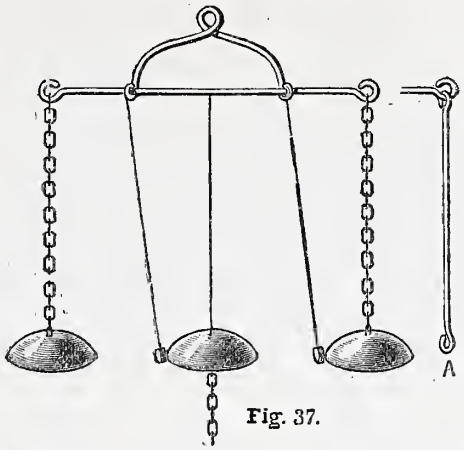



Fig. 37.

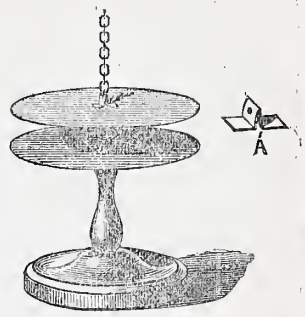
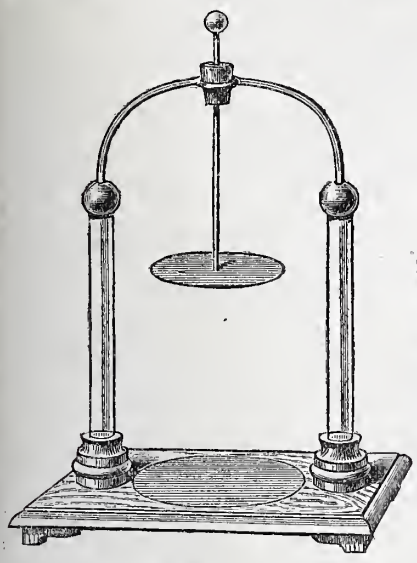



Fig 38



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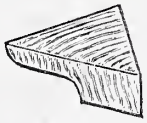


Fig. 35.

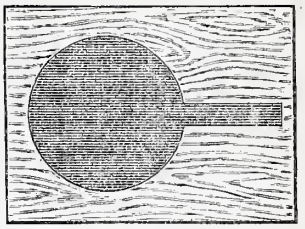
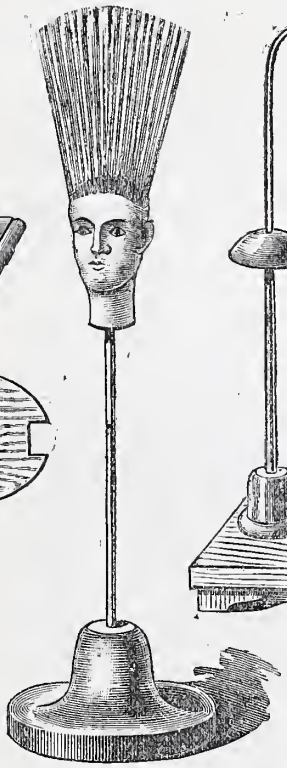


Fig. 36



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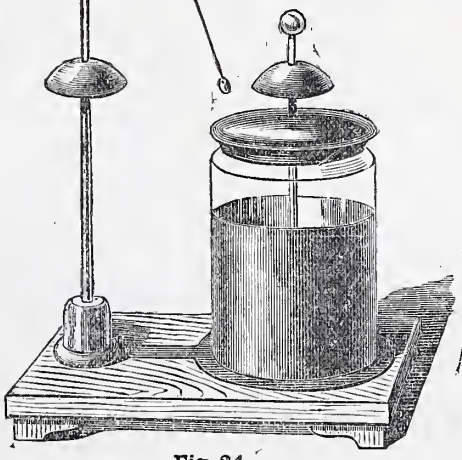
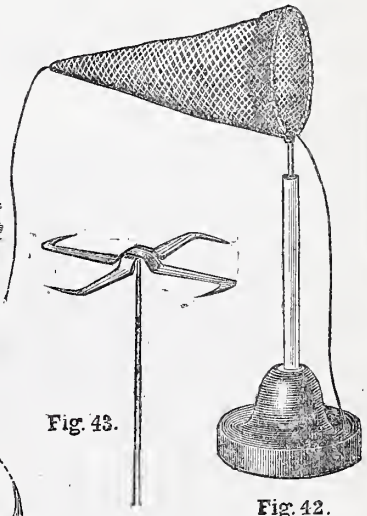


Fig. 34.



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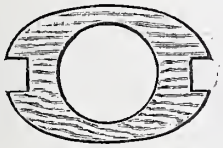


Fig. 49.

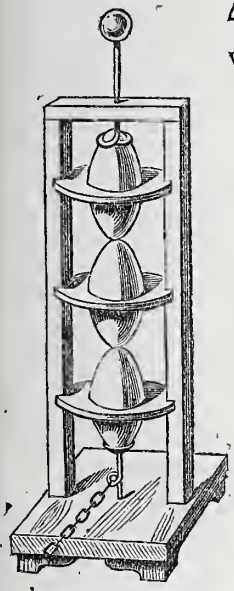


Fig. 46.

Fig. 47.

Fig. 48.

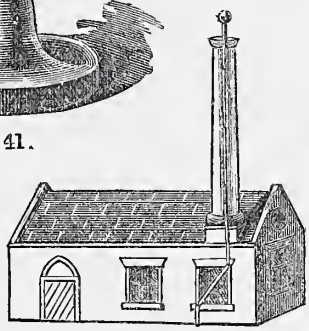


Fig. 55.

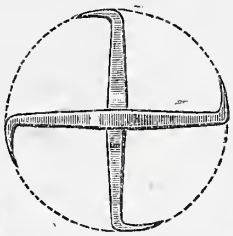


Fig. 44

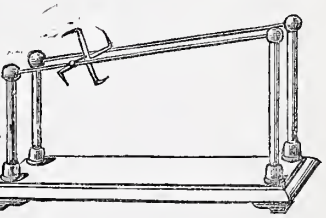


Fig. 45.

Fig. 51.

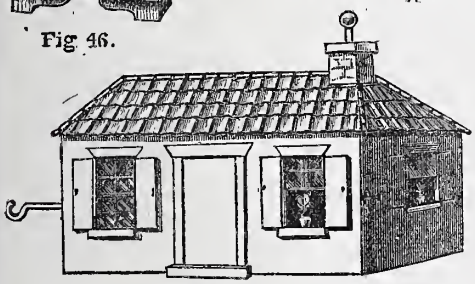


Fig. 53.

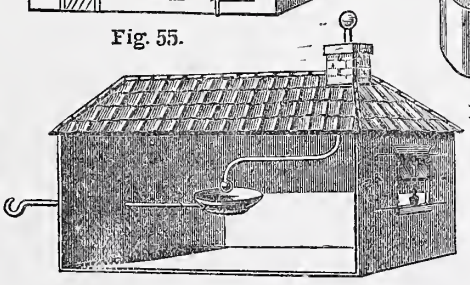


Fig. 54.

Fig. 52.

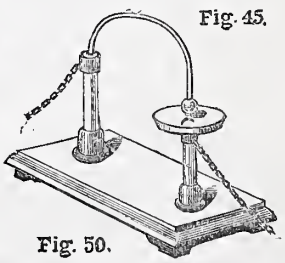


Fig. 50.

Fig. 34.—Leyden Jar with Bells. Fig. 35.—Moulded Supporting Foot. Fig. 36.—Plan of Base. Fig. 37.—Electrical Chimes—A, Alternative Support for Bells. Fig. 38.—Image Plate. Fig. 39.—Stand for Dancing Figures. Fig. 40.—Insulating Stool. Fig. 41.—Electrified Head of Hair. Fig. 42.—Butterfly Net. Fig. 43.—Whirl. Fig. 44.—Plan of Whirl. Fig. 45.—Electrical Inclined Plane. Fig. 46.—Egg Stand. Figs. 47 and 48.—Enlarged Details of Conducting Wires. Fig. 49.—Plan of Wooden Disc. Fig. 50.—Apparatus for firing Ether. Fig. 51.—Cap for Saucer. Fig. 52.—Cap for Bent Arm. Figs. 53 and 54.—Exterior and Interior of Fire House. Fig. 55.—Thunder House.

pass round the case, fastening it tightly, and keeping the lid firmly closed.

Other improvements will, of course, suggest themselves. I have only endeavoured to give an idea how the thing can be done, and done with a suitable regard to cost. If the amateur likes to cover the case with real Russian leather, line it with plush or satin, and ornament the corners with silver plates, nothing I have said will prevent him. These hints as to the finish of the camera case, and the material and style with which and in which it may be finished, are merely thrown out to prevent any would-be maker of the appliance from thinking that there is any need for following a certain course with regard to the completion of the case, on the plea that such has been prescribed by the original maker, and that it is absolutely necessary on this account to follow it. On the contrary, it is better in this and all similar matters of finish and decoration for the maker to follow his own style, and to use such covering matter as may appear to him to be most suitable for the purpose, for by doing this, not only are different tastes better suited, but the pocket is also saved from needless depletion, which is of equal importance.

## "PASSE-PARTOUTS," AND OTHER DECORATIVE MATTERS.

BY PASQUIN.

A LARGE number of the readers of WORK are such as might be included in the same category as the writer—those whose artistic instincts are ahead of their means. To such, therefore, all "tips" or "wrinkles" which may conduce to the embellishment of the home are always welcome; and it is with a view to supplement whatever has already appeared in the pages of our favourite journal that the present suggestions are offered for the consideration of the readers of WORK; and as all such "tips" are the result of actual practice and experience, it is more than probable that there are many who will appreciate them.

First, then, let us consider the old-fashioned "passe-partout," which furnishes us with a cheap and easy method of preserving such pictures as are not thought worthy of the expense of a frame.

It is surprising what good results may be obtained from the most unpromising materials. As an instance, I will mention a common woodcut, representing Defregger's "Holy Family"—a modern work, but one of considerable merit. This woodcut occupied the centre of a sheet almanac issued as a Christmas supplement with a certain weekly newspaper some three or four years ago. It was not worthy of a frame, so I proceeded to treat it as follows:—Firstly, I "painted" or "tinted" it in water colours, keeping the tones subdued, and in keeping with the subject. Then I procured a piece of ordinary picture-glass, half an inch larger each way than the actual size of the print, on which I had already left a margin of about an inch, thus leaving 1½ in. from the edge of the glass to the edge of the picture. This glass cost me only 3d. Then I cut a piece of stout *glazed* brown paper to the exact size of the glass: this was to form the *back*. I had previously prepared several yards of paper tape, about three-quarters of an inch in width, and coated on one side with strong gum, which was allowed to dry thoroughly. Dextrine would, perhaps, have been preferable, but the gum was at hand, and the dextrine was not. Glue would have done, if thin and workable; but there would have been a risk of "messing" the work—a matter always worth guarding against. The glass, picture, and brown paper back were then bound neatly together at the edges with the paper tape, care being taken to get an equal grip *back* and *front*. When all was dry—a matter of half an hour—a piece of macramè string was knotted at each end, and a band of strong brown paper gummed over the ends. As the whole weight of the glass has to be borne by this cord, care should be taken to get a sound grip of the latter, for which purpose a strip was gummed *lengthwise* from top to bottom, thus putting all the strain upon it.

Now, as far as the structural arrangements go, the "passe-partout" is complete, so we proceed to the decorative or ornamental part. I procured a sheet of the coarsest sand- or glass-paper, which I cut up into strips of an inch and a half each, taking care to have *clean edges*. For this reason, I pencilled out the widths with a straight-edge, and used scissors to cut with in preference to a knife, which would probably, from the nature of the material, have caused more or less of a ragged outline. As the sheet was not long enough for the sides, each was composed of two pieces, the join being afterwards hidden, as you will see later on. The angles, of course, required to be mitred, which I managed by squaring a piece of cardboard, and cutting across diagonally. This then served as a template, other or more orthodox appliances not being at hand. The strips of sand-paper were then *glued* in place on the edges of the glass, thus covering the original binding paper or tape, as well as the margin of the picture, which had been left for the purpose. The mitres, as well as the joins in the sides, were then covered with diamond-shaped pieces of the same sand-paper, while over these again were glued smaller, but shield-shaped, pieces. When all was dry, the strips were painted over with lithographer's *gold* bronze, mixed to the consistency of cream with gum-water. A little care is here necessary to keep the gold clear of the glass. The diamond-shaped pieces were then bronzed, but with *copper* bronze, while the small shields were finally touched up with *silver*, and the job was complete.

These "passe-partouts" have now been hanging up for three years, and begin to show signs of requiring a second wash of bronze; otherwise, they are as sound and elegant as the day they were made.

For bedrooms, nurseries, and other such rooms, this method will be found very useful, as the work involved is nothing, while the materials required are within the reach of the poorest of us, costing, at the outside, only about 3d. per picture—the glass, of course, being the principal outlay. The bronzes are very cheap, and any lithographic printer will, for a few pence, supply you with sufficient of each to do many pictures.

But we have hitherto dealt with a picture with a plain back; what shall we do with those cut from the pages of the illustrated journals, and which have letterpress on the backs? Unpromising as such prints may appear to be, it is possible, with a little ingenuity, to convert them into "things of beauty," and thus "joys for ever." As an illustration of my method of treating such woodcuts, I may mention a portrait of Mary Queen of Scots, which appeared in the *Graphic* some time ago. This was a copy of an ancient painting, and as I could not command even a replica of the latter, I conceived the design of making one for myself. I ought to add that the woodcut had letterpress all over the back. I got a piece of glass the exact size of the print, which I first *cleaned* perfectly. This glass must be *chemically* clean, or the picture will probably blister or peel off long after you have expended time and labour upon it. Having cleaned it perfectly, then coat it thickly on one side with freshly-made boiled starch, which should be of the consistency of blancmange. Soak your print for a few seconds in clean water, and apply *face* to the glass. Then take a piece of parchment-paper, thoroughly soaked in water, and apply to the back of the print. Then, with a paper-knife or other smooth-edged tool, commence to work out, *from the centre* and towards the edges, *all* the starch. Go over this several times, watching—from the front—for air-bubbles, which must all be squeezed out carefully and perfectly. Then, when no more such bubbles are visible, and no more starch is to be worked out from between the picture and the glass, set the whole aside to dry. This may take a day or so: don't attempt to hurry it. When quite dry, take a piece of No. 2 glass-paper, and go carefully all over the back, taking care not to make holes, or to rub hard. It is a positive advantage to have the printing on the back, as by this you can judge of the effect of the glass-papering process. When all the letterpress is rubbed down, go more carefully, but continue the rubbing down as long as you dare. When you judge you have gone down thin enough, take a piece of No. 0, and finish *very* carefully. With the finer number a great deal more of the paper may be got away—the object being, of course, to leave only the thinnest film, with the print on the front of it. As soon as the paper is rubbed away as far as is admissible, mix a little castor-oil and turpentine, in equal parts, and rub this mixture well into the remaining film with the tips of the fingers. Do not fear to use too much, as it can be removed afterwards, when its work is done. The effect of this dressing is to render the print transparent, which it does instantaneously. Leave the print thus "in oil" all night, and next morning remove all superfluous mixture with a piece of cotton-wool. In this process use all necessary care to avoid injuring the transparent film, which, however, will bear a great deal of rough treatment on occasion. Your picture is now ready for painting—the final process.

"Oh!" some readers of WORK will say, "this is only the old crystoleum process, with which everyone is familiar, and which is long out of fashion." I beg pardon of such gentlemen—for whom, by the way, this article is not written. Did you ever know the crystoleum process applied to common woodcuts, with printing on the back? Again, *two* glasses are used in crystoleum, while I only advocate one, the picture supplying all the necessary detail, and the "painting"—for want of a better name—being of the most slap-dash order. Nevertheless, the result is not only pleasing, but really artistic, having all the softness and "velvety" appearance of a crystoleum painting.

Now as to the "painting." Mix first a good flesh tint, which may be arrived at by using zinc-white, chrome-yellow, and carmine in due proportions. Experiment with these until you get a flesh tint suitable for the subject in hand. Then with a very fine pencil put in the lips (carmine), the iris of the eyes (blue or brown, as the case may be),

the whites of the eyes, and all other fine or minute detail. Then with your flesh tint go *over all*, and afterwards put in your other tints or colours. As to the kind of colours to use, let them be *good* tube oils, but in the mixing use only turpentine—no *oil*—as you want your colours to dry quickly, while the glass furnishes more than sufficient glaze.

Pictures treated thus require no varnishing, a piece of soft paper being pressed over the back when the colours are finally dry, and the whole framed in the ordinary way. I have a series of four pictures thus produced, which were originally fac-similes of stained glass windows in the new Cardiff Castle. They are scenes from *As You Like It*, and were published as a supplement to the *Builder*. From this it may be seen that high-class productions are by no means essential.

Neither are woodcuts and prints the only materials available for the decoration of the impecunious man's home. The common plaster busts and images of the noble Italian refugee also lend themselves readily to artistic treatment—even the most crude and inchoate. What I once regarded as positive eyesores have, by judicious handling, become also "things of beauty," and—what is a still better test—money far in excess of their intrinsic value has been bidden for them. Take the well-known allegorical figures of Africa, Asia, etc., which I regard as most suitable for such manipulation. These are about 18 in. in height, and are sold at cheap rates by all statuaries. Go carefully over each one with a penknife and a fret-file or two, and remove all the "burr" left by the moulds. Of such excrescences there are usually more than enough to keep you employed for an evening or two. If the space between the upper and fore-arm and the head (as in the case of the "Basket of Flowers Boy") is left solid, bore this in the centre, and file carefully away to the proper outline, finishing, when necessary, with fine glass-paper. When all such false outlines are remedied, size the image with good strong size; thin glue answers very well. At this stage there is nothing very beautiful about the figure, which presents a uniformly streaky and dirty appearance. This, however, is of no consequence. Then mix your flesh tints, remembering that for "Africa" a different complexion is required to that which would be all right for "Europe." Experiment with white, browns, and yellows till you get it right. Then, when the flesh tints are put on, proceed to colour the garments, symbolical accessories, foliage (if any), etc.; but remember that each figure should be coloured "in keeping" with its subject. Any jewellery may be livened up with a little gold bronze, *applied dry* with a camel-hair pencil while the paint is still "tacky." In mixing the colours for this purpose, also, oil may be dispensed with for the most part, but carmine *always* requires a *little*, otherwise it dries *powdery*, and is liable to rub off if touched or dusted. No glaze is desirable upon statuary so treated; a dead surface is always preferable. Use the best artists' colours you can afford, and the result will agreeably surprise you. Some statuettes painted by the writer some five or six years ago are now as good as ever, and are still much admired.

These three methods of home decoration are, among others, drawn from the personal practice of the writer, and, besides furnishing his home with pleasing and durable ornaments, provided him with wholesome and fascinating employment during many a period of enforced idleness. Time of this kind, when employment even in the most trivial pursuits is welcomed as a boon, often falls to the lot of men and women, and hence the *raison d'être* of the instructions given above for the performance of work which people who are always busy might regard as useless and uninteresting.

**Front and Side Elevations of a Useful Bookcase for Small Books.**

## A USEFUL HANGING BOOKCASE FOR SMALL BOOKS.

DESIGNED BY S. J. SPELLER.

It will be in the remembrance of many readers of Work that in the course of the year 1890 prizes were offered for competition by Messrs. Cassell & Company, Limited, for three designs for bookcases specially adapted to hold the numerous volumes of Cassell's National Library. One of the competitors, Mr. S. J. Speller, of Frome, sent an alternative design of a more simple character than that from the same maker which won a prize. It was intended to publish this, as well as the prize-winning design, at the time, but the demands on space in Work were then so heavy, that it was determined to hold it over for some future occasion. An opportunity of presenting it to our readers until the present time has not hitherto offered itself, and it is now given, partly on the principle that it is better to do a thing late than to leave it undone altogether, and partly because a simple but, at the same time, a highly attractive design of this kind is sure to find favour with many, and be made by them either for the adornment of their own homes, or as a welcome gift to add to the embellishments of the home of a friend.

The bookcase may be made in any material, from soft pine to hard oak, according to the preference of the maker; but if it be intended to enrich the work with carving as shown in the design, hard wood should be used. Moreover, pine is by no means a wood suitable for carving, and the workman might come to grief in endeavouring to copy the ornamentation at top and bottom in any soft material. Therefore, all points considered, it may be taken that oak is by far the best timber to use in making a set of hanging bookshelves, such as those now under consideration. The total height of the bookcase from top to bottom is, as shown in the illustration, 4 ft. 3 in., and dividing out and marking this as a scale, the proportions of other parts can be easily ascertained by actual measurement. It may be said with reference to sizes of parts that, in order to give due effect to the carved work on the front edges of the sides, the sides themselves should not be less than $1\frac{1}{4}$ in. in thickness, or thereabouts; the depth of the panels, as shown in the side elevation to the right, from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. below the original surface; and the shelves about $\frac{5}{8}$ in. thick. The ornamental work at the top and bottom may be pierced as shown in the front elevation to the left, or boldly carved out of the solid and the ground stamped. The sides may be got out of 1 in. stuff if preferred, but if the edges are carved according to the design, they will not present as effective an appearance as they will when worked in thicker stuff. The sides should be further rebated to take back, and grooved on the inner surface of each to take the shelves.

It has been said that the bookshelves are intended for the reception of very small volumes—namely, those of Cassell's National Library, a new issue of which, with various additions, is now in progress. There is no reason, however, why bookshelves on this pattern should not be made to take larger volumes; and, if this be desired, all that has to be done is to make the sides of suitable length, and to make the width of the space between shelf and shelf proportionate to the height of the books each shelf is intended to hold. The edges of the shelves may be simply carved, the leather, as shown in the illustration, being inserted in a groove made in the under part of the shelf a short distance from the edge, and held in place by a slip of wood which fills the remainder of the groove. Those who cannot accomplish the grooving may attain the appearance by pulling the leather along the edge of the shelf—by gluing is the best mode—and then putting on a bead of the same thickness as the shelf outside the leather.

## A COMFORTABLE ARM-CHAIR.

BY H. A. MILES.

INTRODUCTORY REMARKS—MATERIAL AND UPHOLSTERY—ECONOMICAL USE OF MATERIAL—FRAMING—THICKNESSING—CHOICE OF MATERIALS DETERMINES METHOD OF CONSTRUCTION—HOW TO CUT OUT PIECES OF FRAMING—CONCLUDING REMARKS.

*Introductory Remarks.*—Every house is usually furnished with an arm-chair, or so-called easy chair, but how seldom is it a seat into which a tired person could sink and drop off to sleep! As a rule, the seat is so deep that, unless the owner is possessed of exceptionally long understandings, he would be unable to recline against the back without raising his feet from the floor; then how frequently the back is either too upright or too sloping, too high or too low, either propping the head up in the comfortable manner of a photographer's rest, or suffering it to hang over in a manner strongly suggestive of a barber's shop.

To obtain the maximum of comfort, of course, a chair should be made of a size suitable for the person who will occupy it; but a happy medium may be struck, and a chair produced of such a design that most persons would be able to indulge in a post-prandial forty winks in ease and comfort.

Such a chair it was my good fortune to come across during my recent wanderings in the country, and as I never lose an opportunity of making hay while the sun shines, I at once pulled out my rule and made a rough dimensioned sketch of the chair on the spot, taking the opportunity afforded by the first showery afternoon to try and introduce it to my readers.

*Material and Upholstery.*—The material used was English oak, upholstered in morocco.

A side elevation is shown in Fig. 1, a back view in Fig. 2, while Fig. 3 shows the most economical method of cutting out the material.

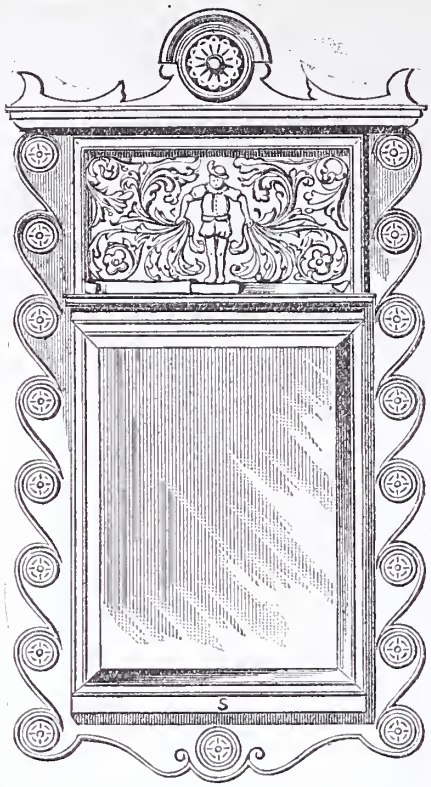


Fig. 1.—Wall Mirror in Brass Repoussé Work.

*Framing.*—The thickness of the framing is about $1\frac{3}{8}$ in., and the portions round the seat and back are thicknessed up with $\frac{3}{4}$ in. deal on which to fasten the upholstery. It would be preferable to mortise and tenon the cross pieces, A (Fig. 3), into the side pieces, B (Fig. 3), before gluing and screwing the latter to the side framing, as the tenons can then be wedged up.

*Choice of Material determines Method of Construction.*—If oak is considered too expensive, good yellow deal or pitch-pine would make a very neat-looking piece of furniture. If pitch-pine or any other soft wood be used, it would be advisable to add a rail between the front legs, as shown in Figs. 1 and 2 by dotted lines, G.

*How to cut out Pieces of Framing.*—The entire set of pieces are in duplicate, so that if two pieces of wood be fastened together and the curves drawn on one side, all can be cut out together, either by a frame-saw, used by hand, or preferably by means of a band-saw.

*Concluding Remarks.*—I have merely given a rough idea of the chair, without entering into small details of construction, and for this reason have given dimensions from centre to centre, so that the proportions of the parts may be modified to suit the strength of the material used without materially altering the design.

I can safely promise anyone who has the necessary ability to make it that he will have to take a long journey if he wishes to find a more comfortable seat.

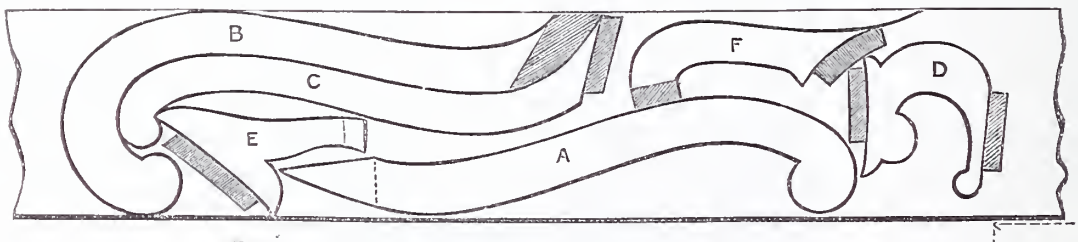



Fig. 3.—Method of cutting out the Various Parts from one Piece of Board.

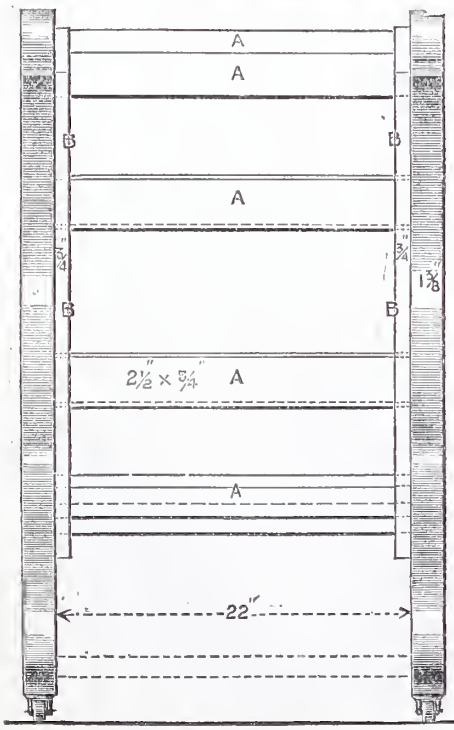



Fig. 2.—Elevation of Back of Chair.

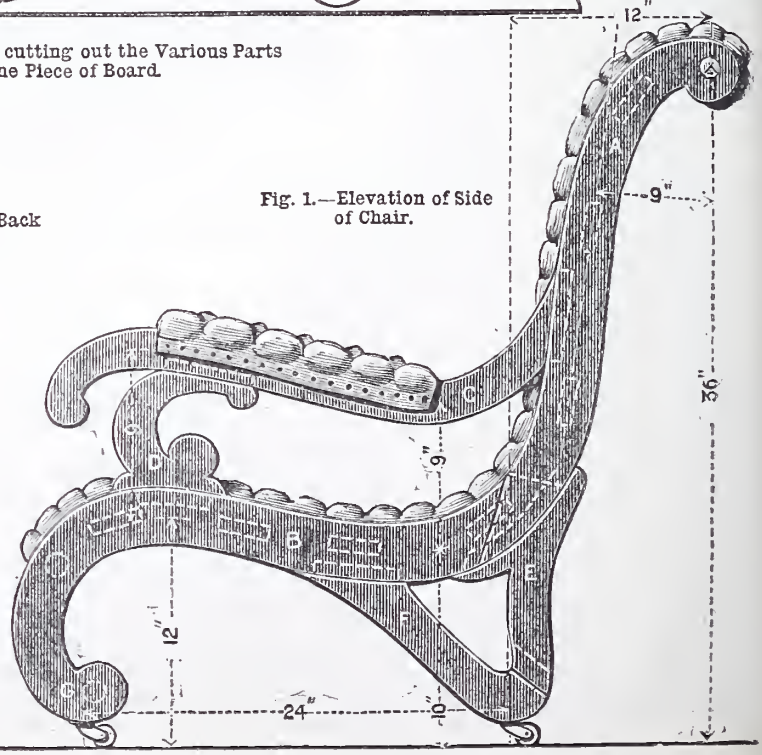



Fig. 1.—Elevation of Side of Chair.

## A WALL MIRROR, WITH BRASS ORNAMENTS IN REPOUSSÉ WORK.

BY ROBERT COXON.

THIS design for a wall mirror will be found to produce an effective piece of work if carefully carried out. It is designed more especially to suit the brass frieze, which is of an original character in a quaint old

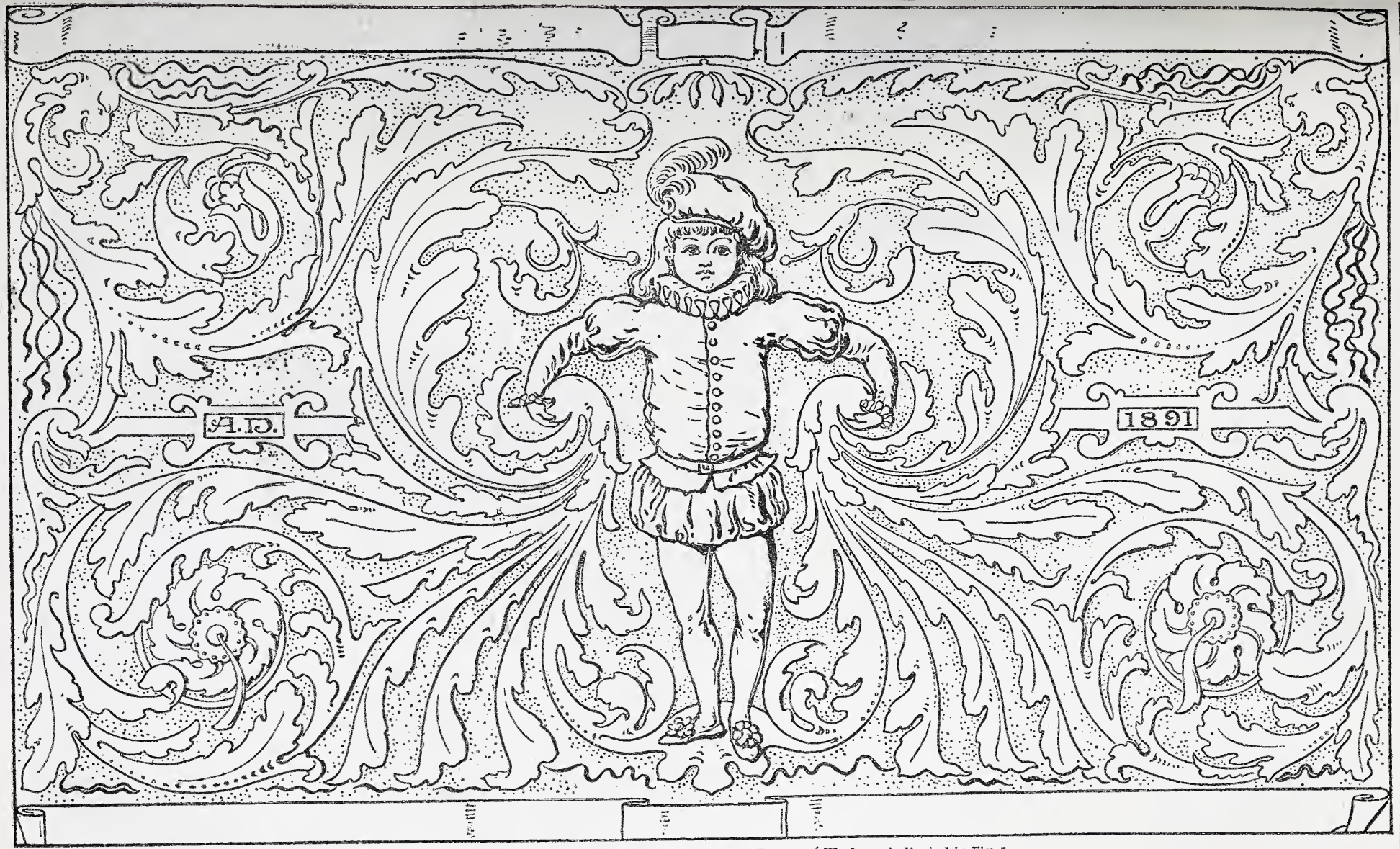



Fig. 2.—Full-size Design for Ornamental Panel in Brass Repoussé Work, as indicated in Fig. 1.

English style, and would form a charming piece of decoration for amateur repoussé workers; the woodwork best suited being ebony or a hard wood stained or ebonised, but the characteristic of the drawing would lend itself to reproduction by wood-carver's tools, and those of artistic tendencies would find it a good subject for execution in painting or gesso work. Those of our readers requiring a more simple method would find little difficulty in reproducing the design in burnt wood engraving, a simple but effective art which is much followed just now.

If carried out in brass repoussé work, care should be taken to carefully trace the design, as much of the crisp effect is lost when this is not uniformly correct. The rosettes at the frame scroll work could be purchased at a moderate cost from any upholsterer's furnisher, and might be equally effective a little smaller than shown, but not to exceed 1½ in. in diameter. The bevelled glass is mounted in the frame with a ¾ in. moulding. The shelf s at bottom of the glass would be about 3 in. broad. This shelf, as will be seen by looking for it in Fig. 1 in the opposite page, is shown only by its edge, Fig. 1 being intended to show the mirror complete, and the position of the ornamental panel in brass repoussé work at the top (as shown full size above in Fig. 2), and the enrichments of the frame.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Setting Out.

We have looked at the setting out for mortise and tenon and for dovetail joints. There is a further hint to be given on dovetails—that is, to avoid too great an angle in the spreading of the dovetail. The common idea is that the greater the difference between the size of the pins at the outer surface, where they are small, and the inner surface, where they are large, the better. Now it is not so. It only needs a slight difference, depending, of course, upon the thickness of the material what that difference is to be. Look at some good cabinet-work, and copy the angles and proportions of dovetails and pins.

Dowelled joints may be set out in similar manner—that is, with square and gauge; but if many joints are to be made, a template, which can be made of thin wood, metal, or even cardboard, will be of service in saving time, the centres of the dowels being pricked through the template, and, by its aid, to the work itself. Care must be taken in the use of the template that it is not turned, but used from the proper edge in every instance. It is to be remembered in setting out that every detail should be known and provided for at the beginning, otherwise mistakes will arise.

The professional way of setting out is by means of a rod, as it is called, which is a strip of wood as long as the work, on which all the lines are marked on one side, measured lengthways, and usually on the other side, or on a separate rod measured *across* the length. This answers the purpose as well as a full-size drawing to a workman; but by all means retain the habit of making scale drawings of your work, if you have such a desirable habit; if not, attain to it as soon as possible. The time when the workman shall be an *artificer* in its true sense will be brought nearer when the workman is in the habit of drawing to scale plans, elevations, and sections of his work. It will cultivate the ability to see the end from the beginning, which is needful if a working drawing is to be entitled to the name of a design.

The setting out *is* the difficulty of the beginner, but the difficulty disappears as he is learning to draw to scale. There is no plan of learning so good or so rapid and effective, and for the amateur, for whom these lessons are intended, it is absolutely necessary that he should learn to 'do whatever he wishes by himself, availing himself, of course, of any convenience of prepared material, but making the article suitable to its intended purpose, and to show its suitability obviously, yet pleasing the beholder by the oneness of the whole thing.

On the subject of setting out, I must remind the reader that he must, in most cases, be guided by the capacity of his tool-chest. It is of no use to gauge for a tenon of any other size than one we have a chisel suitable for, or to mark dovetailing smaller than any chisels we have in stock, or dowels of a size we have no bits to bore, and so on. On the other hand, halving, dovetail halving, housing, and bridle-joints are not so very imperative in demanding special tools, or tools of a special size. The best thing that the amateur workman can do when he finds that he wants a chisel or bit of a size he has not got, is to buy it. Tools are always useful, and, in this case as well as others, store is no sore.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 99.—Rogers' Improved Attachment for Lathes.

Some of my readers may, perhaps, remember that in Vol. II., page 583, of Work, otherwise No. 88, an illustration and description were given by a correspondent of an improved shaping attachment for lathes. In the illustrations given below, a modified form of shaping attachment, similar, in some respects, to that to which attention has just been directed, is shown. This form, which is known as "Rogers' Improved Attachment for Lathes," has been designed by Mr. F. M. Rogers, Fellow of the Chemical Society and Associate of the Society of Telegraph Engineers and Electricians, to meet the demand for a tool of this class, capable of working on a slight, single-geared treadle lathe such as is generally used by amateurs and light metal-workers. The appliance itself, in its complete state, is shown in Fig. 1. The stroke is fixed, and is determined by the throw of the eccentric sheave shown in Fig. 2, which is screwed direct to the nose of the mandrel, and travels in the grooved path upon the back of the face-plate, thereby imparting a noiseless reciprocating motion to it. The attachment is made to suit lathes of different sizes, but the stroke in the size shown in Fig. 1, which is the size adapted to a 4 in. centre lathe, is about 2 in., which enables one hundred and twenty cuts per minute to be taken with ease in brass or gun-metal. The V packing-strips are of gun-metal, and an adjustment is provided for taking up wear. When fitted with

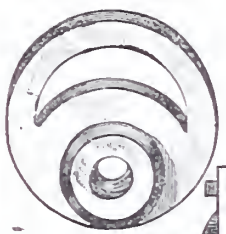


Fig. 2. Eccentric Sheave.

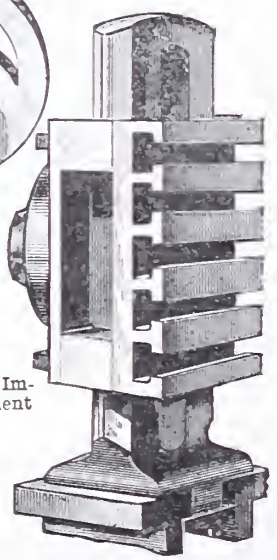


Fig. 1. — Rogers' Improved Attachment for Lathes.

a parallel vice, this little tool will rapidly shape odd pieces of metal which otherwise would have to be filed up. Larger work is bolted to the face-plate. The slide-rest can be operated by hand or by self-acting motion. In addition to the shaping of metal, planing can also be effected by the aid of this appliance, key-grooves cut, and a variety of other tooling work accomplished with accuracy and rapidity, provided the speed is suitably proportioned to the work. Light metal workers will find their work much facilitated by supplying themselves with a punch and pair of shearing-blades for cropping sheets or plates and roughing out material. These, it is almost needless to say, can be procured with the attachment, which, when in use, has its standard bolted to the bed of the lathe. This appliance is well worthy the attention of turners, especially amateurs who have an inclination for metal work. It appears to have been carefully designed with an especial view to the general requirements of this class of workmen, and to be turned out with equal care, accuracy, and finish.

### 100.—Kerr's Improved Workman's Drinking Flask.

The ordinary oval tin bottle or flask generally used by workmen, stoppered by a cork, and unprovided with any means by which its contents may be swallowed other than by that of pouring

**Kerr's Improved Workman's Drinking Flask with Cone Cover (A); with Cone Cover inverted and screwed on Flask (B); Cone Cover inverted (C) as Cup; Milled Stopper (D); Section of Top of Flask (E).**

them into the month through the orifice at the top, must certainly give place to the neat and well-appointed drinking flask known as "Kerr's Improved Workman's Drinking Flask," invented and recently patented by Mr. D. W. Kerr, plumber to the Dumfries Gas Commission. This flask, when not in use, or when filled with tea or coffee, presents the appearance shown at A in the accompanying illustration. In this it looks like an ordinary round bottle with a cone-shaped top and a milled cap or cover, which screws on or off at pleasure, in place of the ordinary cork, with a handle affixed to the upper part by which the can may be slung or carried in the hand. A closer examination, however, reveals the fact that the cone-shaped cover screws off, and shows that underneath it is another top fixed to the bottom, also cone-shaped but handleless, as may be seen at B. In the top of this is inserted a short brass cylinder with a screw-thread cut within, as shown in section at E. The cone-shaped cup or cover, when removed, appears as shown at C; and when it is turned upside down in this position, the orifice that is now at the bottom being closed by the milled cap or cover—shown separately at D—can be used as a drinking cup. But it has yet another use than this, for when the milled cup is removed, the cover or cup can be screwed into the mouth of the flask and thus act as a funnel or filler when pouring in hot tea or coffee. When heating tea or any other liquid in an ordinary flask, it is necessary to remove the cork or top screw to allow the steam that is generated to escape, but with this improved flask a mere turn of the cover suffices to afford an outlet for the steam through a small hole in the screw part shown at E. The steam is directed downwards between the top of the flask and the cover, and cannot blow upwards so as to scald hands or face. The movable cup, moreover, speedily cools, and may be used for drinking purposes as soon as the liquid within the flask is hot enough. The flask is made in three sizes—namely, 1 pint, 1½ pints, and 1 quart—and will be found as useful at picnics and to sportsmen and tourists as to working men.

The Editor.

## SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

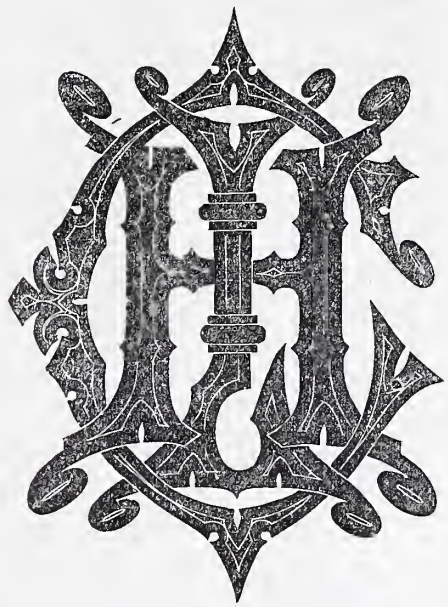
**Subjects for Royal Engineers.**—J. B. (*Salford*).—The Royal Military College, Sandhurst, is devoted to the instruction of young officers, both for cavalry and infantry, after they have passed the examination for commissions, and before they are appointed to regiments. The course lasts a year, and the instruction is confined to purely military subjects—fortification, military sketching, tactics, military law, correspondence, and accounts. At the conclusion of the course, the students are required to pass an examination in these subjects, and their commissions are dated according to the result; those in the first class being antedated two years; those in the second, twelve months; and those in the third dating from day of examination. You would have to enter as a candidate at an open competitive examination. The limits of age are seventeen to twenty, except in the case of university students and one or two other exceptions. The examinations are held under the Civil Service Commissioners. The successful candidates receive commissions as sub-lieutenants, and then go to Sandhurst. The Royal Military Academy at Woolwich is the training school for Royal Engineers. The course of instruction is mainly scientific, mathematics being one of the chief subjects—and also professional. Successful candidates for the Engineers receive appointments, and may go to Chatham, or be employed on works or buildings.—J.

**Piano Tuning.**—JACKSON.—A very concise and clear little book of instructions to pianoforte tuners is "The Tuner's Guide," by Abadie, price 6d., published by Lafleur, of Green Street, Leicester Square. We know of no work on the voicing of harmoniums and American organs; though we have an impression that Messrs. Metzler, of Great Marlborough Street, used to publish a little *brochure* on the subject.—G.

**Harp.**—CONSTANT READER.—It is scarcely possible, within the limits assigned to inquirers in this column, to give full working details of the construction of a harp. Here, however, are some of the main features, which will enable our correspondent to set to work. A harp consists of three parts: 1, a column; 2, a body, shaped like a boat and held in shape by ribs; 3, the neck. The wood usually employed is maple for the pole, body, and neck; and for the sounding-board or belly, a special kind of pine-wood—obtained principally from the forests of Bohemia and Switzerland—which possesses a high degree of sensitiveness to musical vibrations. The same description of wood has been and is still used for the sound-boards of every description of musical instrument—violins, 'cellos and string basses, guitars, zithers, and pianos. The only metal work employed is the ring in which the pole is held where it joins the body at the base or thick end, and the wrest-pins or tuning-pins. The distance between each two strings is determined merely by the thickness of the player's fingers. The pole is made separately, of course; the body separately, the neck separately. The neck is glued permanently into the head; but the body is not permanently fixed—it is held in position by the tension of the strings on dowels at the treble end, and by the ring already referred to at the base. Seven strings complete the octave, so that a 5-octave harp would consist of thirty-five strings; and our amateur harp-builder would probably add another string, so as to make the harp begin and end on the same note. Should he wish for a few extra semi-tones, to enable him to wander from the key in which he starts, he must procure some fiddle-pegs, and insert them in the neck in such a way that, when turned from the vertical to the horizontal, the peg shall, by pressure on the string, shorten it by about one-sixteenth of its length—*i.e.*, so that it will arrest the vibrations at a point about one-sixteenth short of its total length. The shortest string, E, on Erard's 43-string 6-octave harp is 3 in. long, and the longest, G, is 58 in. There is a double-action harp which gives three different sounds from each string; but, should our correspondent's ambition have contemplated the making of one of these, there is only one way to accomplish it—viz., to buy one, take it to pieces, see how it is made, and copy it.—G.

**Pantograph.**—JOINT.—The pantograph has had more than one allusion made to it in back numbers: see p. 669, Vol. I. (No. 42), for an illustration and a description of it. Do not concern yourself with making one. At a price not exceeding sixpence one may be bought, which would afford you every detail necessary, if you contemplate making quantities for sale; or would answer its destined purpose much better, probably, than a home-made one would. Any artists' colourman would obtain you one.—J. S.

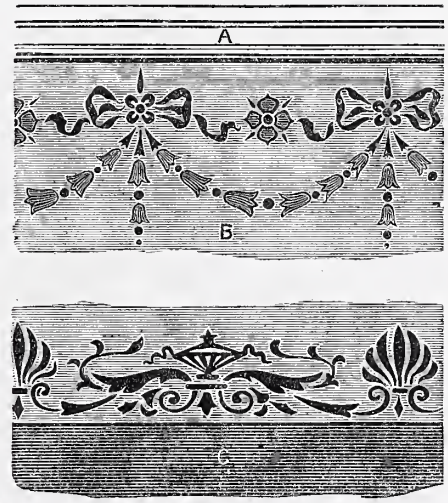
**Monogram for Inlaying.**—C. L. H. (*Reading*).—In print this monogram is decidedly bold, distinct, and effective; nevertheless, C. L. H. could render it much more so if—when reproducing for inlay—he composed each initial of a different-coloured wood; or, if a subdued and delicate effect be preferred, three *shades* of any particular colour could be employed—say, for instance, dark, medium, and light yellows. These would certainly make a rich and pleasing combination. Should our correspondent



C. L. H. Monogram for Inlaying.

possess sufficient patience and skill, he could even introduce two colours or shades in each letter, taking the white lines on the lettering as indicating the middle insertions. This treatment would, of course, necessitate great care; but, if neatly executed, the result would amply repay the time and trouble expended. Before piercing, C. L. H. would, doubtless, profit by noting the hints contained in previous replies to E. M. N. and others which have appeared in WORK.—A. C.

**Paint, To Harmonise.**—J. K. B. (*Manchester*).—For a bedroom treated in "light pink," I think your safest colour for a frieze stencil would be a dark shade of the wall colour. If you are going to put a dado of colour, then it would be well to make up this, using the same stainers as for the pink, but also adding umber, in order to keep the red under control. Then use the dado colour for the frieze. I must confess that I don't admire *both* dado and frieze in a bedroom; but if the room is of a good height, and the customer desires it, well and good.




A, Cornice; B, Frieze; C, Dado.

The frieze stencil and border I have sketched here to half scale would look well in one colour. I should also advise stencilling the dado border with the dado colour, and then running a base-line to the border in black, or very deep bronze-green. Sage, or very quiet yellow-green, is the only other tone likely to suit with your wall colour and for a bedroom. I think shades of all one warm tone will be best. Mind your stencil colour is strong enough. Dry a piece upon the pink before use.—DECORATOR.

**Combined Bench and Tool Chest.**—MANCUNIAM'S address is unknown to us. If you require more than the full details already given to you on p. 524, No. 33 of WORK, please write definitely through "Shop."

**Bending Brass Tube.**—A PUZZLED ONE.—I expect that what you call brass tube is in reality what is known in the trade as brass cased tube—that is, an iron tube with a thin casing of brass. If this is the case, I advise you not to try to bend it to an angle, but to cut and mitre it. Bend a piece of solid round iron to the angle of the window; let it be about 3 in. long each way, and let this fit tightly into the cased tube and form a connecting piece. You can solder the mitre-joint or not; if you make a true and good fit, it is hardly necessary. I have fitted up a good many in this way with satisfaction. —R. A.

**Soldering Hoops on Churns.**—E. T. (*Broadway*).—It is decidedly best to take the hoops off, and re-tin the part that comes in contact with the churn. To get over the difficulty of keeping the hoop hot whilst you solder round, you should use a gas blowpipe to warm it as you go along. With regard to learning the churn-making trade, you ask if you would have to serve a time and pay a premium. If you know anything of tin-work in general, you could get a job without either paying a premium or serving a time; but it would be as an improver, and at a lower wage than you would get in any branch that you were familiar with.—R. A.

**Battery for Lighting Model Church.**—VEGA. —It may interest you to know that I have a small single fluid bichromate battery of four cells, contained in a case about 6 in. by 6 in. by 6 in., with lifting arrangement for immersing elements as required, which brilliantly lights a 2½ c.-p. incandescent lamp. If you would like a description, I will give it you, with the Editor's permission.—H. E.

**Dulcimer.**—W. M. C. (*London*).—All the information you require upon this subject will be found in the following numbers of WORK: 31, 38, 41.

**Imitation Tortoiseshell.**—R. G. H. (*Birmingham*).—The address of the Xylonite Company is Fore Street Avenue, London, E.C.; and besides being makers of imitation tortoiseshell, they also turn out some capital imitations of ivory, coral, lapis, etc., in xylonite. There is an article on xylonite on p. 787, Vol. II. of WORK (No. 101), in which the writer gives some useful information; but not on polishing. The firm will reply to you if a stamped directed envelope is sent; but meanwhile a good surface can be obtained if it is treated as tortoiseshell is—viz., smoothed with a file and glass-paper if necessary, then with fine powdered pumice and water, and finally with clean damp whiting, finishing up by rubbing with dry whiting and the palm of the hand. The pumice and damp whiting is applied by means of a piece of soft cloth, unless you have a lathe, when a dolly or bob might advantageously be used for it. If you look through the indexes of the two volumes of WORK, you will find several answers on polishing horn and tortoiseshell, which may help you. In this case where you say you want to re-polish some handles that have gone dull, fine whiting ought to be sufficient when added to a good lot of rubbing.—H. S. G.

**Gold Lace.**—L. N. (*Oldham*).—To clean this, refer to a reply on p. 223, Vol. II. of WORK (No. 66), which you can order through your newsagent for 1d. This is always an unsatisfactory job, and when you get your new regalia, take the greatest care of it by carefully drying it in a soft rag if by any means it gets wet. Keep it out of the way of smoke, etc., in a tight-fitting box, and do not let any rubber rings be used to fasten the box, or even kept near it, for silver tarnishes very quickly even when gilt, as it is in your case. Gold lace, so called, is, I believe, never of gold, but either silver or copper wire electro-gilt.—H. S. G.

**Embossing on Glass.**—A ZINC-WORKER.—You say that you "have tried fluoric acid for embossing on glass with little or no result, as it bites into the glass, but leaves a clear ground." Now, this is just how it should act, and diluting the acid would certainly not produce the ground glass appearance. Where you have made a mistake is in using fluoric acid instead of fluoric acid *gas*. To make this, mix finely powdered fluor-spar (calcium fluoride), three parts, and sulphuric acid, two parts; put in a leaden dish; lay the glass to be etched, with the design prepared and drawn in the same way as for the liquid process, over the dish, and apply a gentle heat; the gas is then given off, and the glass is etched with a ground appearance. This operation should be conducted in the open air, as the fumes are highly dangerous to health. If you do not care to use this method, the only other way is to proceed as you have been doing, and afterwards roughening the design with emery of different degrees of fineness; but you would find this rather a risky proceeding, and the results would not be as good.—W. E. D., JNR.

**Sign-Writers' Alphabets.**—W. R. W. (*Fulham*). —I cannot understand that you could not obtain what you desire from Brodie & Middleton. Nevertheless, you will find what you want in the following books, published by Crosby Lockwood and Co., Stationers' Hall Court, E.C.: "Ornamental Alphabets, Ancient and Mediæval," by F. Delamotte, cloth, price 4s.; or, "Examples of Modern

Alphabets, Plain and Ornamental"; or, "Mediæval Alphabets and Initials for Illuminators." There are also several sheets of alphabets, etc., in "The Art and Craft of Sign-Writing," published by W. G. Sutherland, St. Ann Street, Manchester.—H. L. B.

**Incubator.**—W. E. T. (*Burton-on-Trent*).—Probably before you see this the wished-for article on a hot air incubator will have appeared, it being already in type. The Rearer article will follow shortly. For your other queries, get your bookseller to procure indexes of Vols. I. and II., and look up what you want. All back numbers can be obtained at the usual price. For rates of Sale and Exchange column, consult the current or any issue. —LEGHORN.

**Gesso Work.**—SCULPTOR.—Materials for gesso work can be obtained from the Society of Artists, 53, New Bond Street, W. Directions for the use of the composition are given on the tins. To commence the art, gesso composition is all-sufficient; but if large pieces of work are in hand, artists generally make their own gesso of the finest possible plaster of Paris, rubbed down with water to a batter, and glue or resin added.—C.

**Glaziers' Diamonds.**—A. R. (*Askett, Bucks*).—Evidently the address you want is Messrs. James Nicholson & Co., Glass, Lead, Varnish, etc., Merchants, 214, Upper Thames Street, E.C. If it is not, then you had better write again, when no doubt our obliging Editor will insert your request. As you may not be able to wait so long, and in case the above is not the correct one, I here give two other addresses of makers of glaziers' diamonds—viz., Messrs. Sharratt & Newth, 43 and 44, Percival Street, Clerkenwell, and Mr. Fred Biddle, 4, Percival Street.—H. S. G.

**Milling Machines.**—F. G. (*Erith*).—The best book on this subject is "The Mechanician and Constructor," by Cameron Knight, published by Spon at 18s. But there is nothing in it on milling machines, neither will you be able to get any work on that subject. Any specific queries on this subject would, however, be answered in WORK.—J.

**Axle.**—G. S. (*Hollinwood*).—Axle-trees are only fitted to mail or collinge axles, and there is no altering the pitch; but when the common arms are used, they are set into a bed, and to get the right pitch so as to allow the wheels to knock and run sweet, we do what is commonly known amongst wheelers as "gaiting" them. First get the bed planed straight and true, then set the arms at each end of the bed. We will suppose that we are fixing the arms in the bed for the hind wheels, 4 ft. high, cart fashion. We therefore get the straight-edge and place it across the felloes at the front of the wheel, then measure the space between the face of the spoke on the nave and the straight-edge, which we will suppose to be 2 in.; keep the straight-edge in this position and measure the distance at the other end of the same spoke near the felloe. Whatever this measurement may be, it must be deducted from the first measurement. If the latter was 1 in., it therefore leaves 1. The secret of gaiting a wheel lies in allowing a small ¼ in. hook from the string to the shoulder of the arm off every inch we measure from the disb of the wheel. Therefore, in this case it will be a ¼ in. hook, the arms being let into the bed until this measurement is attained.—W. P.

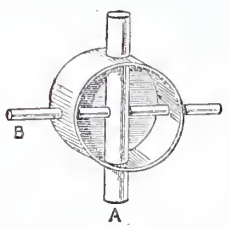
**Filling.**—W. C. (*Peterhead*).—Patent filling is now too well known amongst painters, having superseded ochre, formerly used for filling up. The advantage of the patent filling over ochre is that it makes a more solid ground to work upon, besides requiring less labour in rubbing down. The following is the recipe for mixing the filling:—Mix 4 lbs. of patent filling and 2 lbs. of best white tub lead into a paste with turps; place into a can, and thin down with 1 pint of turps, ½ pint of gold size, and ½ pint of jobbing carriage varnish. When it is well mixed up it is ready for use, and can have from one to two coats daily. The carriage must only have this filling applied upon those parts which show, and should have a couple of coats of lead colour before the filling is applied, the last coat being stained with Indian red or rose-pink, to guide you when rubbing down. When the last coat is put on, leave for a couple of days to dry, and when rubbed down let it stand for another couple of days for the water to evaporate out of the filling. When thoroughly dry, give it a coat of lead colour and proceed painting the carriage.—W. P.

**Weight of Copper.**—AMATEUR.—A square foot of copper ¼ in. thick weighs 5·75 lbs.; a square foot, ⅛ in. thick, 2·87 lbs. The method of making the port-holes in a model cylinder depends on the size of the cylinder. Anything over about ⅝ in. or ¾ in. bore is *cored*, the shape of the core-box being governed by circumstances; smaller cylinders have their ports drilled.—J.

**Getting Gold off from Gilt Buttons.**—J. K. (*Mile End*).—String the buttons on a platinum wire, immerse them as an anode in a solution composed of one part of potassium cyanide in ten parts of water, and pass a current through the solution from a strong battery to a strip of gold forming the negative pole in the solution, until all the gold is dissolved off the buttons. Then evaporate all the water from the solution, and dry and fuse the salt in a plumbago crucible with an equal bulk of dry carbonate of soda. The crucible must be kept at a white heat for several minutes. The button of metal thus obtained will be an alloy of gold with brass.—G. E. B.

**Silvered Glass.**—J. B. (*Doncaster*).—As I understand your questions, you wish to know where you can buy a small quantity of silvered glass in Doncaster; also if there is a firm in Hull. (1) I do not know where you can get silvered glass in Doncaster; but nearly any cabinet-maker will supply an amateur; and although, perhaps, you may have to pay a slightly higher price than if you bought of a manufacturer, still you can very often get better served, as large dealers do not care to be bothered with very small orders. (2) As regards Hull, I think you will be well served if you apply to Messrs. Primrose & Co., Glass Merchants, Hull. I may say it is very near the Paragon Station—in fact, just outside. To fill up cracks in oak, try resin and beeswax, melted together and tinted to proper colour with burnt umber and Dutch pink: or, if you prefer it, putty, tinted to match.—W. E. D.

**Winter Electrical Machine (Prime Conductor and Glass Rod).**—DRAUGHTSMAN.—You ask for the address of a firm supplying brass bedstead knobs suitable for the ball of the prime conductor of the above-named machine. Messrs. Noyes & Co., Old Street, St. Luke's, London, could supply you with brass bedstead knobs; but the largest size kept in stock is 2½ in. in diameter, which is scarcely large enough for the purpose, as it would look out of proportion to the Winter ring attachment. Knobs of the size required are to be obtained in Curtain Road; but I fear that you would have to purchase the bedstead as well, which would make it come expensive. If you state your wants to Prof. Caplatzi, The Science Exchange, Chenies Street, Tottenham Court Road, London, I believe that he will be able to supply you with a brass ball made specially for the conductor of this class of machine. Should you experience any difficulty in obtaining a brass ball of the diameter needed, you could employ, as a makeshift, a brass box in place of the ball. This should be made from a 2½ in. length of brass tubing, 3½ in. in diameter, with a disc of the same metal neatly soldered on to the open ends of the tube. A 6 in. length of ¾ in. tube is now put through the box from side to side, as shown at A in the accompanying diagram; and an 8 in. length of stout ¾ in. tube is soldered crosswise through the box, as shown at B, the tube being inserted through holes drilled in the centre of the larger tube. Finally, a small quantity of soft solder is run all round the junctions of the tubes, care being taken not to plaster the solder about, as this would mar the appearance of the whole work. The solder should be cut up into the form of very small beads, which are just flushed round the joints by means of a few puffs from a blowpipe. The subsequent operations, including the attachment of the collecting rings, must be carried out in precisely the same way as if a ball were employed for the conductor. It is, of course, highly important that the outer surfaces of the metal should be carefully cleaned up and left with a perfectly smooth and even surface, free from dents or imperfections. If you are not handy at brass-work, you have yet another alternative plan of making the prime conductor. You can turn a ball in a lathe from a block of sound, dry wood, and then insert the conducting fittings in the usual manner, and afterwards cover the entire surface with tinfoil or gold-leaf. Tinfoil, which would be the best to use, should be cut into the form of a series of longitudinal strips, similar in form to a section of an orange, which are then pasted on to the surface of the ball, and smoothed down until quite smooth by means of a piece of soft wadding and a hone paper-knife, or the handle of a tooth-brush. Glass rod and tubing of all sizes can generally be obtained from an electrician in any large town; or, if you experience any trouble in getting it, you might send to Prof. Caplatzi, stating the diameter and length required, which will be cut off and charged for at the rate of 1s. per lb.; or, if you prefer to go to the fountain-head, you can obtain it from Mr. D. Williams, experimental glass blower, Beech Street, Barbican, London, who deals in glass rod and tubing, and is a manufacturer of chemical and scientific glassware, including incandescent lamps, thermometers, etc.—C. A. P.



Prime Conductor of Winter Electrical Machine, with Side removed, showing Arrangement of Interior—A, B, Brass Tubes.

**Zither.**—W. J. (*Belfast*).—I replied to W. J. a short time ago on the above subject, giving him full information thereon; but it appears from his question, as now put, that he has not made a zither proper at all, but only one of the toy kind, better known, perhaps, as "Prince of Wales's harp," for which, of course, my instructions are useless. As, however, the instrument, even considered as a toy, is, especially if well made, capable of producing very sweet sounds, it is quite worth the trouble of stringing up properly. To do this, the following steel wire should be used: first and second strings (commencing from the bottom, or longest), No. 12; third and fourth, No. 11; fifth and sixth, No. 10; seventh and eighth, No. 9; ninth and tenth, No. 8; eleventh and twelfth, No. 7. If the first of these are rather "twangy," it will be as well to substitute covered strings (copper on steel), such as are used for the fourth and fifth of the zither proper. The tuning is a very easy matter, the scale being the ordinary "diatonic" scale; and it, of course, limits the tunes capable of being played on it to those standing within its compass, and containing no "accidentals," either sharp or flat. If these instructions are not sufficiently explicit, and W. J. will write again, giving the dimensions of his instrument, and, if possible, a rough sketch, I shall probably be able to assist him further; but he must not be so impatient at not getting a reply *at once*. He must remember that "big wheels move slowly," and "Shop" has now become a very "big wheel" indeed; but not so big but that his "spoke" will surely come round in time.—R. F.

**Acid and Gilding.**—AN IMPROVER.—*Hydrofluoric acid* is the name of the chemical compound used by glass writers, which has the property of disintegrating or eating into glass and kindred substances. This is the article which has been in use for many years for embossing, the parts to remain clear being eaten out to a lower level than the original surface of the glass, which latter is then obscured by grinding with emery and a glass slab. This should only be used with plate-glass. *White acid* is a comparatively modern invention, and is a compound which not only eats into the glass, but *obscures* the same in one action; it can, therefore, be used for sheet-glass, and is really a tremendous advance upon the "old fluoric" for many purposes connected with glass embossing. For further useful particulars, see previous answer to "Acid and Gilding" in present volume. The exact proportions used in making isinglass mordant, or size, for glass gilding, is a matter on which there is no necessary unanimity of opinion. The true theory of the process is this: that the mordant is only a temporary expedient to enable us to manipulate the gold; to gild and "double gild," and hold it in position until, by hot bath washings, we are able to dissolve it from its place and leave the gilding in perfect contact with the glass. This process, which is really the pith of the burnishing, is difficult to succeed with until practice and experience have been paid for by the inevitable failures and renewed and conquering perseverance. My advice is, therefore, to use only as much *finest* Russian isinglass as will cover a shilling; to put this into a new and thoroughly clean glazed earthenware pot (the London painters' "hand pot," or the best substitute you can get); pour over it a pint of boiling filtered water; then, as an extra precaution, when quite dissolved, strain through silk or the finest fabric you can get it through; and, finally, be sure glass, brush, and everything else are scrupulously clean. Many writers add to their size an equal quantity of spirits of wine; this is neither necessary nor advantageous. The most fruitful causes of failure and disappointment in obtaining good burnish are these: using foreign-beaten gold out of ordinary rouged books; using the size too strong; insufficient washing; improperly cleaned and greasy glass, tools, etc.; and *want of experience and practice* most of all.—F. P.

**Polishing Marble.**—J. S. F. (*Swindon*).—As your query evidently refers to a piece of real marble, you will find the surface polish will be renewed by taking a little rotten-stone (finely pulverised), and rubbing the slab with this and a small piece of fine marble or stone. Work with a circular motion, using water only if it is a light marble; but, if black, sweet oil may be substituted for the water, which fluids are, of course, used in conjunction with the polishing slab and rotten stone. Time and patience are also required in considerable proportions.—F. P.

**Colouring Figures.**—CLAUDE.—The only method I can suggest for colouring the small plaster figures after the manner you desire, is to dip them into a solution of the ordinary dyes. Cheap dry pigments, such as Venetian red, French ultramarine blue, and raw sienna (in water), would, if fine in quality, make coloured fluids which would dye the plaster; but some of them would not "bind" as firm as the chemical dyes, nor would the action be so regular as the latter solutions. Why not colour the plaster by mixing it with coloured water? Have you tried this?—F. P.

**Stain and Arches.**—E. B. C. (*Cheltenham*).—I do not know that there is anything recognised as *the* stain (green) for furniture. Get some green dyes, and select the one which gives the colour you like best. Plenty of shades are to be got. I hardly understand your inquiry about arches, but any outline can be cut with a bow-saw. Perhaps this hint may help you; but if it does not, write again, giving us a little more idea of what you mean by Moorish arches for corners of rooms.—D. D.

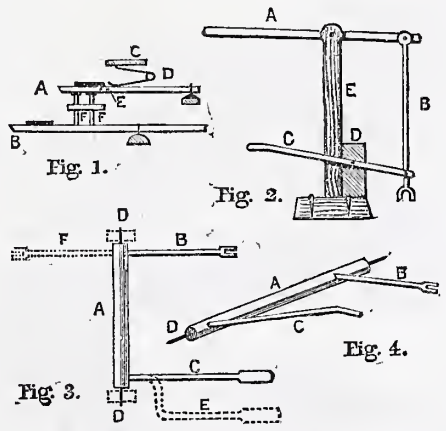
**Employment.**—J. A. N. (*Portsmouth*).—If you want to improve yourself, and get employment in a cabinet shop, why not try those in your own neighbourhood? WORK is very glad to help anyone on; but, really, it can hardly become a labour agency; and I daresay you know the saw: "Heaven helps those who help themselves." Go about among the cabinet-makers in your own and neighbouring towns, and keep your eyes open for a vacancy. If you were in a remote country village, it might be meet to write you differently; but situated where you are, you have more chance of finding a place to suit yourself than you would have by travelling to any town we might tell you of. How would you like, for instance, to be told that you might get into a shop in Liverpool or Edinburgh, and when you got there find that the foreman could not estimate your abilities at what you might consider a fair value. Whether you could bind yourself for a year's service would depend very much on your employer. If you are a smart,

handy man, where would be the use of doing so? and if you are a duffer, your employer might object. Without knowing your work, it is impossible to say what would be suitable wages. You might be cheap at 30s. a week or dear at 10s.—D. D.

**Bleaching Wood.**—J. T. H. (*Liverpool*).—I am not aware of any steaming proeess by which such woods as maple and sycamore can be bleached and made white; but you may lighten almost any wood by washing it with a solution of oxalie acid in water. From your memorandum heading, though, I imagine it is not worth while in your business to take much trouble in making the wood white. Possibly chloride of lime might do all you require. If you will write again, and let us know more particulars, we may be able to advise you more definitely what to do. Meanwhile, remember that oxalic acid is a deadly poison; so be careful with it.—D. D.

**Wheel.**—DOUBLE GLOSTER.—When making a new wheel to go with, and mateh, an old one, you will have to cut out a felloe pattern. Cutting from, or using, an old felloe will not do. First measure the height of the pattern wheel, not including the tire, then plaee a piece of pine ¼ in. thick upon the floor and describe a eircle ½ in. higher than the pattern wheel with trammel or eompasses; next measure the thiekness of the felloes, and if much worn by repeated re-tireing, make the new felloes ¼ in. thicker at least. We therefore reset our trammel 2, 2½ or 3 in. as required, and draw another circle within the outer one. If the wheel has 10, 12, or 14 spokes in it, we divide this eircle into 5, 6, or 7 equal parts, eaeh part or arc representing a felloe. Be sure that a felloe is deseribed and marked out upon the board. We now saw this pattern out and mark upon it the height of the wheel it represents. We then lay it aside, and get the iron hub or nave and plaee it in the pit frame, illustrated and described in No. 15, Vol. I., of WORK; with the nave being east or malleable iron it will be ready mortised. We shall, however, require a face-stick or spoke-boy; this is a staff, and is serewed to the front of the nave so that it works stiffly about. At the top end, or nearly so, a pieee of whalebone, or cane, is inserted through a hole and plugged tightly to keep it from shifting when dishing the spoke. First get a pieee of wood and drive it into the bush at the front of the nave, then serew the faee-stick or spoke-boy at the lower end to the eentre of this plug. To set the whalebone, or cane, right for dish, we plaee a straight-edge aeross the faee of the hub or nave, then measure the distance between the front of the spoke near the felloe and the straight-edge. Whatever this measurement may be, we let the whalebone, or eane, protrude from the face-stiek, bore a hole with a shell-bit the same distanee up the stick as the top end of the spoke near the felloes is from the nave in the old wheel, then set the whalebone right and plug tightly, to keep from shifting when onee set. When the spokes are dressed off the same as the old ones—exeepting the tangs, or tenons, whieh we do not toueh at present—we eommenee to drive them in; get a spoke and pare it down until it fits the mortise easily, as it will tighten the further it is driven. Hold the spoke-boy at the front, and see that the face of the spoke only just touches the end of the whalebone, or eane, then drive the spoke home; these spokes must be driven in alternately, and not one after the other, or the nave will split. When driving a spoke in always have it perpendicular—the faee-stiek can be worked round to eaeh spoke without unserewing it. When all the spokes are driven in we lay the wheel down, letting the nave rest upon a block faee upwards; then measure from the top of the nave to the top of the felloe on the pattern wheel; then get a staff one end wedge-shaped, so that it will touch the nave between the spokes. At this measurement, from the nave to the top of the wheel, we mark upon the staff, and insert a sharp bradawl and seratch the spokes all round, afterwards sawing the superfluous away. Next measure the thickness of tbe felloe; if 2 in., insert the bradawl 2 in. lower down, and mark each side and back of the spokes; we are now marking them off for tenons. If the wheel is a light one you are making, the tenons will be round; if a heavy eart wheel, tbey will be square. If round, we saw with the tenon-saw round the spoke—more at the baek and front than the sides; whatever the strength of the tenon is to be, we get an auger and bore a mortise hole through a pieee of oak 1 in. thiek (this same auger must bore the felloes). When all the spokes are sawn round, plaee the wheel in the pit frame, then place the pieee of oak on the top of the tenon and mark with pencil; pare the tenon down until the mortise pattern fits it; serve all the other tenons the same. We lay the wheel upon the block again, faee upwards, and get our felloes ready; if you buy them ready sawn you will say what size of a wheel you intend making; and when you get them, plane one side up straight and true, then place the felloe pattern upon it and mark with the peneil; then saw and chop off the superfluous, using the square often. When all are marked in this way we place them upon the wheel, letting the felloes rest upon the tenons; the joints of two felloes always eome in the centre between two spokes; if the felloes do not fit, we take a little joint out until the rim is eomplete. Next run the pencil at eaeh side of tbe tenon, thus marking the felloe; then number the spokes and felloes to correspond when putting together; also draw a straight line across the joint; get a felloe and mark with the square from this line, then set your gauge for the centre and also mark and bore for the mortises. Then, after the mortises have been bored, we have an ineh or so at the end of the joint for a dowel hole; these dowels will be 2 or 3 in. long, oak pegs or round iron ones. Now dress the felloes off the same as the old pattern, then insert a dowel at each end of a felloe and knock them on. Next insert the chisel in the tenons—not horizontal, but perpendicular—and wedge the tenons up with good oak wedges. We now give the wheel a coat of paint, and when dry send it to be hooped; when the tire has been put on we dress the rim of the wbeel all round, baek and front, near the hoop, and also the joints; then paint it, and your wbeel is made. In Vol. II., in "Shop" (p. 225), will be found sketches illustrating making and putting a wheel together.—W. P.

**Organ Matters.**—T. W. (*Gamesley*).—You ask how you can lighten the touch on the upper row of keys whieh you bave fitted to your organ. As shown in the sketeh which aeeompanies your query, it would appear that the keys have no independent connection with a second manual, but merely press down the keys of a lower manual by means of a plunger plaeed under the fore part of the keys. If this is so, I tbink the touch could easily be ligbtened by weighting the fore part of the upper row of keys with lead weighting, so that they almost press down the lower row, only requiring a slight touch to cause them to act. The weighting could be inserted in the keys in the same way as it is done for the purpose of balancing them. Or you could secure tbe same end by placing a spring over the fore part of each key, one end of the spring being on the key, and the other end fixed in a spring rail about 2 in. above. The sketches will explain how this is done. Either of these plans could be tested by trying the weighting or spring on a single key. You also ask how you can adapt a foot-blower to the organ, so that you ean be independent of a hand-blower, who is not always available when you require his serviees. Have you tried a pedal, working on a eentre pin on the same standard as the arm of the hand-blower, the further end being loosely pinned on to the lug of that blower, as shown in Fig. 2? If neeessary, a bloek could be screwed on to the standard, so that the pedal blower could be centred nearer to the lug, and thus obtain greater leverage and lighten the foot pressure required. The pedal could be bent round so as to bring it within easy reaeh of tbe foot. If this plan is not praetieable, then it will be necessary to adopt the roller system, whieh is shown in Figs. 3 and 4. A stout roller, eentred on a strong pin at eaeh end, is plaecd eross-wise under or near the end of the bellows, and elose to the floor. At the front end of the roller is an arm, carrying a pedal plate; and if this arm is not to be entirely in front of the easing, it must be bent, as shown in the dotted lines of Fig. 3. This arm is made to slope upwards, and another arm is fixed to the further end of tbe roller, sloping very slightly downwards, and having a lug, or a little wheel, at its free end, so that it will either be pinned to a eonneetion with the under-side of the feeder, or will press against the same part of the feeder. The roller and arms can be made of wood or iron; the latter would, of course, be strongest, and take up least space. The arms can be both on tbe same side of the roller, or on opposite sides, according to the position in which it has to be fixed under the instrument; and tbis will, of course, depend on the amount of room available, so that it may not interfere with any of the action. It can be made to work with either right or left foot, as required, aeeording to the positions of the arms on the roller; and, of course, the longer the pedal arm the more leverage.—M. W.




**Organ Matters. Fig. 1.—A, Upper Keys; B, Lower Keys; C, Spring Nail; D, Spring to press down Keys; E, Lead Weighting; F, Plungers. Fig. 2.—A, Hand-Blowing Handle; B, Lug; C, Suggested Foot-Blower; D, Block for centring Foot-Blower; E, Standard. Figs. 3 and 4.—A, Roller; B, Back Arm with Lug; C, Front Arm with Pedal Plate; D, Centre Pins and Blocks; E, Suggested Bent Arm for Pedal; F, Suggested Arm on reverse side of Roller.**

**Musical Box Combs.**—J. B. (*Kennington*).—You did a most foolish thing by unscrewing the flyers or fan part of musical box. Had you read the chapter on musical boxes, you would have seen that the driving part containing mainspring must be at rest—no pressure on the barrel with pins in it. I stated it clearly, so that no one could make a mistake. The same aceident has resulted in the destruetion of hundreds of good boxes. I see it is some time ago that this oeeurred, so it is evident you have not seen the pages of WORK. So many of the teeth are gone, that repairing is out of the question; and if you will look at the barrel with a magnifying-glass, you will see one tune destroyed—that is, the pins that acted on the teeth of comb will be bent, and lots broken. That you ean remedy (see chapter on Musical Boxes), but you will require a new comb; and if box has tbe maker's name upon the card—which it will have—also the *number* of box, you ean get a new comb to exaetly fit and with the least trouble; it will be Geneva, Switzerland, as no one in England sells them. The cost will be about 25s. to 30s.; earriage extra.—J. S.

**Cloth Paint.**—D. M. (*Glasgow*).—If you had stated the nature of your fabric, and your ehief reason for desiring to paint it, I might more definitely have replied. I do not, however, think you can better a mixture of "boiled oil"—viz., boiled *linseed* oil and patent paste driers, such as is used for sailors' oilskins, etc. A little pigment might be added to colour the mixture, if desired, or even a little white lead; but the paint should only well saturate the eloth and not lie on the surface, or else you will get a film that will crack. About 1 lb. driers to 1 quart boiled oil.—F. P.

**Pine Polishing.**—C. A. (*Birmingham*).—To stain and polish your pine ehest of drawers in imitation mahogany, you cannot do better than proceed as follows: (1) Stain tbe job with tbe brown or walnut stain of vandyke brown, amuonia, and water. Mind that this stain is only to be a weak one, not by any means so dark as if the wood were required to be finished walnut colour. (2) Fill in with a mixture of turpentine and whiting, eoloured with a little Venetian red. Rub this well in, and clean off all the surplus before (3) bodying in with ordinary Freneh polish, reddened with Bismarck brown. Be eareful not to use too much of the Bismarck brown, as it is a very powerful colour. About a pinch of it to a pint of polish will be suffieient. (4) Finish off with a mixture of equal quantities of Freneh polish and glaze, applied with a tolerably wet rubber. This method of finishing will probably suit you better than spiriting off, as it is both easier and quicker. You may as well buy the Freneh polish and glaze ready-made. In justice to tbe French polisher, whom you faney wanted to over-charge you, I may state that the figure you name is by no means excessive. Of course, if it is more than you wished to pay, you need not have the work done by him; but you must remember that polishers have to live by their trade, and you could not expect him to do your ehest of drawers without a reasonable remuneration. When you have done the job, just reckon how mueh materials have eost you, and the number of hours you have spent on it, and then, by assessing your time at a very moderate value, you will see there is not much ehange out of 7s. 6d. To this add the reflection that if the work had been done for you it would, probably, have been far superior to what yours—as you are a novice—ean possibly be. This leads me to say that as you have never done any polishing, if you make your first attempt on your chest of drawers, you need not be surprised if you spoil the job. Try first on a pieee of waste wood, just to get your hand in, and to get some idea of the tints.—D. D.

**French Polishing.**—J. E. (*Blackhill*).—If you have done "fairly well" with your eseritoire, without having had any previous experience in polishing, or more knowledge than you have been able to pick up from hints in "Shop," I am inclined to say that you have done not fairly only, but very well. Without praetice, you could not expect to get the polish "up to the mark" like an experienced polisher would; so I tbink you have every eause to be satisfied. Of course you will do better as you proeeed, and from your letter you seem to have somewhat misunderstood the various operations. You will do better by using methylated spirits only in finishing. Of course, the bodying in, or what you call the last coating, must be dry before you spirit off. You will have observed that the body polish dries very quiekly, and even if you tried, I do not think you could spirit off while it is wet. The spiriting is merely done to remove the streakiness left by the polish rubber; so that, you see, there is no necessity for doing it till tbe last thing. If you body up well, several coats of polish are not necessary, though there may be no actual barm in them. A good deal depends on tbe nature of the work in hand.—D. D.

**Polishing.**—W. R. (*Newcastle*).—The fine little eracks on the polish of your piano are caused by what is teehnically known as sweating, *i.e.*, either the grease whieh may have been in the eomposition of the filling, or oil, used in the polishing process, has sweated through the thin coating of shellac. The cracks, or sweating, beeome visible from the dust which settles on the oil. Therefore, the disfigurement caused can almost entirely be averted by earefully wiping new furniture now and again with a soft damp cloth. When the oil has done exuding, which may not be for some months, the work may be re-polished with advantage. Sweating is not entirely preventible. Possibly you might be able to remove the dirt with warm water and a little

soap; but it will be better for you to nse a reviver, composed of vinegar, raw linseed oil, and methylated spirit, in about the following proportions, which, however, need not be closely adhered to: ½ pint of vinegar, 1 noggin of spirit, and a tablespoonful of oil. Use this on a piece of soft rag, and a small amount of rubbing will remove all the sweating. To toucb up the parts where the black has been worn off, use some black polish, made by mixing gas black with ordinary French polish. Go over the bare parts with this by means of a rubber till they are snfficiently ebonised, finishing off in the usual way. Yon must remember that you will probably have to go over the whole job with polish to prevent the newer portions looking different from the old. If the work is properly done, the case of the piano ought to look as good as new. Of course, if you like to do so, you may re-stain; but as this involves removing the whole of the present or existing polish, you will probably prefer the simpler method which has been indicated. If your piano is a valuable one, yon had better employ a skilled French polisher to do what is necessary.—D. D.

**Brass Water Aspirator.**—WATER ASPIRATOR asks O. B. to give a few measurements of the brass water aspirator described in WORK, Oct. 24th. In reply to this, I think it will be sufficient to say that Messrs. M. and S.'s instrument, in glass, is about 8 in. long. The illustration given, though not drawn to scale, supplies, with this one measurement, sufficient data, I think, to construct such an apparatus.—O. B.

**Capacity of a Tank.**—W. C. (*Deptford*).—To find the capacity of a square or oblong tank, multiply the length in feet by the breadth in feet by the depth in feet. This gives the capacity in cubic feet, and if multiplied by 6·2321, the capacity in gallons. Example:—A tank 10 ft. long by 4 ft. wide by 6 ft. deep will hold (10 × 4 × 6 =) 240 cubic feet of water, or (240 × 6·2321 =) 1495·704 gallons. To find the capacity of a round tank, multiply the depth in feet by the square of the radius in feet by 3·1416. This gives the capacity in cubic feet, and, if multiplied by 6·2321, the capacity in gallons. Example:—A tank is 5 ft. high, and has a diameter of 8 ft.; the radius, which is half the diameter, will therefore be 4 ft., and this, squared, is (4 × 4 =) 16 ft.; therefore, capacity equals (5 × 16 × 3·1416 =) 251·328 cubic feet, or (251·328 × 6·2321 =) 1566·3 gallons. One cubic foot of water equals 6·2321 gallons.—F. B. C.

**Size of Cylinder of a 1-Horse Engine.**—J. H. (*Lower Broughton*).—No one can tell without knowing also the rate of revolution and the average pressure during the stroke. Also, it is not the length of the cylinder inside, but the stroke of the piston which you require to know. You will find all this fully explained in No. 106 of WORK. If, however, you mean, not an actual horse power, but a nominal horse power (a conventional term by which engines are sold, and has very little to do with the power they can exert), then you can obtain the information from the price-lists of engine-makers, striking an average; for they will not exactly agree. Looking at the price list of Hindley, of Bourton, Dorset, I find he allows for a 1-horse engine a cylinder of 3 in. diameter and 4½ in. stroke. To show you how little that has to do with the actual horse power, I may say that, supposing this engine would exert 1-horse power when supplied with steam at 50 lbs. pressure, then it would exert 2-horse power if worked with 100 lbs. steam. If, again, it gave 1-horse power with 50 lbs. steam at 100 revolutions per minute, then it would give 2 horse power at 200 revolutions. You see that, by doubling the pressure and the speed, you could quadruple the power: the same 1-horse engine might give 4-horse power; so that the size of the cylinder alone is misleading.—F. A. M.

**Camera.**—BELLOWS ON THREE LEGS.—Instructions for making this and the tripod stand appeared in the following numbers of WORK: 13, 23, 29, 70.

**Mail Cart.**—A NEW READER.—You will find that instructions for making this appeared in No. 30 of WORK.

**Safety Bicycles.**—WEEDLESS.—Consult the following numbers of WORK: 107, 111, 115, 119, 124, 127, 132, 137.

**Training.**—A. H. (*Hyde*).—WORK is not the channel for the questions you ask. Consult the Editor of *Cassell's Saturday Journal*.

**Cart-Wheel Making.**—WOOD-WORKER.—These papers are in preparation.

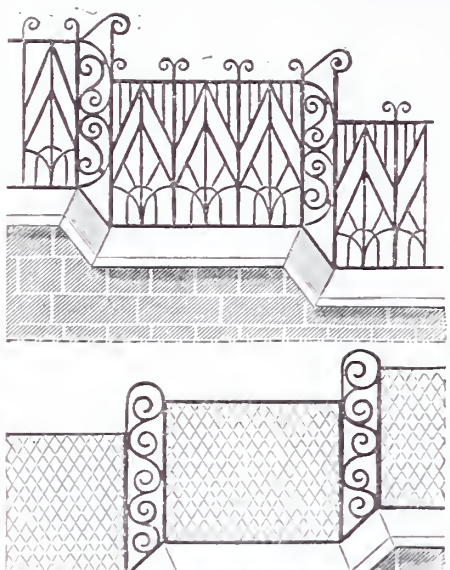
**Lathes.**—E. J. T. B. (*Barnet*).—Refer to the following numbers of WORK: 2, 3, 4, 6, 8, 10, 14, 17, 40, 45.

**Model Locomotive.**—A. E. (*Cardiff*).—You and all correspondents should repeat your questions when writing about replies which have not appeared.

**Overmantel.**—R. H. H. (*Shutter Oak*).—The demands on space in WORK are far too great to admit of the appearance of another overmantel of any kind at present. See back numbers.

**Weather Glass.**—PETERBORO'.—I may say that the glass (½ in.) mentioned in the article (see No. 135, page 483) should be procurable at any operative chemist's in almost any town. But if you cannot get it thus, you can certainly get any quantity from Messrs. Reynolds & Branson, Commercial Street, Leeds, or from any other dealer in scientific apparatus. But I do not think that any of these dealers will supply less than 1 lb., for which quantity the price is 1s., plus 3d. postage. I take this opportunity of suggesting a further improvement in the construction of the glass. I find that the greatest difficulty is in making the joint tight between the tube and the bottle. I have just constructed another glass, and have used one of the new screw-stoppered ale bottles. These have a capacity of half a pint (nominal), and for 4d. I get a caoutchouc bung, ¾ in. at the smaller end, with one hole through. Now, by wetting this, it may be firmly and tightly screwed into the neck of the bottle; and, by wetting the tube before insertion, a perfectly air-tight and flexible joint may be made. This I find to be a very decided improvement over the method I described in the article.—J. G. L.

**Wall Wire-Work.**—BETA.—I will not now give you full satisfaction, for the very good reason that to here publish sufficient explanatory notes (as you ask for) concerning the wire fencing with which you wish to adorn your wall would fill more space in "Shop" than I could conscientiously cover. Perhaps you know that my special branch in connection with WORK consists of furniture designing. But a series of articles upon Wire-Working have appeared, through the instrumentality of a practical friend, at the Editor's request. I must, therefore, ask you to be good enough to refer to them, if you think of doing anything in this line yourself. It will be some time, however, before they are complete; for, although some correspondents are under the impression that subjects they desire ought to be furnished at the instant they are asked



Wire Fencing Designs.

for, some period must necessarily elapse while all the articles are being written and drawn, then printed, then engraved, and a place found for them. To not thoroughly disappoint you, I have given two designs suitable for fencing for your wall, which, you say, has two ramps. I shall henceforth describe the putting together of the diamond wires as shown. I should advise you to have the fencing in three separate parts, with thick scroll wires soldered together, or iron scrolls between them. I should certainly not let the top line of fencing follow the line of the wall, as then you would fail to obtain any character in it. While you are waiting, remember that "patience is a virtue."—J. S.

**Provisional Protection (Patents).**—F. G. W. (*Hackney*) is, perhaps, confounding *Registration* with Provisional Protection. The stamped form for the latter costs £1. Of course, no patent agent can work for the mere price of the stamp; his fee must be paid in addition. If F. G. W. wants his work done gratis, he must do it himself; and how to do it he may learn from the article, Vol. I., p. 515.—C. C. C.

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—G. L. (*Westminster*); MARINE GLASS; W. M. (*Dundee*); R. G. (*Settle*); S. W. C. (*Leicester*); H. W. (*Norwich*); C. G. M. (*Penistone*); A. S. (*Farringdon Road*); G. T. (*Hollinwood*); R. R. F. (*Frome*); GARTAR; A. J. (*Edinburgh*); G. G. (*Llandudno*); E. MCN. (*Gateshead*); RALPHO; REX; G. F. R. (*Bournemouth*); A GUNMAN; W. L. F. (*Dublin*); L. W. (*Islington*); G. J. W. (*Ballymena*); C. J. (*Leeds*); M. (*Bishop Auckland*); R. B. (*Egremont*); MECHANIC; CHOPSTICK; J. P. (*Liverpool*); W. S. W. (*Leeds*); "WORK" READER; J. B. T. (*Manchester*); EDIPRA; W. MCK. (*Elgin*); A. W. (*Parsonstown*); YOUNG ENGINEER; J. T. S. (*Sheffield*); T. G. & SON (*Sheffield*); SPARK; A. D. (*Monkwearmouth*) LEEDS ENGINEERS' ASSOCIATION; E. H. S. (*Corfe*); W. H. (*Portobello*); A. M. B. (*Dublin*); J. S. (*Amsterdam*); J. A. (*Halifax*); F. H. (*Battersea*); J. R. (*Glasgow*.

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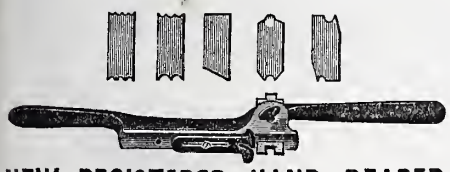

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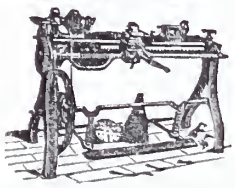

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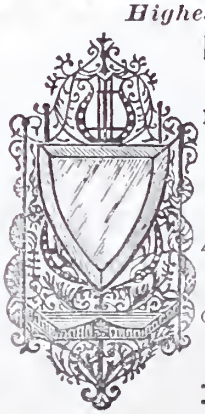

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# WORK

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VOL. III.—No. 147.] SATURDAY, JANUARY 9, 1892. [PRICE ONE PENNY.

### A SMALL POULTRY FARM.

BY G. P.

INTRODUCTION—DIMENSIONS OF VARIOUS BUILDINGS—MATERIALS FOR VARIOUS PARTS: WILLESDEN PAPER, MATCH-BOARDING—CONSTRUCTION OF FRAMEWORK: SETTING OF CORNER POSTS, FIXING CROSS-RAILS, SETTING AND FIXING RAFTERS OF POULTRY HOUSE, SETTING AND FIXING RAFTERS OF COOPS.

*Introduction.*—Much is written and talked in the present day on the subject of poultry farming. One enthusiastic party declares that this much-neglected branch of farming is the thing which is wanted to do away with hard times. We see columns of figures to prove how much money goes out of Great Britain for eggs and poultry; and the writers of these columns generally have another set of figures to prove how easily the British farmer might divert the stream, and land all these hundreds of pounds in his own pocket. On the other side, we hear of the utter failure of attempted poultry farms; the difficulty of keeping a large number of fowls in health on the same ground; the obstinate way in which hens refuse to lay at the time eggs are fetching a good price; the prodigal way in which they present us with eggs when they are scarcely worth selling; and so on, and so on. My own opinion, after a good many years' experience as a poultry keeper, is that there is a good

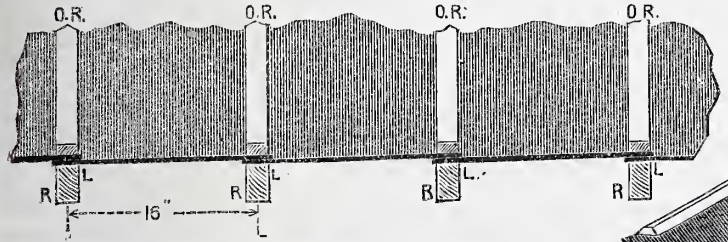



Fig. 5.—Section of Fig. 4 along line A B—R, Rafters; W R, Willesden Roofing; L, Three-inch Overlap at Joints; O R, Outside Rafter.

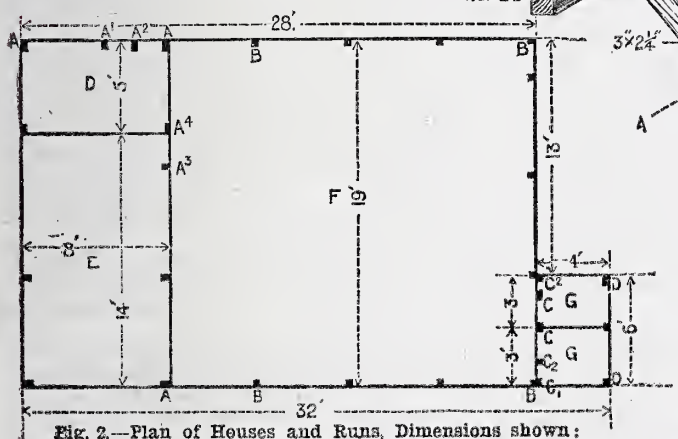



Fig. 2.—Plan of Houses and Runs, Dimensions shown: D, Large House; E, Run; F, Grass Plot; G, Coops.

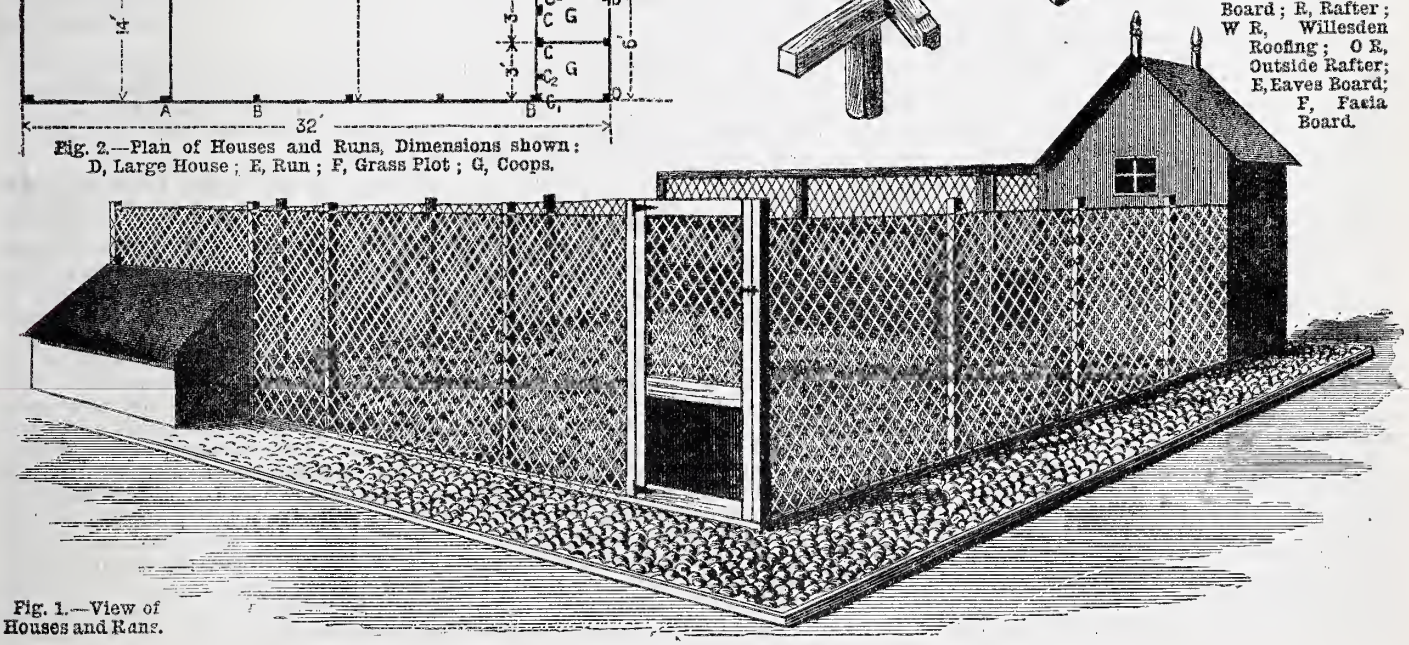


Fig. 1.—View of Houses and Runs.

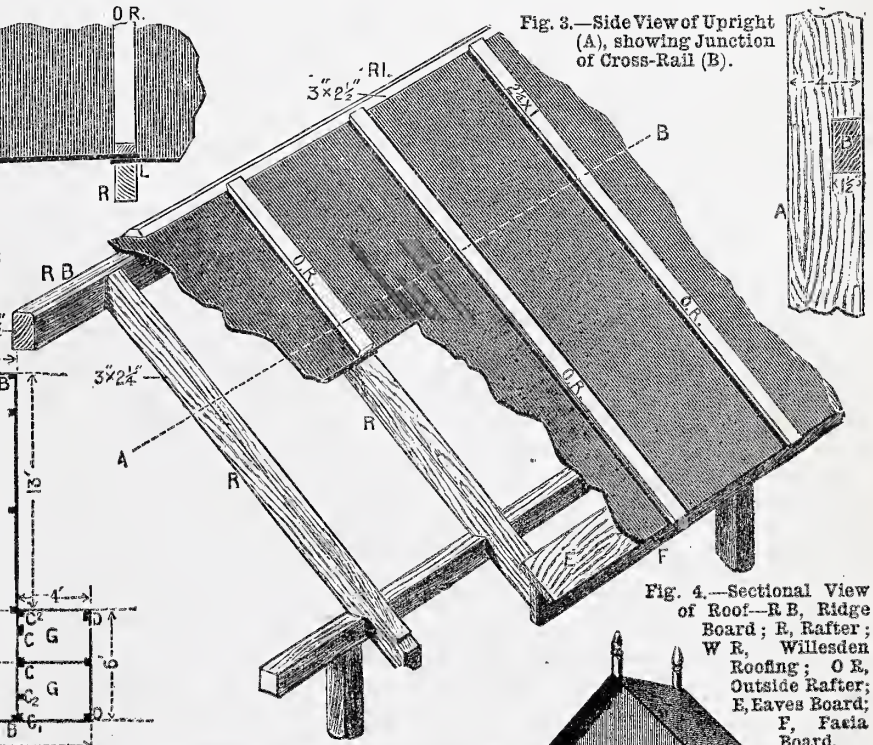



Fig. 4.—Sectional View of Roof—R B, Ridge Board; R, Rafter; W R, Willesden Roofing; O R, Outside Rafter; E, Eaves Board; F, Facia Board.




Fig. 3.—Side View of Upright (A), showing Junction of Cross-Rail (B).

deal to be said on both sides of the question. I confidently believe that hens properly housed, well attended to, getting good grain and soft food, green meat—such as grass or vegetables—and not overfed, pay well, the annual profit being fully 4s. per hen. But it is recognised by all experienced in poultry keeping that the first essential to success is thoroughly good housing; and it is with the object of showing my readers how to construct a thoroughly good, water-proof, draught-proof, and warm abode for their fowls that I write this paper. The illustration (Fig. 1) is a view of a small poultry yard. The original has been in use for a number of years, and has been found to be very satisfactory. It is compact, very convenient, and suitable for an amateur poultry keeper, providing him with room for one variety, and also with accommodation for hatching eggs and rearing chickens.

*Dimensions of Various Buildings.*—The poultry farm consists of one large house, 8 ft. 4 in. long by 5 ft. broad, by 6 ft. high at the eaves and 8 ft. 9 in. high at the ridge; with a run 14 ft. long by 18 ft. 4 in. wide by 6 ft. high, attached. In front of this house and run is a grass plot 20 ft. long by 19 ft. broad; and at the side of this grass plot, remote from the house and run, are two or three chicken-coops, in which eggs are hatched and chickens reared.

*Materials for Various Parts.* — Before commencing to build, we will, of course, have to provide ourselves with materials, a complete list of which will be given at the end. In that list it will be noticed that a material called Willesden Paper is mentioned, and as some—perhaps most—of my readers may not be familiar with the name, I had better describe what the material is, and what it is used for.

*Willesden Paper.*—For a long time it has been known that paper, canvas, etc., when placed in a solution of cuprammonium hydroxide, become gelatinised and diffused through the liquid. This could not be made of any practical use until the Willesden Paper and Canvas Co. conceived the idea of passing the substances through at such a rate that the exterior of the fibres only was gelatinised; then, by subsequent drying, an elastic varnish was formed, which readily took up copper in the form of cuprocellulose, thus preventing the material from being affected by water or damp. The above-named Company have been now working the process, with such modifications as have been suggested by experience, with great success for a considerable time, and their goods are becoming more popular year by year; but as yet, the substance has not been very much used by amateurs—principally, I suppose, from their ignorance of there being such a material in the market. This is a great pity, and one which should be remedied. The two kinds of paper required for this building are the four-ply and the one-ply. The former is extensively used as a building material, and is required by us for the roofs of our buildings. For this it is especially suitable, for, besides being cheap and easily fixed, it is entirely weather-proof, being affected by neither damp, nor frost, nor excessive heat. It is much warmer than galvanised iron, and, area for area, is only one-ninth the weight. The one-ply papers are for underlining slates, partitions, damp walls, stencil-paper, etc. We are to make use of them for lining our houses, for, being rot-proof, water-proof, insect-proof, inodorous, and warm, they are just what is required for lining a poultry house. These papers may be had in rolls of any length, the four-ply 19 in., 27 in., and 54 in. wide, at 9d., 1s. 2d., and 2s. 3d. per yard run respectively; and the one-ply brown, No. 1.80, 56 in. wide, at 6d. per yard run, from the Willesden Paper and Canvas Works, Willesden Junction, London, N.W. It will thus be seen that the name "Willesden," as applied to the paper, is derived from the name of the town at which it is manufactured, and not from the process it has been subjected to.

*Match-boarding.*—I have mentioned this in the list to be used for covering the framework of the houses, not because it is preferable to Willesden, but because it may be put up at *slightly* less expense, and because it will suit the secondary purpose for which it is here required.

*Construction of Framework.*—Having now provided ourselves with the materials named in the list, we may set about the construction of our poultry house.

*Setting Corner Posts.*—We first take the eleven 4 in. by 2 in. posts, char the lower ends, and coat them well with coal-tar; then place them firmly 2 ft. in the ground, in the positions marked A, Fig. 2. As it is better to do all work of the same kind at one time, we had better now put in the corner posts for the chicken-coops, and also those for the fence round the grass plot. The poles for the plot are 1½ in. square, and are driven 2 ft. into the ground, in the positions indicated at B, Fig. 2. The height of the fence depends on the breed chosen. Cochins or Brahmas are easily retained within bounds by netting a yard high; for moderate-sized fowls, 5 ft. high will do; whilst to confine game, Hamburghs, or bantams, a fence of 8 ft. or 9 ft. in height will be found necessary. I have made provision for a fence 5 ft. high, this being the usual. The corner posts for the coops will have to be 2 in. by 2½ in., those marked D (Fig. 2) being 4 ft. long and placed 1½ ft. into the ground, while those marked C are 6 ft. long, and are placed 2 ft. into the ground. The lower ends of all these posts should be previously charred and coated with tar.

*Fixing Cross-rails.* — Horizontal rails, 3 in. by 1½ in., are now to be fixed between the uprights of the large house about 18 in. from the ground, and also across the top of the corner posts; while similar cross-pieces are fixed across the tops of, and half-way up, the posts round the *run*. When putting up these lower horizontal rails, spaces must be left for the doors into the house and into the run (see A, $A_2$, and $A_3$, $A_4$, Fig. 2). With regard to the coops, cross-pieces must be fixed along the tops of the corner posts of these, and similar cross-pieces 1 ft. from the ground. These rails are 2 in. by 2½ in.—*i.e.*, the same width and thickness as the uprights. "Oh! it is all very well telling us that it must be done; but how is it to be done?" I fancy I hear some amateur say. Well, it is really so simple I had almost passed it over. But let me answer: "Principally with nails." The rails are made to fit exactly between the uprights, and are nailed there with two or three 2½ in. nails, put in on the slope. Those pieces round the large house and run had, however, better be let into the uprights (see Fig. 3).

*Setting and Fixing of Rafters of Poultry House.*—Good and cheap rafters for the roof of the house may be obtained by sawing two flat cuts in 7 in. by 3 in. battens, which will give three pieces, each 3 in. by 2½ in. Those for the ends of the house are 4 ft. 1½ in. long: they are halved into each other at their top ends, and the bottom ends are let into the top horizontal rail (see Fig. 4). The ridge board (Fig. 4) is now nailed on, and the remaining rafters, each 4 ft. long, are fixed as in Fig. 4. The correct spacing of rafters must be as shown in detail at section A B, Fig. 5—viz., 16 in. from centre to centre of rafter.

*Setting and Fixing Rafters of Coops.*—Similar construction is required for the roof of the coops, the only difference being that it is a *lean-to* roof—viz., one consisting of a single sloping piece—instead of a *span* roof, which consists of two sloping pieces forming an angle with each other, and which is really two lean-to roofs joined together. The rafters for this roof are 4 ft. 8 in. long.

Space forbids, and I must needs leave over the rest of my remarks for a future number of Work, at no very distant date.

## HOW TO SECURE COPYRIGHT IN DESIGNS.

BY CHARLES KELSEY.

MAKING THE APPLICATION — WHERE TO OBTAIN APPLICATION FORMS: THEIR PRICE—FILLING UP THE APPLICATION FORM — STATEMENT OF NATURE OF DESIGN—THE REPRESENTATIONS — PROVISIONAL REGISTRATION — ISSUE OF CERTIFICATE—LENGTH OF COPYRIGHT—CONFLICTING DESIGNS—CONSENTS—INSPECTION OF CONFLICTING DESIGNS—ACTIONS FOR INFRINGEMENT.

HAVING in my previous paper dealt with the definition of a design and proprietor, and explained the conditions which must exist precedent to registration, and also explained the manner in which designs are subdivided for the purposes of registration, I will proceed to treat of the other matters relative to the subject.

*Making the Application.*—This consists in lodging at the Office an application form properly filled up, together with three representations of the design. I will deal in the first place with the application form.

*Where to obtain Application Forms and their Price.*—These are sold not at the Patent Office, but at the Inland Revenue Office, Royal Courts of Justice, London (Room No. 6). Also, speaking generally, at all the more important post-offices in the kingdom; and if not kept in stock, may be ordered at any money-order office in the United Kingdom.

There are two principal forms: Forms E, for the classes from 1 to 12, cost 10s. each; Forms E, for the classes 13 and 14, cost 1s. each, stamped.

These fees, trifling in themselves, are all the expense that the application involves—that is, if the designer or inventor makes his application himself, without employing a patent agent.

When he intends to apply the same design, with, perhaps, various small modifications, to a set of articles such as are ordinarily on sale together—such as, for example, a dinner or dessert set, a tea or coffee service, a set of fire brasses, a suite of furniture or a suit of clothes—Form O, costing £1, should be used.

*Filling up the Application Form.*—First insert, in its proper place, the number of the class in which it is desired to register. This will be obtained from the list previously given. Or, in case of doubt, ask the Comptroller to decide for you, telling him of what materials the design is composed, and how it will be executed. Then insert the full name and address, and the trade, profession, or calling of the applicant. Then where the certificate is to be forwarded to; if the inventor is applying himself, he merely says to himself at the above address; but if a patent agent is

acting, he naturally inserts his own address, so as to have the certificate through his hands. And then, at the foot of the form, is a space for the insertion of the applicant's or his agent's signature, and for the date of the application.

If an agent is employed, the applicant signs a Form of Authorisation for the agent to act in his stead, which is filed with the application form.

So far, all is very simple, and the only point where any difficulty will be experienced is in filling up the remaining space. This is for the

*Statement of Nature of Design.*—By the Act and rules, the filling up of this part is made imperative, the object being to make the applicant define clearly what the registration is for. The applicant must therefore state whether it is the shape or configuration, the pattern or the ornament, or any two or more of these which he desires to protect.

He selects the most fitting term or terms, and after the foregoing remarks little difficulty will be experienced in this. If all is new—shape or configuration, pattern and ornament—and he desires to claim for all, he can do so. If only the pattern or ornament is new, he claims for this alone, and the same in reference to the shape.

If only a portion of the article is novel, he should claim only for that portion, distinguishing it by letters or figures corresponding to similar letters or figures upon the representations. A good plan is to tint the part claimed as new in some distinctive colour.

It is better also to indicate what the article is, in the claim—such as "Design for a Bicycle Frame. Applicable for the shape or configuration;" unless the drawing is self-intelligible, or words appear upon the drawing to that effect.

In cases where a new shape is designed which will be decorated in a variety of ways, it is best to claim for the shape alone, leaving the after-applied decorations to be specially applied for if considered sufficiently important. In cases where the design sought to be registered is a pattern or ornament which can be applied without modification to various articles—as in the transfer prints used for the decoration of china, or the engraved ornament applied to silver or electro-plated goods—the registration may be claimed in a general way for application to all the goods included in the particular class. But when the application is for the registration of a shape, this is hardly possible, as the application to varied articles to be used for distinct purposes necessitates variations in the shape, and such variations require to be separately registered, unless it is such a case as can be included under the Set form previously alluded to.

But the courts have held that mere variations in size, where the relative proportions of the various parts are not altered, will all be protected by the one application. This completes the filling up of the application form, and it will be seen that it is a very simple matter, which may be accomplished by almost any person without assistance, and thus the services of a patent agent may be dispensed with, and the payment of his fee avoided.

*The Representations.*—Accompanying each application form must be sent three exactly similar representations of the design. Considerable latitude is allowed on this point, which favours the applicant greatly. He can send drawings or tracings of his designs, impressions pulled from copper-plates, prints from wood blocks, such as are used for advertising the articles, photographs of the designs, rubbings from book-covers or flat metal goods; or in the cases, like textiles, paperhangings, and paper-like articles, actual pieces of the finished articles.

The drawings should be executed upon paper of foolscap size, 13 in. × 8 in., where possible, and two views may be shown, or in cases where more are required to show the design properly, this number can be amplified; they should be executed in ink, or, if in pencil, should be fixed by a wash of gum-water or water-colour, and the tracings must be upon tracing cloth—not upon thin tracing paper—so as to secure a permanent record of the design.

The drawings or tracings need not be artistically executed. The only requisite is that they should show the design properly and clearly; but very rough sketches should not be sent, for if the design is not shown properly, the loss will be the applicant's own.

Photographs should be mounted upon similar foolscap paper—not upon thick cardboard—and the applicant should, for his own safety, obtain permanent prints. If specimens are lodged, they should be of the same size—13 in. × 8 in.—as nearly as possible; but if a larger size is necessary to show the design properly, they will be accepted up to 21 in. × 12 in. If the pattern is not complete in this larger size, photographs of the pattern should be sent.

An applicant may easily decide for himself whether specimens of a particular design will be accepted in lieu of drawings or other representations, by asking himself whether the article is such a one as could be pasted into a book without cutting or bursting through the adjacent pages. Speaking generally, all that conform to these conditions will be accepted.

When sets of articles are required to be registered, the representations should show the variations which will occur on the different articles.

*Provisional Registration.*—In cases where the applicant wishes to secure an early date of registration before his drawings are executed, or other representations prepared, he can forward one sketch of his design with the application form, and this will be accepted by the Office, and the certificate will be dated from the day of the receipt of the application form; but no certificate will be issued until the proper drawings are sent.

The applicant must not deliver any articles on sale before the certificate is issued, or his registration will be invalidated, the Comptroller in such cases having the power to strike the design off the register.

The applicant may, however, after the date of the receipt by the Office of the sketch of the design, solicit orders to ascertain if it is worth while proceeding with his application. The sketch should be such as to show his design properly; and when sending the complete representations, he should not depart in any material particular from the one first lodged.

*Issue of the Certificate.*—About eight or ten days after the receipt of the application, if all is correct, the certificate of registration will be issued, and forwarded by post to the address given by the applicant.

If not in proper order, the applicant will have it returned to him to make the alterations desired by the Office, which will be indicated in the letter accompanying the returned documents; and on his amending as desired, the application will be proceeded with.

*Length of Copyright.*—The copyright granted in any of the classes lasts for a uniform period of five years from the date of receipt of application form at the Office.

*Conflicting Designs.*—When an application is made, the Office compares the design with the designs for similar articles previously registered, the term of copyright in which is still running; and if it is found that the design has been anticipated, or if it is obviously an imitation of any such design, the Comptroller will give the applicant notice of the fact, and inform him that he cannot proceed to issue the certificate. If the applicant desires to explain away the similarity, or urge reasons why a certificate should be granted to him, the Comptroller will fix a day for a personal interview, when the applicant or his agent can attend and go fully into the matter.

The Comptroller having heard all that can be urged in its favour, will decide whether or not he can issue a certificate of registration. If he decides against the applicant, an appeal against the Comptroller's decision to the Board of Trade is open, and, after hearing the applicant and the Comptroller, the Board will either endorse the Comptroller's decision, or decide against him, and direct him to register the design.

There is no fee for a hearing before the Comptroller, but if the applicant determines to appeal to the Board of Trade against the Comptroller's decision, a stamped Form F is required, which costs £1.

Of course, none of these difficulties will crop up if the design is a *bonâ-fide* original one.

This procedure acts as a deterrent to the class of imitators who are always ready to copy as nearly as possible the products of the ingenuity of other persons, if such are finding a sale, and acts very much to the advantage of the honest designer or inventor.

*Consents.*—The Comptroller will sometimes suggest where the design differs from some original one to a certain extent—and is yet at the same time evidently an imitation of it—that the latter applicant should procure the consent of the original proprietor, upon getting which, and lodging it with the Comptroller, he will proceed with the registration. The Comptroller will furnish the latter applicant with the original proprietor's name and address, so that communications may be opened for that purpose. In such cases the original inventor can often obtain a *quid pro quo* in exchange for giving his consent, and thus secure some return for the ingenuity which the latter applicant is desirous of taking advantage of. Of course, the proprietor can refuse to give his consent, and then, the Comptroller does not proceed, unless directed to do so as the result of an appeal to the Board of Trade; and if the latter applicant still puts his design upon the market, without making any arrangement with the proprietor of the original design, he can be proceeded against for infringement, and if the courts decide against him, may be ordered to pay damages and costs.

If, on the other hand, the latter applicant thinks he has made no infringement, it is quite open for him to put his design upon the market; but he will have been warned of the risks he is running in so doing.

Here, again, the practice in the designs branch differs from the patent procedure, for patents can be secured for the same thing by as many different persons as choose to apply for them, so far as the Office is concerned, for it makes no search on the question of anticipation; but the patent specifications are all open to inspection for a certain time

before the grant of a patent, to give time for oppositions to be lodged; whereas, the designs, during the term of copyright, are not open to the inspection of the general public without the consent of the proprietors.

*Inspection of Conflicting Designs.*—An exception to this rule of keeping all designs secret during the period of copyright, is made in the cases where the Comptroller informs an applicant that his design has been anticipated. The applicant or his agent can inspect the conflicting design or designs quoted by the Comptroller on payment of a fee of one shilling. This is generally done before a date for a hearing is asked to be fixed. This inspection of the conflicting design will enable the applicant to see how far, and in what respect, he has been anticipated.

*Actions for Infringement.*—This action of the Comptroller should not be considered as altogether final on the question of infringement. A certificate may be issued to the latter applicant, and still the earlier proprietor may feel aggrieved, and can institute an action if he chooses, when the courts will hear both sides, and come to a decision on the evidence tendered. The action of the Office in such cases is not infallible, and the decision arrived at may not be altogether correct from various causes. For instance, the Comptroller may not be in possession of all the material facts of the case, and in dealing with a large number of designs every day, it will be evident that mistakes or errors of judgment may be sometimes made, though every care be taken to obviate such. The issue of a certificate of registration stands on the same footing as the grant of a patent. It does not confer an unchallengeable right, for in either case the courts may cancel them, if it is shown that they have been wrongly issued. This is a point which is often not properly understood by novices in patent matters, who frequently consider when the Office has granted a patent or certificate of registration that their rights are secure and unchallengeable.

I must defer my remarks on the remaining portions of my subject to my next and concluding paper.

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

### Working Cordage.

SEIZING — SENNIT — FRENCH SENNIT — GASKETS — FLEMISH EYE — GROMMET — SELVAGEE — WORMING, PARCELLING, AND MARLING — SERVING — BELAYING — FAIRLEADER — BELAYING PIN — TOGGLE — FENDER — THIMBLE — MOUSING A HOOK — STROPPING A BLOCK.

To give a complete account of all that can be done with cordage would, in fact, be to write a treatise on rigging, which is altogether outside our present purpose. But there are many ways of using rope for the construction of various articles in constant use aboard ship that every seaman has to acquire, several of which are of great service to landsmen and all those who have anything to do with cordage. Some of the principal of these we shall now consider. Seizing is fastening together two ropes, or different parts of the same rope, with several coils of small rope, spun-yarn, etc., laid on close together. There are several kinds of seizings which take their names from the positions they occupy in the rigging. End seizing is a round seizing at the end of a rope. Throat seizing is the first seizing clapped on where a rope or ropes cross each other. Middle seizing is between a throat and end seizing. Eye seizing is a round seizing next to an eye in the rope. To make a round seizing, make a small eye in the end of the seizing stuff, and, after taking a turn round both parts of the rope, reeve the ends through the eye, take two or three turns, and haul them taut with a marlinespike hitch; pass eight or ten turns close together, and heave taut. Bring the end back under these turns and out between the last two coils, and pass another series of turns on the top of the others, which are called riders, and are not hove so taut as the first turns. There is always one less of the riding turns than of the lower ones. Two cross turns are sometimes taken, passing between the ropes to be joined and across the whole of the seizing; the end is brought under the last turn, hove tight, and secured, if large, with a wall knot, crossed; if small, with an overhand knot, and cut off. Other seizings are done in the same way.

Sennit is a sort of flat rope, made by plaiting ropeyarn or spunyarn together, the outside yarns being brought over to the middle from each side alternately. It must always consist of an odd number of yarns, generally from five to thirteen.

French sennit is braided with an even number of yarns passed over and under every other time.

Gaskets are made of braided cordage in the same manner as sennit. They are used for confining the sails when furled to the yards. They are called arm gaskets when used at the ends of the yards. Bunt gaskets are used in the middle of the yard to hold the bunt of the sail, and quarter gaskets between the middle and extremities of the yards.

A Flemish eye (Fig. 119) is a method of making an eye without splicing. Unlay one strand at the end of a rope; bring the other two strands, just as they are, against the standing part, so as to form an eye of the size required. Lay up the strand which has been unlaid in the intervals in the rope from which it has been taken, only the reverse way—that is, you commence at the end and keep on laying it round until it comes down the standing part and lies along with the other strands. The ends are then tapered, marled down, and served over with small stuff.

An artificial eye is the end of a rope unlaid, and the yarns of which the strands are composed are separated. The yarns are now hitched round a piece of wood the size of the proposed eye. They are then marled, parcelled, and served over.

A grommet (Fig. 120) is a ring of rope made by carefully unlaying one strand from a rope and cutting it off. All the turns must be left in it. Form a ring by laying one part over the other, taking care that the turns coincide with one another. Pass one end round and round, in the lay, until all the intervals are filled up and the ring is complete. The two ends are secured as in a long splice, first with an overhand knot, and then by dividing the strands and passing half of them under the standing part, and cutting off the remainder. Grommets are used for stropping blocks, handles for chests, snorters for the heel of sprits, etc. They are very often parcelled and served to make them look neater. It is easier to make them if the rope from which the strands are taken is laid up hard.

Selvagee (Fig. 121) is a number of ropeyarns fastened together. To make it, drive two nails into a piece of board at a sufficient distance from one another to form the size of selvagee required. Wind ropeyarn round these to form the thickness you wish, and marl them down with spunyarn. They are used to form a neat stropping for blocks, or to go round a spar for fixing a hook to. Fig. 122 shows how a selvagee is employed for fastening a block to a rope. The middle of it is placed against the rope, and the bights passed one over the other, until they come close to the rope, when the hook of the block is inserted.

Worming is filling the intervals between the strands of a rope by laying spunyarn or other small stuff into them. This renders the rope more even and smooth for parcelling and serving. The first end of the worming is securely stopped and passed along one of the divisions of the rope. When it has been carried as far as it is required, it is stopped and laid back down another interval, and then forward along the remaining one, and stopped at the end. To estimate the quantity of serving stuff required for a given length of rope, multiply the length of rope to be served by the number of strands in the rope, and add one-third of the product. The result is the length of serving necessary to do the work. Thus, if six fathoms of three-strand rope have to be served—

| | | |
|---|---|---|
| Length | 6 | fathoms. |
| | 3 | strands. |
| | 18 | |
| | 6 | one-third. |
| | 24 | length of serving. |

Fig. 123 shows at A how worming looks when finished.

Parcelling is done by winding strips of old canvas smoothly round a rope in spiral turns after it has been wormed and before it is served. This is shown at B (Fig. 123). The canvas is generally well tarred before it is used. To secure the canvas in its place it is marled down—that is, some marline or other small stuff is wound round it, which is secured at every turn with a hitch, so that each of the turns is secure and independent of each other. This is shown at B (Fig. 123). The proper hitch for securing the turns is given on a larger scale in Fig. 70 (page 361). In marling down, the coils are never laid close to one another, as in serving, but always at some distance apart. Fig. 124 shows the way a rope is served or covered with coils of spunyarn or other small stuff laid on quite close to one another. This is done with a serving mallet, as shown in the figure. The end of the yarn is first secured by placing it under the first two or three coils. The mallet, after being placed against the rope, has two or three turns passed round the body of it, and another turn or two on the handle. This produces sufficient friction to leave the coils taut as the mallet is worked round the rope by its handle. Another person is required for passing the ball of serving stuff. The service must be put on against the lay of the rope. A rope may be served single-handed by using a large reel for carrying the serving stuff, with a hole in its centre large enough for the rope to run through. This is kept just ahead of the mallet, and the serving stuff comes off the reel of its own accord as required. When the mallet is within a few turns of the end, the turns are taken off it by hand, the end is put through them, and heaved well taut.

Fig. 125 is the way a rope is belayed or made fast by cross turns round a cleat. The cleat is in this case supposed to be lashed to a stay or other rope, but it is often made fast to some part of the vessel.

Occasionally a single hitch is put over the upper horn of the cleat, which makes the rope still more secure. It is often required to take a rope at right angles from one part of a vessel to another. This is done by means of a "fairleader" (Fig. 126). It is merely a block of wood with a hole in it of sufficient size to allow the line to run freely through it. The back of it is grooved to fit the rope it is lashed to. Where more than one line has toggle slipped into it. It can readily be undone by slackening the ropes and putting the toggle through the eye, end foremost. Fig. 129 is another form of toggle, a round piece of wood shaped like a button being used in this case. It has a hole in the centre, through which a rope is passed and the end knotted.

In running alongside a pier-head, or when boarding a vessel in a small boat, it is it and clap an eye-seizing on it, marling it down as shown in the engraving. A lanyard of small cords, such as log-line, is then spliced into the eye, and it is ready for hanging over the boat's side. These fenders are very soft—"plum," as we call it in Cornwall—and last a long time. Fig. 131 is another and a handsomer form of boat's fender. This is made of a centre or "heart" of ropeyarn worked over or grafted with

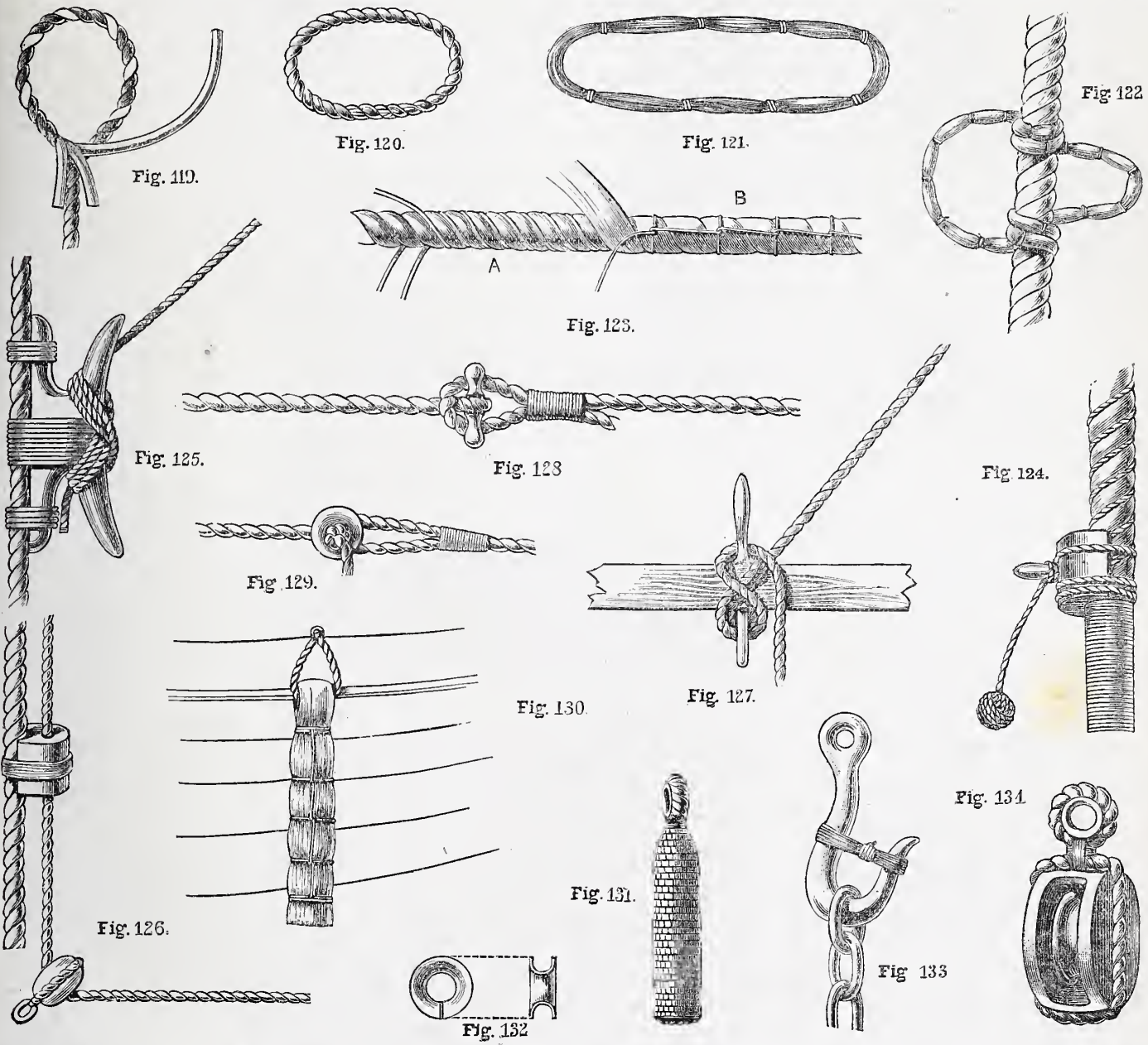



**Fig. 119.—Flemish Eye. Fig. 120.—Grommet. Fig. 121.—Selvagee. Fig. 122.—Selvagee fastening Block to Rope. Fig. 123.—Worming, Parcelling, and Marling. Fig. 124.—Serving. Fig. 125.—Belaying. Fig. 126.—Fairleader. Fig. 127.—Belaying Pin. Figs. 128, 129.—Toggle. Figs. 130, 131.—Fender. Fig. 132.—Thimble. Fig. 133.—Mousing a Hook. Fig. 134.—Stropping a Block.**

to be led, a piece of board or plank with holes through it is used. A fairleader is not necessarily fastened to a rope, but is fixed in that position where it comes in handiest.

Fig. 127 shows a belaying pin with a rope made fast to it. This is the usual way of securing running rigging, as it is made fast and cast off so rapidly. Fig. 128 shows a method of securing ropes together by means of a toggle. This is a piece of wood turned to the shape shown in the figure. It has a groove in the centre, round which the end of a rope is spliced. An eye is made in another rope by any of the methods described and the necessary to have something to protect the boat's sides from being chafed and the paint or varnish rubbed off. These are called fenders. They are occasionally made of wood, which is slung over the boat's side by a lanyard reeved through a hole in the end of it. More often they are made of canvas, stuffed with oakum and painted. Fig. 130 is an excellent form of fender, easily made, very effective, and needs no painting. Take a piece of Manilla rope double the length of the fender required; unlay it, and open the strands; comb them down until all the yarns lie straight; double short pieces of ropeyarn called "knittles" or "nettles," which is in fact a species of weaving. The nettles are first cut to the right length, and the middle part slightly twisted. They are then brought snugly round a thimble, and a seizing put under it. The heart is put into its place and the nettles laid evenly over it. One-half of the nettles, taken alternately, are now turned back over the eye, the rest lying down the heart. Pass a turn or two of twine or marline, called the warp, or filling round the fender where the nettles separate, and hitch it. The nettles that are turned back must

now be brought down, and the ones that are down turned up over the eye. The warp is now passed again, and hitched as before. This must be repeated until the whole of the fender is covered with a sort of woven coat as in the engraving. The ends of the nettles are brought round the last turn of the warp, and interlaced in the grafting. This fender requires a lanyard the same as the last one.

A thimble (Fig. 132), side view and in section, is a ring of iron, usually galvanised, with a hollow formed round it, so that a rope or strop may fit snugly into it. They vary in shape, some being heart-shaped and some round, as in the engraving. They are very much used when a small eye is wanted at the end of a rope for another rope to pass through. Fig. 133 is a method of preventing a chain slipping off a hook, which it would have a great tendency to do when, as often happens, it is dragged along the ground or deck. A few turns of ropeyarn are passed round the end of the hook and the standing part, and the ends brought round the middle a few times, and fastened with a reef-knot. This is called "mousing a hook." For "stropping a block" (Fig. 134), a grommet or selvagee is often used. Sometimes the stropping is made by splicing the ends of a suitable length of rope together. A grommet, however, is neater, and a selvagee the neatest of all, particularly when it is covered with leather. The block is first fixed in one bight, so that the lower part of the block sits on the splice, if there is one. A thimble is put into the other bight, and a seizing put on between the block and the thimble, each turn of which is hove taut with a heaver. The turns are, lastly, crossed, and the ends knotted. Fig. 134 shows the work finished.

## IMPROVEMENTS IN KALLITYPE.

BY L. IVOR POOLE.

INCREASED SIMPLICITY—CLEANLINESS—MATERIALS FOR DEVELOPMENT—VARIETY OF TONE—EXPOSURE—DEVELOPMENT—FIXING—WASHING—ALBUMEN KALLITYPE.

A SHORT time ago I had the pleasure of directing the attention of readers of WORK to the photographic printing process known as Kallitype. Since the article referred to, the proprietors of kallitype have made important progress with their prepared paper, the improvements being of such a radical kind that, as now practised, the process may almost be said to be a new one. The principal reason for the new departure may be stated to consist in the increased simplicity of development, or rather, in the ingredients of the developing solutions. Those who practised the old or original kallitype will remember that, though admirable in its simplicity, and inexpensive, there was great danger of staining the fingers while manipulating the prints. This is now done away, and the process is as cleanly as the most particular could desire. The materials for developing are also cheaper than formerly.

The new paper is known as "Kallitype No. 2," and, like the older form, has a matt surface. Indeed, when developed, the prints look exactly the same as by the older process.

The developing materials are Rochelle salt, borax, and a very small quantity of bichromate of potash; so that it will be seen they are very easily obtainable.

The Rochelle salt—or, as it is called under its scientific name, tartrate of soda and potash—will be familiar to many as a component of seidlitz powders, so that it may be gathered it is obtainable at an ordinary chemist's. It is very cheap.

Borax is too well known to require any remarks, beyond saying that the ordinary commercial kind does very well for kallitypy. On the proportion used along with the Rochelle salt the colour of the prints depends.

The developer recommended for black kallitype prints consists of 1 oz. Rochelle salt, ¾ oz. borax, 10 oz. water, and from 10 to 12 minims of a solution of 20 grains bichromate of potash in water.

By diminishing the above-named quantity of borax to 2 drachms purple tones are obtained, and personally these are more unpleasant to use than the former. That, however, is a matter of taste on which each can please himself, as either the black or purple can be obtained at will, and with equal ease. I presume no one will imagine that the purple alluded to is a bright colour, such as is obtained by the blue or cyanotype process, for it might rather be described to a novice as purple-black.

By omitting the borax, and reducing the Rochelle salt to ½ oz. in 10 oz. water, sepia or brown tones are obtained. When this is desired, half the quantity of bichromate solution, or 6 minims to the 10 oz. of water, is recommended. Many of the sepia-coloured prints are very beautiful, but from some reason, which I am unable to explain, I find it more difficult to produce them with certainty to the same tone. This simply amounts to saying that rather more care is required in the printing.

An earlier formula for producing sepia tones was as follows:—Rochelle salt, ½ oz.; borax, 1 drachm; strong hydrochloric acid, 5 drops; water, 10 oz.; and 10 minims of the bichromate solution. With this also I got some very fine results; but the ordinary formula as given above, being so much simpler, will no doubt meet with more favour.

The prints, of whatever tone, are treated much as if they were on the original kallitype paper. They are exposed in the usual manner till the details in the densest parts of the negative are fairly indicated, and are then kept in the dark and dry till it may be convenient to develop them. The development, if the prints, meantime, are kept from exposure to light or damp, may be deferred for any reasonable time, but what the limit is I am unable to say, as all mine have been done within a few days. For the benefit of those who did not read the former article on Kallitype, it may be said that the prints do not appear fully till development. As the image becomes partly visible, however, there is very little difficulty in determining the right amount of exposure after a short experience. The paper, it may be added, is more sensitive than the ordinary sensitised albumenised kind used for silver prints, but not so much so as bromide paper or any of those used for enlargements or reproduction by artificial light. Owing to its sensitiveness, it should only be handled in a very subdued daylight or by artificial light, but not necessarily that of the dark room.

Over-exposure merely causes too great an amount of blackness in the picture, analogous to the blackening of an over-exposed plate in the camera, while under-printing, of course, gives a weak picture.

When ready, the prints are immersed in one or other of the developers. The print immediately appears, but does not attain its full density for a few minutes. The time considered requisite for full development of a perfect print is stated to be half an hour, but I have found it sometimes an advantage to remove the prints sooner.

It should be noted that if the prints are removed too soon from the developing bath, the yellow tint which is observable will not entirely be removed, as it should be, during the subsequent fixing. On the other hand, if they are left too long in the developer, yellow stains may show on the finished print.

A large number of prints may be developed at the same time, but they should be kept moving, as when toning ordinary silver prints; and the same developer may be used repeatedly if it is kept from the action of light. It is said that 10 oz. of developer will serve for five or six dozen half-plate prints, or, say, a gross of quarter-plate size. In practice, however, I have not been able to accomplish this, or, to be more explicit, have not tried, as, in accordance with the instructions issued with the paper, I have preferred to use plenty of developer. It is so cheap and easily made, that it is better to do so than to run the risk of spoiling prints by using old stuff. A very considerable number of prints, however, may be developed in the same solution without apparent deterioration.

The fixing and clearing, or elimination of the yellow colour, is effected by means of a bath consisting of 4 drachms of the ordinary strong liquid ammonia (·880) in a quart of water—or, say, 1 drachm to a tumblerful. In this the prints should be kept moving for about a quarter of an hour. They may then be washed, but it is recommended that they should be treated in a second fixing bath of the same proportions as the first. This ensures perfect fixing.

After treatment in the fixing bath, they should be well washed, either in running water or in frequent changes, for about a quarter of an hour, though if left in for longer no harm results. They are then finished, and only require to be dried and mounted.

Toning, in the ordinary sense, is unnecessary, as this is done during development, and there is no troublesome washing, as with silver prints, to get rid of the baneful hypo.; so that, on these two grounds alone, kallitype should become a favourite process, especially with those who cannot devote much time to photography, but wish to get finished results as quickly as possible.

There are many to whom the glazed finish of the ordinary silver print is more pleasing than a matt surface, and to meet them, the manufacturers are now issuing albumen kallitype paper. When done on this, the kallitype prints are scarcely distinguishable from good silver prints, without anything like the amount of trouble which there is in producing them. As has been shown, they can be had in almost any tone, including the purple-black which so many amateurs seem to vainly strive to get in silver prints.

Although three formulæ are given for black, purple, and sepia tones respectively, it does not follow that these must be kept closely to; for by carefully altering the various proportions I believe any desired tone—within the range of those given as the extremes, of course—can be got to the utmost nicety. On one occasion, when away in the country, and a long distance from any chemist's where I could obtain developing materials, I developed a batch of prints with a mixture of purple and sepia tone developers. The tone of these is certainly not

inferior to that of any of the others, so that it will be seen no great exactitude is necessary in mixing the developers. The chief point with them is not to use too much of the bichromate solution. This gives greater contrast between high lights and deep shadows, but if used in excess, destroys the half-tones on which so much of the beauty of a photograph depends.

Finally, it may be stated that kallitype prints are considered permanent; and I think that if readers of WORK will try the process they will be, like myself, delighted with its economy, simplicity, and rapidity, as well as with the results.

## SOME LESSONS IN WINDOW MAKING.

BY G. LE BRUN.

### DOUBLE-HUNG SASHES: A FEW NOTES ON THEIR CONSTRUCTION.

DOUBLE-HUNG sashes are so common, and in such general use in this country, that there is scarcely a carpenter's shop of any pretension in which they are not made. But, although this class of window is so common, there are several ways of constructing the framing that is in use in different localities, and even in different shops in the same town, which, although differing in details, have the same end in view—viz., the production of a well-fitting, weather-resisting window that admits of being easily opened and shut. The construction of the building in which the windows are to find a final resting-place often to some extent influences the details of the window case: thus, varying thicknesses of walls, the use of stone or brick, and the kind of inside finishing to be used, either with or without shutters, all affect in a slight degree the various details to be considered in the making of the framing that is to contain the sashes. Added to this, practical workmen differ greatly as to the best modes of doing the work, one man thinking that his particular way is the best to the exclusion of all other ways, forgetting that if the result be a perfectly finished piece of work, without unnecessary expenditure of time, one way is as good as another.

It has of late become the practice in large towns to use to a great extent, especially in cheap or "jerry" work, a good deal of Swedish wood, which can be purchased at the woodyard ready for framing together; thus we find stuff for sash framing, sash bars, sills, sash and parting beads, ready to the hand of the builder who desires to minimise the cost of labour, and who can buy the said stuff in lengths to suit. I am not in favour of this mode of working, however cheap it may be, and in the course of this paper will adhere to the good old-fashioned way of working all the material required out of the rough. Various woods are used for the purpose of window making, from white pine to oak or mahogany. Perhaps the best woods to use, and the commonest for good work, are either red pine or pitch pine—preferably the latter, from its good standing qualities. The inner facings (or linings, as they are sometimes called) may be of yellow deal.

A hung window, when finished, presents the appearance shown in Fig. 1, and to proceed with the construction of it, we must get out our wood. Let us say, for example's sake, that the opening which we have to fit our window to is 6 ft. by 3 ft. "daylight"—that is, exclusive of the rebates: we will then want a sill 3 ft. 9 in. long, 7½ in. wide, and 3⅛ in. thick at one edge, tapering down to about 1 in. at the other. A section of this sole in the rough is shown at Fig. 2, and it must be worked into the shape shown in section in Fig. 3. The groove shown on the under-side is to assist in holding the bedding of cement it will get when put in its place, so as prevent rain water being driven underneath by the force of strong winds; the groove on the inside edge is for the insertion of the edge of the inside finishing piece, although in many cases this will have to be omitted. The bead run on the top of the inner edge is ⅝ in. When the sole is worked out to section, it is best to make a mould of thin wood that can be applied to each end of the sole, and draw on it with a pencil; this will ensure their being all alike, and greatly facilitate matters when you come to fit your sashes in the case. This especially when you have more than one window to make.

The next piece is the lintel; this will be of the same length as the sole—6¾ in. wide and 1½ in. thick. A groove, ¼ in. deep, is run on the under-side, 2¼ in. from the outside edge, for the reception of the parting bead; this groove is $\frac{9}{16}$ in. wide. This groove is shown in Fig. 4, which is a section of the lintel, complete, showing sash bead, parting bead, and outside facing in position. A groove is sometimes run in the inner edge to receive the edge of the finishing board, as previously described in connection with the working of the sole.

There are, as I have previously mentioned, different methods of constructing the sides of the window case. Of these methods one of the simplest is that shown at Fig. 5, and we will follow it in the construction of our window. At the same time, as it is always well to know different ways of doing the same thing, two other methods are also shown in Figs. 6 and 7, in which the principal difference is that they are so framed up that the weights (W) are enclosed in wooden boxes. Whether or not this is an advantage is pretty much a matter of opinion. Personally, I do not see much advantage in thus boxing the weights, and in practice have never found that weights, when unboxed, were liable to entangle their cords. Still, these extra parts serve to stiffen the window case, if nothing else, and in some localities are very generally adopted.

The pulley stiles for our case are cut out of 1 in. stuff, and are planed up true on one side and both edges, being gauged to a width of 5¾ in.; their length (in the rough before cutting to size) is 6 ft. 1 in. Groove them from the outer edge for the reception of the parting bead with the same plough as used for the lintel. A pair of inside linings (or facings, as they are sometimes called), 6 ft. 3 in. long and 5 in. wide, of ⅞ in. stuff, and a pair of outside linings of the same length, 3 in. wide and ⅝ in. thick, are also required. A ⅝ in. bead is now run along one edge of the outside linings, and also on the edge of a similar piece, 3 ft. 1 in. long, which is to be nailed on the outer edge of the lintel, A (Fig. 4).

Take a piece of stuff, 6 ft. long and ⅝ in. thick, free from knots, run a cutting gauge, set to 1 in., along both sides, then run your ⅝ in. bead-plane along the edge, break off the piece, and you have one parting bead; make another, also a piece for the lintel: then shift the cutting gauge to 1½ in., and run off the sash beads (sometimes called bâton rods) in a similar manner. If you do not possess a cutting gauge, a rip saw can be used, but a gauge is the proper tool, as it is a great saver of time. Plane up the rough edges of the parting beads, but leave those of the sash beads until you come to fit the sashes to the case.

The wood thus all prepared, the setting out of the case may be proceeded with. We begin with the sill: lay it on the bench and measure off 3 ft. in the centre, leaving an equal length of wood at each end. Mark and square across the upper side and inside edge, and cut down with the tenon saw to within ⅞ in. of the bottom of the sill; make two other cuts to the outside of the first, and on the angle, the distance from the first cuts being about 1½ in. at the inside edge, and 2 in. at the outside edge, of the sill, so as to give room for driving a wedge behind the pulley stile when fitting together: then off the inside edge of the stumps cut away the thickness of the inside facing. These cuts are shown in Fig. 8 (A, A), in which the finished sole is shown.

The lintel of the case is set out to the size in a similar manner (Fig. 8A), and is cut away like the sole for the reception of the facings.

The pulley stiles are cut ½ in. shorter than the "daylight" of the brick or stone opening, which in this case is 6 ft., so their exact length will be 5 ft. 11½ in. By referring to Fig. 9, the mode of cutting the pocket-hole for the insertion of the sash weights will be seen. Pocket-holes differ in length according to the size and weight of the sashes. Thus, a sash glazed with plate-glass weighs heavier than one glazed with sheet, and so requires larger and heavier weights; therefore the pockets must be cut to suit. This is, however, a matter of detail, and it will be sufficient for our purpose if we make the pockets of the case we are working upon of a medium size—say, the lower end about 9 in. from the case sole, and the pocket itself about 1 ft. 6 in. long. In the figure you will notice that one end is cut at an angle; this is the top end. Cut from both sides of the stile, a trifle more than half-way through, with a finely set dovetail saw, bore two holes with a small centre-bit in the middle of the groove of the stile (Fig. 9, A A), and rip down between them, using a port saw to commence the cut. Do not knock out the pieces just at present; that is done in putting the case together.

The insertion of the pulleys in the stile next claims our attention. They should be put in about 4 or 5 in. from the top end, and in the centre of each sash run, being sunk flush with the wood, and carefully fitted in, as if they do not fit well and firmly, they will work loose in time with the working up and down of the sashes. See also that when fitted the wheel runs easily and does not jam. When many cases of the same kind are being made, it is usual to make a mould with two square holes in it, so that, when applied to the top of the pulley stile, the holes can be marked round with a pencil, and thus show where to cut away without measuring. This mould ought to have a piece of wood nailed along one side and end to serve as a guide, or fence, in applying it to the stile.

The various parts of the case being now ready for putting together, take the inside facing and nail them on to the inside edge of the pulley stiles, taking care not to nail the pocket piece, which, if done, would cause much profanity when you came to knock it out. These facings are not as yet cut to length; that is done in finishing the case. Lay the stiles on the bench, the facing over

the edge, and clean off with a fine-set hand plane.

To put the case together, clear the tools off the bench, and lay across it two pieces of wood rather longer than the case is wide, and of any reasonable width and thickness—about 5 in. by 2 in. is a fairly suitable size. Lay on these pieces the stiles, facings downwards, then place the sill and lintel in position, and fix them so with wedges driven in behind the stiles as shown in Fig. 10, A being the wedge. When firmly wedged, and the joints quite close, secure the case further by nailing the sill and lintel firmly to the stiles with 3 in. nails. The outside edge of the case is now uppermost as it lies on the bench, so before turning it over put on the outside facings, first making sure that the case is perfectly square by trying it diagonally with a pointed rod. The lintel facing is put on first, and allowed to project inwards $\frac{5}{8}$ in.; the side facings are then fitted on and nailed firmly. These facings are sometimes mitred at the corners for the round of the bead, and just as often the side facings are fitted to the lintel facing with a gauge. The case is now turned over, and if the joints on the inside are not perfectly close, a cramp is applied, and the inside facings nailed firmly to the stumps of the sill and lintel. With a smart blow from a hammer behind the bottom ends of the pocket pieces, they are knocked clean out, then replaced in position, and the parting beads fitted in, the lintel piece being put on first, and nailed. The side beads are not nailed, and must fit tightly in the groove, the lower end being cut so as to fit the bevel of the sole, and having a small tenon that will slip down behind the end of the sole and into the groove. The top ends are fitted to the lintel bead with a gouge. The sash beads are now put in, lintel first, as before; then the side beads. The lintel bead is nailed, and is stripped to the proper width before being put on; the side beads are not stripped to width until the sashes are fitted in: they are temporarily held in place by a fine brad driven half way in. Fig 11 shows mode of mitring the corners of these sash beads.

The inside facings, sill, and lintel are now finished off with hand-plane and sandpaper, the stumps of the linings cut off, and the case is finished and ready for the sashes. In many shops a pair of trestles are used for laying the case on while putting together, instead of using the bench for that purpose, but that is a mere detail.

The making of the sashes comes next, and as all the practical details of an ordinary sash have been described in a previous paper, it will be sufficient to call attention to a few points to be attended to in the making of sashes that are hung, the principal difference from the sashes described being the "meeting bars," "chess bars," or "countercheck bars," as the top and bottom sash rails that meet in the centre of the window are called: they have a host of other *aliases* besides these terms, but for our present purpose we will call them the "meeting bars"—it is quite as sensible a term as any of the others. These meeting bars, then, seem often to be the bugbears of the aspiring young carpenter: he is troubled in his mind about them when he gets a hung sash to make, and their perplexities cause him sleepless nights. Why this should be so is a mystery, for a little thought over them ought to be sufficient to clear the brain, and enable it to comprehend their intricacies.

Fig. 12 shows a section of the case and sashes. To set out the sashes accurately, cut a rod the exact length between the lintel and the part of the case-sole where the bottom of the sash-sole will come when fitted—that is, close to the foot of the parting bead. Set out on the rod the width of the sash-sole, say $3\frac{1}{2}$ in., and that of the top rail of the upper sash, say $2\frac{1}{2}$ in.; divide the space between these into two equal parts (sometimes the upper sash is made shorter than the lower), and set out there the meeting bars, $1\frac{1}{2}$ in. This now gives the length of the sashes, the lower one being from the bottom end of the rod to the *upper* side of the meeting bars: the upper one, from the top end of the rod to the *lower* side of the meeting bars. These lengths are shown by the dotted lines outside Fig. 12. In Figs. 13 and 14 the mode of tenoning and rebating

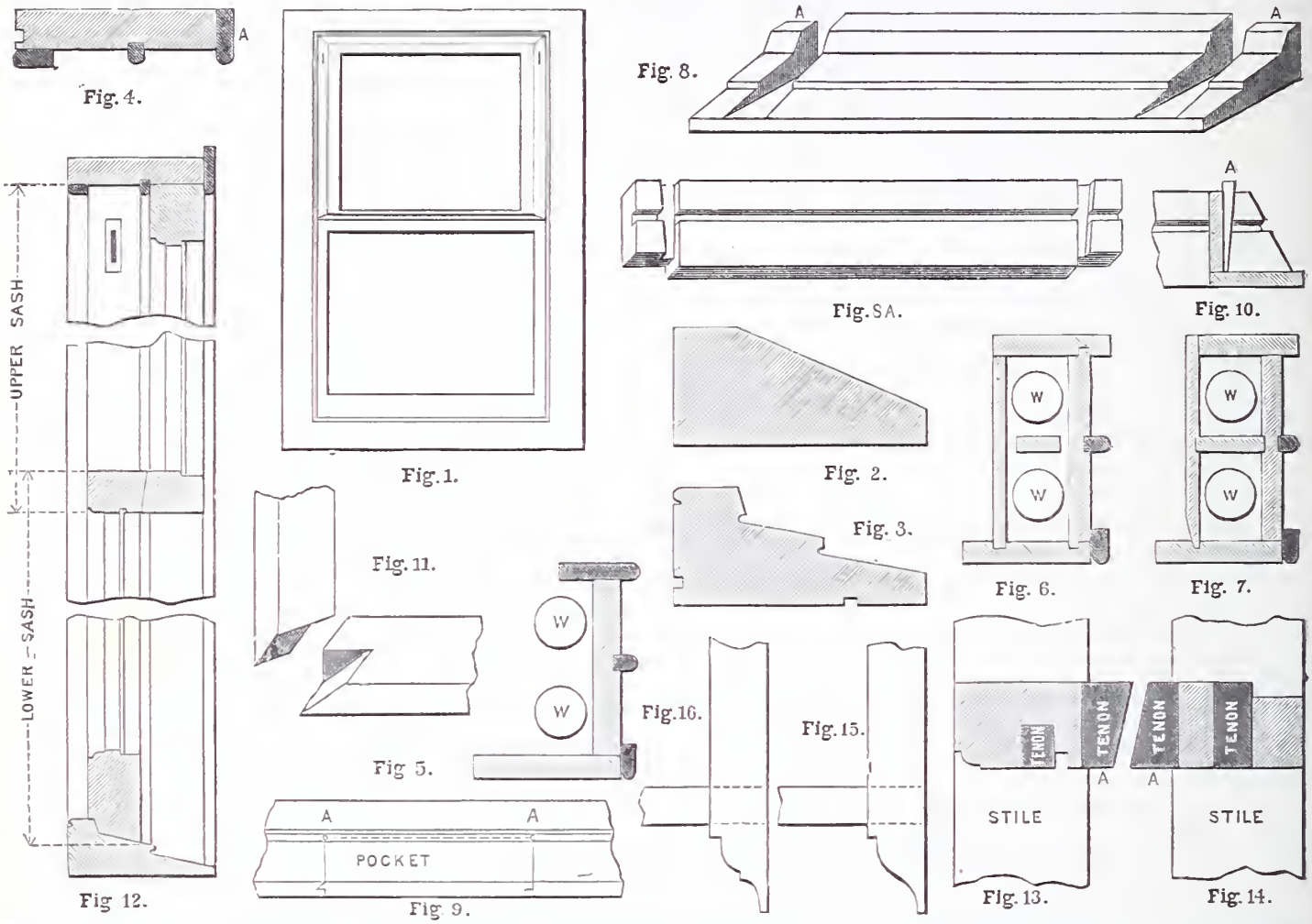



**Fig. 1.—Elevation of Case with Hung Sashes. Fig. 2.—Section of Case Sill in the rough. Fig. 3.—Section of Finished Sill. Fig. 4.—Section of Lintel. Figs. 5, 6, and 7.—Sections showing Alternative Methods of framing Sides of Cases. Fig. 8.—Sill, prepared to receive Pulley Stiles and Linings. Fig. 8A.—Lintel, showing Grooving and Rebating. Fig. 9.—Method of cutting Pocket Pieces. Fig. 10.—Method of wedging up Pulley Stiles. Fig. 11.—Mode of mitring Sash Beads. Fig. 12.—Section of Case with Sashes. Figs. 13 and 14.—Sections of Upper and Lower Meeting Bars. Figs. 15 and 16.—Alternative Mouldings for Stumps of Upper Sash.**

the meeting bars is shown, Fig. 13 being the bar of the lower sash, in which it will be seen that instead of a rebate for the glass, there is a groove run (the reason for which will be obvious), and that the tenon going through the stile is only half the width of that in the upper bar. This is because a moulded stump is generally left on the upper sash, while that of the lower being cut off, the tenon, of course, must be smaller accordingly. Sometimes, in good work, the stump is also left on the lower sash, and in that case the tenon can be the full width. Two alternative shapes for these stumps are given at Figs. 15 and 16. Fig. 14 shows the upper bar, in which there is only the rebate for the glass run, no moulding being required. Besides the ordinary tenons on these two bars, the extra width of them allows of an additional tenon, as shown at A A in the figures. There is a piece about ⅛ in. cut out of the stile to allow of greater steadiness to these tenons, as also shown.

In getting out the wood for these meeting bars, ½ in. wider than the thickness of the sash stuff should be allowed, and one edge only should be planed up, the other being left rough until they are fitted. I think these few explanations should be of sufficient assistance to those who have studied the previous paper, and should enable them to grasp the various details, all the setting out of the rails, the mortising, moulding, and rebating having been there thoroughly gone into.

When the sashes are made and finished off, there remains the job of fitting them to the case. To do this, proceed as follows: Place the case on end against the wall of the workshop, and try if it is quite square by means of the sash beads, which you will take out, applying them from corner to corner. If not square, you must get it so by squeezing the long corner a little, and when right keep it so by means of a piece of wood nailed diagonally across the case on the outer side. Of course, you will keep the inside of the case towards you. Cut off the stumps of the lower sash stiles, and bevel away the lower edge of the sill rail to fit the case sill, using a skew plane to form the inside rebate. Make a good fit, as an ill-fitted sole is an abomination. When fitted, plane up the top of the meeting bar, then putting the sash in its place, measure with a rod the distance from the lintel to the *under* side of the meeting bar: take the distance at both sides of the case, as there might, from some cause or other, be a slight difference. Apply the rod to the upper sash, the end flush with the *under* side of the meeting bar; mark off the height on each stile and strip up to size. The meeting bars are now bevelled, to fit tight against each other, in the way shown in Fig. 12. Sometimes a special plane is used for this purpose that forms a double rebate and prevents the opening of the sash fastener by means of the insertion of a knife from the outside, a mode of entrance that is familiar to the enterprising burglar; but the common way is a simple bevel joint as shown. Of course, it will be apparent that space for the parting bead to work in must be cut from the ends of the bars. The sashes when fitted should not have too much "play" sideways—not more than $\frac{1}{16}$ in. each side. After the fitting is completed, grooves must be run in the outer edges of the stiles for the reception of the cords, using a ½ in. plough-iron, and making the grooves ½ in. deep. Run these grooves from the top edges of the sashes, and fully half-way down the stiles. The sash beads can now be stripped up to the proper width, which can be found by putting them in place and sliding the lower sash up and down, allowing, of course, a little clearance. If you have more than one window in hand at one time, the sashes must be numbered so that they may be put in their proper places when glazed. The numbering is generally done with a ½ in. chisel, Roman numerals being used, and the numbering done on the bevel of the meeting bars, and behind one of the sash beads of the case, in this fashion —IX.

I have thus given a few necessarily short hints to the novice, and trust they may be useful in aiding him a little in the mysteries of hung sashes, and again remind him that there are many and various ways of working, as well as the way described, and advise him to get on friendly terms with the older hands in his shop; they will, if properly drawn out, give him many a wrinkle, and teach him more by verbal explanation than he can ever hope to learn from a short paper like this, however clearly it may be written.

I need scarcely add that the mode of constructing the case sides shown in Figs. 6 and 7 demands slightly different treatment of the ends of the case sole and lintel; but the difference is of such a nature that the proper treatment will suggest itself to the intelligent workman.

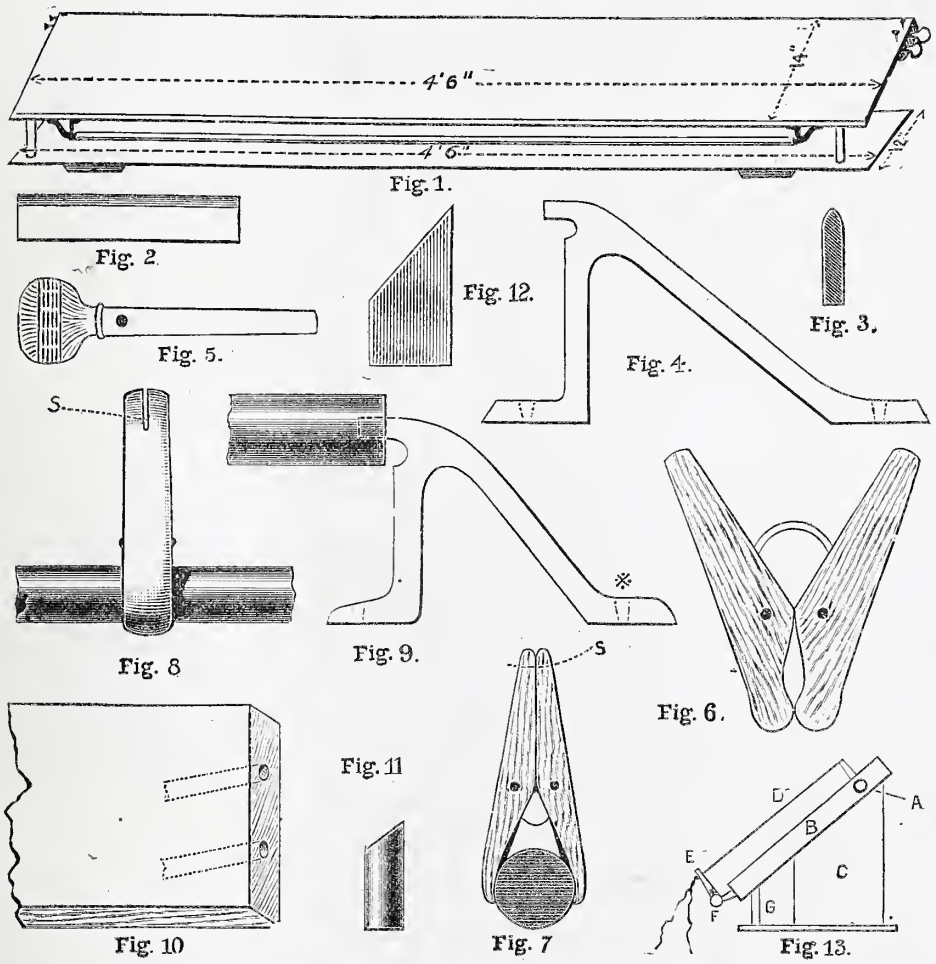



Fig. 1. Fig. 2. Fig. 5. Fig. 12. Fig. 3. Fig. 4. Fig. 8 Fig. 9. Fig. 6. Fig. 10 Fig. 11 Fig. 7 Fig. 13.

**Fig. 1.—Frame fitted on Baseboard with Rod in Position. Fig. 2.—Bridge. Fig. 3.—Section of Bridge. Fig. 4.—Bracket. Fig. 5.—Peg. Fig. 6.—Ordinary American Wood Clothes-Peg or Clip as bought. Fig. 7.—Clip filed up, showing how it grips Rod. Fig. 8.—Elevation of Clip, showing how it grips and slides on Rod. Fig. 9.—How Brackets hold Rod. Fig. 10.—Peg-Block. Fig. 11.—Pillar for Front. Fig. 12.—Bracket for Back. Fig. 13.—Diagram showing how Cord is held in Saw Kerf in the Clip—A, Peg; B, Board; C, Back Bracket; D, Cords; E, Clip; F, Rod; G, Front Pillar.**

## AN EASILY-MADE MACRAMÈ BOARD.

BY PASQUIN.

By reason of its virtually everlasting qualities, macramè lace is always likely to be popular; hence there are probably many persons who would practise this elegant and fascinating art were a really good and easily contrived frame or board to be had at a reasonable price. The one herein described can readily be made by anyone who can handle tools, while the cost is a mere nothing. It is simple in its construction, and possesses many features likely to recommend it to already skilled workers in macramè, two of the principal of which are —the ease with which the foundation cords may be strained taut and kept so, and the simple but effective contrivance for holding the strings for certain stitches. "Solomon's knot" is a case in point. In this stitch it is almost imperative that some such contrivance is available. Some persons loop the two strings which form the basis of the "bar" (and upon which the stitch is worked) through the vest buttonhole, but this is obviously a makeshift arrangement, as the body must be held rigid, or the cords are slackened. In page 430, "C. E. M." gives us an arrangement designed with the same object, but although he succeeds in holding the strings fast enough, they are level with the board, and are consequently awkward

to get round. Further, his contrivance requires opening and shutting, or the use of both hands, whereas in the one I am about to describe, a single simple motion of the hand, as in laying down the cords in question, is all that is required; while they are rigidly and firmly held in any position, and as far from, or as near to, the board as may be deemed desirable. The board I made was of inch stuff, and has since been put to other uses; hence I am unable to furnish exact dimensions, nor does this matter, as very few are likely to attempt a piece of work over six or eight feet in length, and such a piece could be comfortably worked on the size I have here given. As for width of the board, that is really immaterial—any width sufficient to include all the foundation cords will do. However, I have given the dimensions of the one I first made, as nearly as I can remember them. Take, therefore, a piece of inch board, planed up on each side, and of any approved size. First, by means of good paste, cover one side with clean brown paper. This is convenient in several ways: it allows of marking out distances, etc., and also serves to keep delicate coloured string clean. I first mapped out the face of my board into squares of an inch, and at the intersection of the lines I bored holes to receive pins, made from cheap button hooks, with the hook filed off. These I expected would be of service in working deep designs, but beyond utilising such pins and holes to hold work out of the way, I never made much use of them. Probably, however, one line of such holes, at about a third of the way up, would still be found useful, and two such pins as those described would be plenty. Having got out your board proper, proceed to make a base or stand, which may be of half-inch stuff, but must have a stay or cleat screwed on at each end, or nearly; this not only prevents warping, but also serves to keep the appliance steady on the table when in use. Get a piece of old broomstick, and cut two such pillars as are shown in Fig 11, taking care to have the bevel the same in each. These support the board in front, as shown in Fig. 1, while a plain bracket, cut as Fig. 12, supports it at the back. Two such may be used if desired, but one is quite enough to secure stability. Now before putting up the board, affix a stout piece to the right-hand end, to serve as a peg-block. Fig. 10 shows such a block, which may be made the full width of board, if desired, but in practice, I found that only the first two foundation cords required to be perfectly taut; all others can take care of themselves. Bore the peg-block to receive a couple of ordinary 'cello pegs, and at the corresponding part of the other, or left-hand end of board, insert two screws, or even wire nails, to serve as "hitch pins." But even with all the force obtainable from the pegs, the foundation cords will still be far too slack; besides which, they are level with and touching the board. Therefore we make use of two bridges, such as Fig. 2, one at each end. These are carefully raised *after* the foundation strings have been well strained, and you will find the latter become as taut as wire, and remain so for any reasonable time. Next, procure two common cast- (or malleable) iron blind brackets, such as are shown in Fig. 4 These, I believe, are of American make, and are to be had of any ironmonger. Fig. 4 is about the actual size, and these are used to support the rod which is shown in Fig. 1. This rod I bought at a veneer shop in Birmingham, and these also are of American origin. I think the wood is birch, and the rods are about three feet long, and are turned in several sizes. You require one of half inch diameter, as its use is to hold the clip, which, when you buy it, is like Fig. 6. Simply bore the ends of the rod sufficiently to take the nose of the brackets, as in Fig. 9; then, having firmly fixed one of the brackets, and also the other, with the exception of the outer screw marked with the cross, spring into place and screw up. These brackets, of course, are affixed on the *front edge* of the board. Next, get your clothes-peg, as in Fig. 6, and file up so that it will grip the rod, as in Fig. 7. Then, with a tenon saw, cut a clean kerf, as in Fig. 8. This kerf comprises the whole tool, as two or three strings may be held by it, while the clip runs on the rod with friction; hence any position or angle may be retained. The diagram, Fig. 13, shows the relative positions of base, board proper, rod, clip, bridge, and strings being held.

Having used this handy little contrivance for many months, during which I worked some of the most complex designs, I can recommend it as of as much use as a third hand. Those who have wrestled with macramè on the flat can have no idea of the comfort with which one can work when the board is tilted to an angle of 45°, and although the entire board as here given requires space when not in use, its great solidity and practical value cannot fail to be appreciated by all who try it. Of course, the board might be made to fold up flat with its base, or the latter be dispensed with, but as this would be at the expense of stability, a prime consideration in this work, I for one shall stick to the fixture.

I may add that at first I made a pair of rollers for each end; one on the top, and the other under. These were fixed with similar brackets, but those having an *eye* instead of a *slot*. My idea was to work, say, 4 ft., and then to roll that under and work the remainder. In theory, this was fine, but practically it did not "gee." There was the difficulty about getting the foundations tight, and I discovered that it was as easy to take the work off the board, take a good grip through the pattern, near the foundations, with drugget pins, and "belay" afresh. For such, however, as may wish to try this dodge, I may say that about an inch must be cut out of each end of the board, leaving projecting lugs on which to screw the brackets, and that the latter are affixed on the face and under-side of the board, and not on the edges. With these rollers pegs are inadmissible, but bridges may still be used. A useful tip for macramè workers is: Don't bother to count the stitches; use callipers instead. With care, these will always measure to a half stitch, provided the work is evenly done.

## OUR GUIDE TO GOOD THINGS.

**** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 101.—Tolhurst's Heat-Resisting Mastic Paints.

These paints, which are highly spoken of and warmly recommended by those who have used them, are made, as their distinctive name implies, from prepared mastic, known as "Patent Mastic," and have the merit of being entirely free from white and red lead or any other poisonous ingredients. They are ground as fine as enamel, and are therefore as suitable for all kinds of decorative work within doors as they are for outside work. Further, they are specially suited for hot climates, as they will resist all action of the weather, from the intense heat of tropical climates to the vigour of the depth of winter in the Arctic and Antarctic regions. In addition to these good qualities, it is claimed for them: (1) that they are comparatively inexpensive; (2) that they possess covering and penetrating qualities to a greater extent than any lead or oxide paints; (3) that they are extremely durable, and remain, when applied to any surface, in a sound and perfect condition for many years; and (4) that, owing to their heat- and cold-resisting properties, they will not crack or blister under any circumstances. For these valuable qualities they cannot fail to commend themselves to engineers, tool-makers, boiler-makers, contractors, railway and steamship companies, ship-builders, gas and water companies, etc., for whose use, indeed, they are specially prepared. They have an especial affinity for iron, and penetrate with ease the smallest pores, thus affording complete protection against the deteriorating and oxidising influences and action of the weather. Sample tins of 1, 2, 4, 7, or 14 lbs. may be had and prices may be ascertained by application to the manufacturers, Messrs. Tolhurst & Son, whose offices are in London, and whose precise address may be obtained by reference to Kelly's London Directory. I have frequently been asked during the last ten years what paint or enamel would be most suitable for model engines in virtue of its durability and heat-resisting properties, and I have not been able to name any paint in ordinary use which would fairly answer the purpose, and present a hard and permanent surface when dry. It seems to me, however, that the difficulty may be met by the use of these paints, of the existence of which I was unaware until a short time ago, and which I am now inclined to recommend for the purpose mentioned. This firm also manufactures and supplies an equally good steam joint mastic; excellent non-poisonous mastic enamels; gasholder paints, especially prepared for submerged surfaces, and drying quickly with a fine gloss; flat paints, which also dry quickly with a perfectly dead surface, and quick drying funnel paints. Of these the non-poisonous mastic enamels must be applied with a soft, clean brush, until they have ceased to flow, and if found to be too thick for any kind of work they may be thinned with enamel thinnings. They dry quickly—so quickly, indeed, that two successive coats may be given in one and the same day—and present, when dry, a firm, hard, glazed surface, resembling the glaze on porcelain or earthenware, thus obviating any necessity for varnishing. With regard to the steam joint mastic it is pointed ont that 1 cwt. of it is equal in bulk to 1¾ cwt. of red or white lead. The directions for its use are as follows:—"Roll in the hand a piece the size required, and with the aid of a portion of hemp or twine (if considered necessary) proceed in the same manner as in making a lead joint; if possible, it should be made while hot—that is, unmade and made while working, and the pipes almost too hot to handle and wiped perfectly dry. After the joint is made put pressure on gradually." These paints and other kindred substances, into whose preparation the "Patent Mastic" enters, although they may be well known in the trades in which they are used, are not known so widely as they should be by amateurs. For example, I must confess that they were not known to me until my attention was called to them by a friend of the proprietor and patentee. Bnt to me their value is now fully apparent, and I do not hesitate to recommend them for the purposes indicated above. A card of the various colours in which the paints are made will be supplied to applicants with price list upon enquiry of the manufacturers, whose name is given above.

The Editor.

## SHOP:

### A Corner for Those who Want to Talk It.

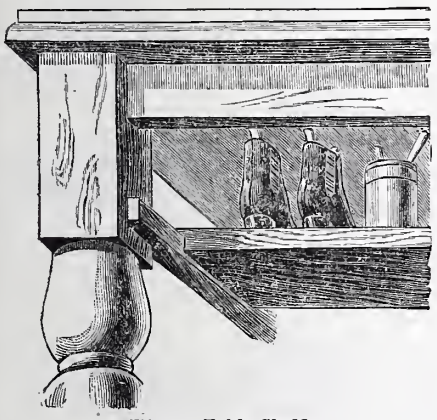
*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Testing Accuracy of Framework.**—J. C. K. (*London, W.*) writes, in sequence to J. S. and G. P. (see pp. 507 and 523):—"As we differ on a very clear matter of fact, and every process of a reliable mode of testing accuracy of square or right angles of framing, and as it is one of the simplest operations in mechanics, I am content to leave it to the judgment of those workers who have to test for squareness of their work. It is needless to repeat the same arguments; I will simply add that, if the square frame is winding, the diagonals being alike for length would prove the frame was not square at two angles. I have had to point this out to learners under me, and in surveying on uncertain levels, it would be misleading if ever attempted, and be no proof. Why Euclid is referred to I do not know. The laws of Euclid would prove my contention that same length diagonals may indicate a trapezoid. If the opposite sides of a picture-frame are equal, and the angles square, no other test is wanted for accuracy."

**Kitchen Table Shelf.**—A. B. (*Salford*) writes:—"The annexed sketch represents a shelf fixed between the legs of an ordinary kitchen table, where it will be found useful for the disposal of boots, blacking-brushes, and other articles. The bearers are notched and screwed to the table legs;



Kitchen Table Shelf.

the shelf is rebated at the ends, and rests loosely on the bearers."—[Thanks for the suggestion, which will no doubt be serviceable in its idea. Boots and blacking-brushes, however, would be replaced by some more wholesome articles in my household. —Ed.]

### II.—Questions Answered by Editor and Staff.

**Work Exhibition.**—A. M. L. (*Bedworth*).—There will be no Exhibition again for the present; but if you have any novelties, let us see them on approval for Work.

**Photography.**—G. C. (*St. Blazey*).—Always consult the indexes of Work, Vols. I. and II., when you wish to learn as to the past contents of the publication.

**Chemistry.**—H. B. H. (*Leicester*).—The best book for qualitative analysis is Clowes' "Practical Chemistry," published by J. and A. Churchill at 7s. 6d.; and for quantitative analysis, Thorpe's "Quantitative Chemical Analysis," published by Longmans, Green & Co., at 4s. 6d. The best plan is to thoroughly master qualitative analysis before starting the quantitative. If Clowes' is too expensive for you, Thorpe and Muir's "Qualitative Chemical Analysis," published by Longmans at 3s. 6d., is a good book, although I prefer Clowes'.—F. B. C.

**Brass Moulders.**—J. B. (*No Address*).—The only flux we ever use is a piece of yellow soap, say, as large as a five-shilling piece, put into an average-sized crucible, and stirred well into the metal, just before pouring into the mould.—J.

**Electric Night-Light.**—Frisky.—Lamps of 5-candle power may be had from vendors of electrical materials. In your town they may be obtained of Messrs. King, Mendham & Co., Narrow Wine Street and Fairfax Street. These lamps are made to work with current from batteries of various sizes and types, and are numbered to indicate the voltage of the current required to light them. By this system we are able to choose a lamp to suit a selected battery, or a battery to suit a selected lamp; lamps of 5-c.p. range in voltage from 5 volts to 65 volts—that is to say, their filaments offer a varying resistance, requiring these variations in the voltage of the current to light them. To light a 5-c.p. lamp we must first know the voltage required to light it, and then choose a battery giving the required voltage. Suppose we have an 8-volt 5-c.p. lamp to light with current from a battery: the battery must give a current having an E.M.F. (electro-motive force) of 8 volts. The highest E.M.F. obtainable from one cell of the bichromate or chromic acid type is 2 volts, so we shall need four such cells connected in series to form the battery of this type for our lamp. The E.M.F. of a Leclanché cell is 1·60 volts, and that of a dry cell from 1·50 to 1·55 volts. We shall therefore require six cells of either of these types to light the lamp. You will therefore see how wide your question is respecting the number of cells it would take to light a 5-c.p. lamp. Now as to the best battery for the purpose. A few months since I should have said there is only one battery suitable, and that is the chromic acid battery. I find now that there are several batteries more suitable for night-lights in the bedroom than the messy chromic acid or bichromate of potash batteries. The large size six-block agglomerate Leclanché cells are preferable, because there is no offensive odour from them, but they cost from 9s. to 10s. 6d. each cell. The ordinary Leclanché of large cells, costing 4s. 6d. per cell, has been used, and I have a correspondent who used such a battery. On the 27th of October, 1890, he discarded the Leclanché, at my suggestion, for a battery of Gassner dry cells, and he writes: "I have had no further trouble. They have not been touched since, and apparently are now as good as the day I started them. One night I left the light on by mistake. By morning the battery had run down. In twelve hours it was usable again, and in forty-eight as good as ever." The Gassner is retailed at 4s. 6d. per cell, but there are other dry cells besides this one. I have now an electric lighting night-light set, sent on approval for trial by the Electric Stores Company. This set is furnished with four E.S. dry cells and a 4-volt lamp, watch-stand, etc. The lamp will light up the face of watch and show the time on pressing an ordinary push-button. The lamps cost about 5s. each. The current can be switched on and off by an ordinary switch.—G. E. B.

**Fire-Boxes.**—J. H. (*Hunslet*).—We are gratified at the appreciation of our labours expressed in the communication of our correspondent, and have given his suggestion our careful attention and consideration. As it is our wish and endeavour to place before our readers and subscribers such information and instructions as will enable them to carry out such matters with the *ordinary* means at their disposal, we are satisfied that any instructions or information we might give on the subject referred to would be of no practical use, inasmuch as to perform work of the kind is out of the power of the general run of our readers. For instance, the following plant and tools are needed for the work: Rolls to take the buckles out of the plates; a slab on which they are trued; drills and cutters for making the holes for the rivets, stays, and tubes; screwing machine for threading the stays between the inner and outer boxes; taps for threading the holes in the plates; reamers for truing the holes for the rivets; a tube expander for tightening and fixing the tubes in the plates; a set of caulking tools for the joints; flogging and hand hammers for caulking and riveting; holding-up hammers and a "dolly" for the riveters; a rivet forge for heating the rivets; a smith's forge; a die, snap, or cup for forming the ends of the rivets, and if they are "countersunk" then there will have to be a countersink for so forming the holes; also chisels for cutting off the ends of the rivets in the old boxes, and punches or drifts for driving out the old rivets; besides many other small appliances and conveniences usually found in well-appointed boiler shops. Added to these are required the services of *skilled* workmen to set out the plates and do the work in the proper way; it would have to be done to make it a sound and *safe* job. We think from this our correspondent will be able to judge how far any instructions and information we might give would be of *utility* to our readers. That they would be *interesting* we do not doubt. We should not advise any of our readers who have not been *practically* trained in such matters to attempt to meddle in them. New fire-boxes are put in by the makers of such engines at such a reasonable price, that it would be the height of folly for anyone not qualified to attempt it, and the owner of such an engine requiring such repair should at once send it to the maker whose name and number appear on the plate attached to it. It is not our desire to lead any of our readers into trouble, or afford them facilities for getting into it.—C. E.

**Patent.**—J. B. T. (*Manchester*).—You cannot patent an *idea*. On application to the Patent Office, Chancery Lane, London, E.C., you can be supplied with printed forms.

**Clarionet Reeds.**—F. J. O'C. (*Dublin*).—You cannot do better than apply to Besson & Co., Euston Road, London.

**Prizes for Competition in Work.**—J. L. (*Bradford*).—We have already given prizes to readers of Work for bookcases, and doubtless there will be further competitions on a more extended scale.—Ed.

**Colouring Brass Work.**—J. P. (*Birmingham*), referring to a receipt given at p. 779, Vol. I., asks how I make my chloride of antimony liquor. As a matter of fact, I do not make it at all, but get it at a chemist's; but chloride, or butter, of antimony, is obtained by dissolving crude or roasted black antimony in hydrochloric acid, adding a small quantity of nitric acid. You are right in supposing that articles may be bronzed by dipping in the ordinary way. My remarks, as quoted by you, were, if I remember aright, made in reply to a query, asking how to colour the brass ferrules, etc., of fishing-rods; and I, therefore, recommended what I think the most satisfactory method.—Opifex.

**Polishing Marble.**—J. M. (*Paddington*).—The usual plan is to lay the slab flat, and first rub it down, if necessary, with a coarse grit. The rubbing is done with a flat stone and water; pounded Yorkshire paving-stone makes good grit. It is then rubbed smooth with wet sand in a similar manner. Lastly, the actual polishing is done with putty-powder, which is applied on thick felt stretched on a block of wood, and, of course, wetted. All the materials are sold by marble merchants. A little salt of sorrel used with the putty-powder brings the polish more quickly; but if the marble is black or coloured, this must be used with caution,—M. M.

**Writing-Desk.**—Cab.—Taking it for granted that the desk you require is of the form shown in Fig. 1, I will describe it. Your suggested sizes, 15 in. by 10 in. by 6 in., would answer, making the front, say, 5 in. deep; four ¼ in. boards for the sides, one ¾ in. for flap, and one for top back piece; a 1 in. bottom board, and three pieces for top gallery, besides two hardwood rails—this is the amount of wood required. Dovetail the sides together (as per instructions in back numbers), having previously shaped two or three tenons on their bottom edges; and to their tops, at the back, dowel the narrow top board, which is supposed to have been hollowed out for the reception of two ink-pots and pens. All tenons should be ½ in. deep, those at the sides fitting into ½ in. deep mortises in the bottom board, and those on the front and back lodging in clear mortises. Shape the under-side of the bottom board, at back and front, as in Fig. 2,

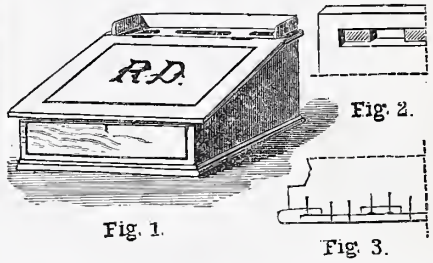


Fig. 2.



Fig. 1.

Fig. 3.

**Writing-Desk. Fig. 1.—Desk. Fig. 2.—Under side of Bottom Board (one corner). Fig. 3.—Elevation, showing Front Board tenoned to Bottom Board and secured by means of Rail.**

for ½ in. deep, in a line with the clear mortises, and insert a ½ in. hardwood rail. Thus, when the back and front sides are joined to the bottom board, their tenons will contact with the ½ in. rail, and by screwing the latter from underneath, and the bottom board to the upper boards, as shown in Fig. 3, a strong job may be made. You will see that by this arrangement a half-inch firmer hold is obtained by the screws used in connection with the bottom and upper boards than would otherwise be the case. You can dispense with these rails if you wish, merely screwing the bottom board to adjacent parts without their intervention. Stringing is done by the strings being glued into straight or curved grooves cut for the purpose in the solid wood, being pressed by the tool handle meanwhile. For the moment, I cannot say where you may obtain a catalogue containing prices of stringing; but should I eventually hear I will let you know.—J. S.

**Stove Trivets, etc.**—J. W. (*Swindon*).—To comply with your request for illustrations and designs for meat cranes, stove trivets, and flat-iron stands, I should require (to give anything of an assortment) about two pages of "Shop," which I am quite certain I should not get. Why not go to the nearest ironmonger, and ask him to show you the pattern books of the Carron Co., Stevens, McDowell and Co., and the General Ironfoundry Co.? and in them you would find a good assortment to select your patterns from. When will correspondents learn that it is impossible to give replies in "next issue?"—R. A.

**Violin—Lantern.**—H. McM. (*Bootle*).—You will find articles on the Triunial Optical Lantern in Nos. 83, 87, 91, 96, and 100 of Work; and papers on Violin Making in Nos. 105, 110, 114, and 118.

**An Invalid's Folding Adjustable Reading Stand.**—INVALID.—It is a curious fact that, upon receipt of your query for an invalid's reading stand, I was being compelled to indulge in the indolence of lying a-bed, where I had been shifting uneasily for several days, as the consequence of a slight accident I had met with. Strangely enough, I had been trying to discover how I could accelerate my professional labours by the aid of a piece of furniture; for the accident did not debar me from using my hands and arms. I had not quite designed one satisfactorily to myself when your letter was handed to me. Being in a position to sympathise with other invalids, I could the better comprehend their requirements; and I hope that the present result of my scheming will be of assistance to you. It is of very little use for me to give sizes, as in this case, more so than in many others, they are a matter of individual necessity. This article is intended to stand upon the bed, a foot being on each side of the invalid. Commence the construction by having a stout rail, the length of which will cover the distance across the invalid's body (bed-clothes included), and also allow a few inches extra at each

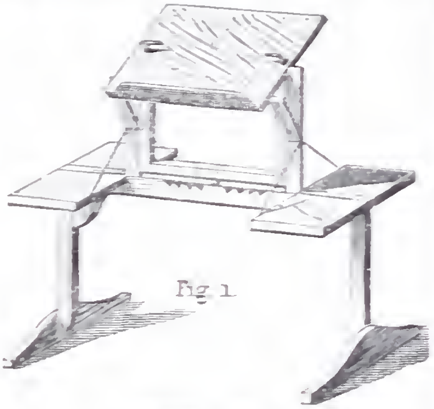


Fig. 1.

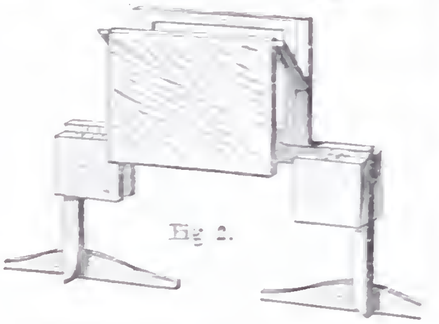


Fig. 2.

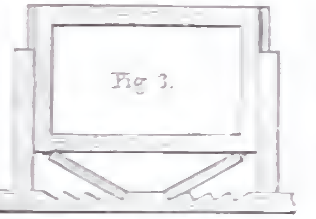


Fig. 3.

Fig. 4.

An Invalid's Folding Adjustable Reading Stand. Fig. 1.—Stand unfolded. Fig. 2.—Stand folded. Fig. 3.—Adjustable Frame for Stand. Fig. 4.—Section—A, Uprights; B, Adjustable Frame.

side. To the top of this rail should be joined two others, the distance between them being the same as the length of the desk-board. At each end of the long rail, underneath, will be joined an upright, to the bottom end of which will be hinged a long foot in such a manner that it can be adjusted as in Fig. 1, or folded, as in Fig. 2. To the two uprights should be joined, diagonally, two supports, between which the desk-board will be pivoted. Between the uprights should run a frame, as in Fig. 3, to the bottom edge of which may be hinged a pair of short rails to fit into notches in the long rail. The outside end edges of this frame should be tongued, and the inner edges of the fixed uprights grooved, of course, previous to joining together. The frame can then be easily raised, and the desk-board kept at any required angle, by permitting the short rails to fall into the notches. Fig. 4 shows section of frame and uprights. Now I have added something which you did not ask for, but which I consider, from my own bed experience, will be useful to you—viz., the shelves. A pair of small boards should be hinged to each end of the long rail. To save a lot of labour in placing supports for these, I should advise the use of a strong loop, each end of the latter being fastened to one of the shelves. If a nail or stout pin is driven into the thickness of each top upright, the string can fit over it, and thus support the shelves. It should not have a very large head; otherwise, when the loop is slipped over it, the shelves will be on the slant, instead of horizontal. Thickness for wood, you must decide. For strength, here and there fix a little bracket. You will require a narrow strip of wood to support the book, and also hooks to keep the leaves down. These hooks can be fixed on top, at the side, or at the bottom (for making, see p. 553, No. 35). You did not ask for a folding article, but I have designed it as such, for occasional convenience when not required. If, however, you would prefer it solid, you will have no difficulty in making it so. I think this article is to be preferred to one to stand by the bedside, for, by my late bed experience, I find that in bending in the bed it makes one's back and shoulders ache. I sincerely trust that but few of my readers will find it necessary to avail themselves of these suggestions.—J. S.

**Hydrogen Furnace.**—T. M. (*Liverpool*).—You could not make one of these so cheap or so satisfactorily as you could purchase one. Some very excellent furnaces are made by Thos. Fletcher & Co., Warrington. They will melt brass, copper, cast iron, and nickel, in quantities from 6 oz. to 28 lbs. The size of gas-pipes for the smallest quantity is ½ in., and range from that to 1½ in. With a chimney with a fairly good draught, they will melt copper; but for cast iron or nickel a blower is required. With a blower, they are calculated to melt a crucible of cast iron in seven minutes, steel in twelve minutes, and nickel in twenty-two minutes. If you send four stamps to the firm, they will send you their illustrated catalogue of melting furnaces, when you will see the various kinds they make. I should imagine it is one of these that is referred to in the article you name, but I have not seen it. If, after getting the catalogue, it is not what is referred to, if you send me the paper, I will try to give you some information respecting it. You will find drawings of the various kinds of furnaces in the catalogue, with prices and full particulars.—M.

**Electric Motors.**—H. C. (*Birmingham*).—Information respecting the Gassner dry battery was given in No. 53, p. 187, Vol. II.; and instructions on making and working accumulators were given in No. [illegible], p. [illegible], Vol. II.; and illustrated instructions on how to make a model electro-motor were given in No. 109, p. 71, Vol. III. of WORK. These three numbers can be forwarded to you by the publishers on receipt of 4½d. in stamps. For further information, consult back numbers.—G. E. B.

**Battery for Electric Light.**—W. B. (*Lewisham*).—The electric light battery described in "Shop," No. 131, p. [illegible], Vol. III. of WORK, in reply to F. G. (*Paddington*), cannot be re-charged with current from a dynamo. It must be re-charged by pouring away all the old spent solution, washing the plates and cells in water, and re-charging the cells with a fresh solution, made as directed in that reply. Four single-fluid batteries will maintain an electric light for about three hours; after which time the solution becomes spent or exhausted, and must be renewed.—G. E. B.

**Small Dynamo.**—LAMPLIGHTER.—I cannot advise you to attempt making the Brush dynamo. You will find those described in Nos. 88, 97, and 99 on pp. [illegible], [illegible], and [illegible], Vol. II. of WORK, much more simple in design, easier to construct, and quite as efficient for your purpose as a model Brush. Full illustrated instructions for making the Siemens, Gramme, Manchester, and Simplex dynamos are given in these numbers. No. 14 gauge copper wire is much too large for winding a model dynamo, and 65-volt 16-c.p. lamps unsuitable for such a small affair as yours. You will find full information in the articles on Model Electric Lights in WORK, Vol. II.—G. E. B.

**Universal Lathe.**—Mr. R. Prince's present address is [illegible] Stratford Road, Plaistow. It is on the Tilbury Line from Fenchurch Street Station. He is now working in his own little shop, and no longer in connection with Watt, Whitney & Co.—F. A. M.

**Horse Power to drive Dynamo.**—J. R. (*New Brompton*).—The following table will help you in determining the horse power needed to drive the Gramme dynamos:—

| Size. | Watts of Current. | C.P. | H.P. Required. |
|---|---|---|---|
| 1 | 125 | 30 | [illegible] to [illegible] |
| 2 | 250 | 60 | [illegible] to [illegible] |
| 3 | 500 | 120 | [illegible] to 1 |
| 4 | 1,600 | 475 | 2 |

Dynamos always run best when the horse power of the engine is in excess of the maximum power required to drive the machines.—G. E. B.

**Boiler Pump.**—PUMP.—I assume that the force pump is required to work in conjunction with a model engine, from the size of boiler given. You do not give the evaporation of water or other particulars from which to determine the capacity required in pump, but I think that illustrated below is about the size suitable. The figures are full size for a pump with a ½ in. diameter plunger, having 1 in. stroke. Fig. 1 is a plan of the top of pump and valve-box; Fig. 2, a vertical section of the same; and Fig. 3, a horizontal section taken on line 1—2. The cylindrical part of the plunger, A, is ½ in. diameter by 3 in. long, turned throughout; and it terminates at the top in a flat extension, having a hole-pin to receive a pin, by which the plunger is connected with a hand lever, or with a connecting rod from a crank or eccentric on an engine-shaft. The plunger should be made of iron or steel. The plunger is worked up and down, in a chamber about ¾ in. diameter, in a brass casting, B C, this chamber being on the side, B. The valve-box is formed on the side, C. It is not absolutely necessary to make the casting of brass, but for small work like this it is preferable. The general thickness of metal is ⅛ in., but where the pump-barrel and valve-box join, it is $\frac{1}{16}$ in. The top of the pump-barrel is bored out to fit the plunger, around which also fits a screw-gland, D, which screws down into a stuffing-box, O, filled with greased hemp packing, or packing of some other kind, to keep the plunger water-tight. The valve-box, C, communicates with the pump-barrel by a passage, L. The valve-box must be bored out to receive the seats of the inlet and outlet valves, K and J, which are shown as ball-valves, but may be of other form if desired. For special information on the subject of pump-valves, see WORK, Vol. I., p. 513 ("Pump Valves"). The balls sold for bicycle bearings may serve this purpose. The seats of the valves are turned so as to be a light driving fit to the valve-box. This will make them water-tight in the casing if the workmanship is good. The upper seat forms a stop for the inlet or suction valve, K, and a screw-plug, E, which closes the valve-box,

Fig. 1.

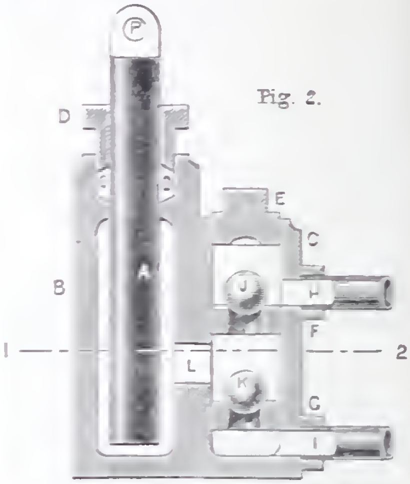



Fig. 2.

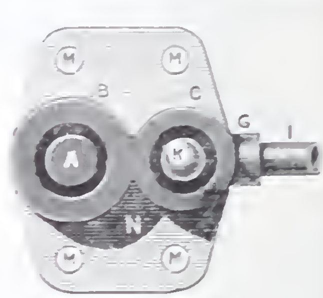



Fig. 3.

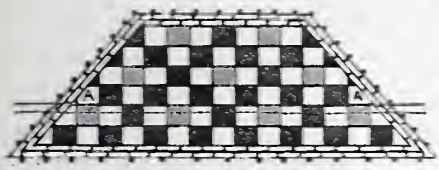
Boiler Pump and Parts.

forms also a stop to outlet valve, J. If there is any trouble to be anticipated about boring out the valve-box, it can be cast open at the bottom, and closed there by a screw-plug. The bottom seat may then be forced in from the bottom end, and the top seat from the top end of the valve-box, and a collar can be left between to secure their correct positions. I is a suction pipe and H an outlet pipe to the boiler. These pipes, about ¼ in. diameter, are screwed into sockets, G and C, in the positions shown. The bottom of the casting is extended on each side, as shown at N, to form a base-plate, with holes, M, for bolting or screwing it down to a frame. Instead of leaving a base-plate, side brackets may be cast on barrel, B, but this will depend upon the frame to which it is intended to fix the pump. At each up-stroke of the plunger a quantity of water is drawn through valve, K, and at each down-stroke a like quantity is forced through valve, J, and pipe, H, to the boiler. It will take about 200 strokes of this pump to deliver a pint of water into the boiler; so, from this *datum*, if you find the evaporation of boiler for a given speed of engine, you can calculate if the pump is sufficiently large for your boiler.—F. C.

**Jules Verne's Electric Light.**—F. M. (*Liverpool*).—Jules Verne's imagination has created a future for the electric light which seems unattainable,

and must, therefore, be regarded as pure fiction. No such lamp as that mentioned in his story, "A Journey into the Interior of the Earth," has yet been invented. It is true that luminous effects can be obtained from Geissler vacuum tubes when the secondary current from a Rhumkorff induction coil is sent through them: but these effects cannot be said to equal an electric light from incandescent lamps; nor would the light from a Geissler tube lamp be sufficient to guide an explorer's footsteps along subterraneous passages. I am not aware that such a lamp has been used for a photographer's dark room. An apparatus suitable to this purpose was described and illustrated in No. 89, p. 502, Vol. II. of WORK.—G. E. B.

**Lead Glass Work.**—S. I. W. (*Paddington*).—Below, you will find a sketch, showing about the shape, I presume, you would want one side of the top of your fern-case to be. You will find that, by the time you have bought the materials, etc., necessary to do a job of this kind, it will be a very expensive fern-case; but if expense is not so much an object as the pleasure of doing the whole thing yourself, you will accomplish what you wish with care and a little patience. I will now try to explain, by as simple a way as possible, how you can do it. First, set out on a piece of paper the exact size and shape you want: then decide and mark out the design and colours you would like. In buying your glass and leads, I should advise you to allow somewhat lavishly for waste, breakages, etc. Next, stretch your design (which, we will presume, is as the sketch below) flat on a board or bench: and, under the row of glass marked A A, lay a length of lead, opening out the grooves with a piece of hard wood, shaped to the form that suggests itself to you as being most suitable, to allow the glass to be inserted without any trouble. See that this lead is perfectly straight, and keep it in its place by a straight-edge lightly fastened below, as shown by dotted line, and some 1½ in. panel pins, driven lightly into the board or bench above, so as to keep the length of lead firmly in its position, shown by the drawing, under it. Now cut your first square of glass above this, beginning from the left-hand end, and fix it with pins driven lightly in above and on the left-hand side; next cut off a short length of




Lead Glass Work Pattern.

lead, and fit it up to the right-hand side of glass, making it sufficiently short to allow of the piece of lead coming on the top of this row to clip the glass: then follow with another piece of glass and lead, and so on to the end, drawing out very carefully any pins that may be in the way, and that were used to keep the first piece of lead in its place. Keep this row in its place by pins driven lightly on the right-hand side of last square; but draw out any that you may have put on the top of this row, and lay the next length of lead along and proceed in the same manner until the top half of the centre is complete. If you now carefully take up the straight-edge from under row A A, you can work downwards, and finish the bottom half, securing the whole with pins, as described. Next cut and fit in the corner pieces up the sides, and cut the long pieces of lead to their right length (which, by the way, should have been cut as you went along). You can now proceed with the border in the same manner, taking one side at the time: and when it is ready for soldering, it will be held together by pins all round it, as shown in sketch. Do not be afraid of putting in sufficient pins. If you now put a dot of solder over each joint, taking care that the heat of your iron does not crack the glass, you can then draw out the pins, and turn it over very carefully and solder the other side. The best iron, etc., for this I have already explained on p. 92, Vol. II.—E. D.

**Cutting Cone Patterns.**—TINNY.—My next article will deal with this subject. It is too long to properly explain in the limited space of "Shop."—R. A.

**Lantern Carrier.**—F. R. (*Gosport*) asks which is the best lantern carrier, and wants a dissolving effect with a single lantern. It is impossible to get the same effects with one lantern that can be got with two or more. By the carrier of which I give a description an instantaneous change of slides can be procured. Fig. 2 gives the carrier frame, A, in perspective, and B perpendicular section. At the lower part a piece is taken out as at *a a*—the width of the front—and sets as a saddle; the spring front pressing against it will keep it perfectly firm. Fig. 1 is the carrier proper; A gives it in perspective and B in plan. None of the Figs. are drawn to scale, and are purposely exaggerated in some points for the sake of greater clearness: but as dimensions are given, no error can be made. It will be easily understood that Fig. 1 slides in Fig. 2. At *a a* in Fig. 1 are screws which are used for the purpose of correct registration or bringing the picture in the centre. The slide is dropped in the groove from the top, when the carrier is flashed across and the slide last exhibited is removed, and a new one substituted. The carrier is now driven in the opposite direction. The one from which I have taken the copy is a home-made one: it is easily constructed, and quite as efficient as an expensive one from a dealer. I think the drawings are so plain that no further description is needed—except to say that

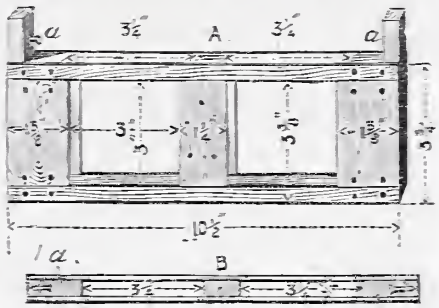



Fig. 1.

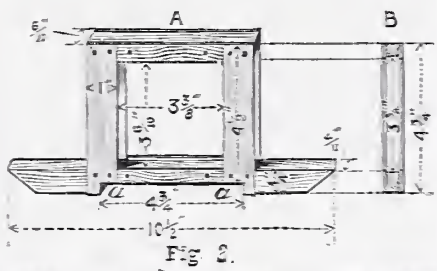



Fig. 2.

Lantern Carrier. Fig. 1.—Flash Carrier for Single Lantern. Fig. 2.—Guide Frame for Carrier: A and B, Plan and Section.

the proper width of the saddle-piece marked *a a*, in Fig. 2, must be determined by the width of the stage of the lantern; the one before me is 4⅛ in.—O. B.

**Bookshelves.**—QUARTO.—Your desire to fill a recess with bookshelves, enclosed by glass doors at the lower portion, without undertaking the labour of making a complete bookcase, is one the answer to which should commend itself to many other readers. So far as individual shelves are concerned, each might loosely lodge upon supports (A, Fig. 1), the latter being screwed to the wall as shown. If the wall is of such a nature that screws directly contacting with it are of little use, drive stout dowels, an inch or so long, into it under the end of each shelf; the object of the dowels being to accommodate the screws, thus permitting due tenacity. It is in no way compulsory to have either side or back board to the enclosed portion, as the doors can be hinged to narrow boards, which are

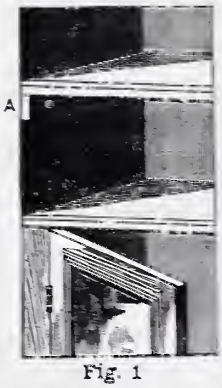



Fig. 1

Fig. 2.

Fig. 3.

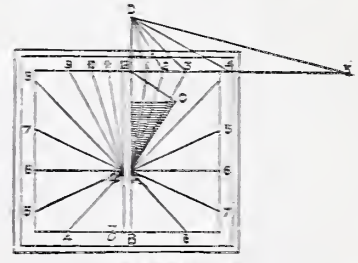
Bookshelves. Fig. 1.—End of Shelves and Top of Door. Fig. 2.—Corner of Enclosed Shelves. Fig. 3.—Pediment and Bracket for Shelves.

screwed or joined vertically between the board immediately above them, and one screwed to or near the floor. These uprights should also be screwed to any intervening shelves, the latter having their adjacent corners shaped as in Fig. 2, in order to permit this to be done. The back numbers of WORK will give you many designs of pediments and brackets suitable for adoption above and below your shelves; but perhaps those shown in Fig. 3 will assist you. The nature of the wood most suitable for you to use depends upon the appearance of your surrounding furniture, your taste, skill, and banking account. Either oak, walnut, or mahogany, pitch pine, deal, or, in fact, any wood, will equally suffice.—J. S.

**Materials for Coils.**—COMMUTATOR.—It must have been several years since you experienced such indifferent treatment at the hands of the dealer in odds and ends, as the paper you mention has ceased to exist as a separate publication. I have no cause of complaint against the person mentioned by you. The building is crammed from floor to roof with a large assortment of useful oddments, which should be seen and valued before purchase.—G. E. B.

**Accumulators.**—H. M. (*Keighley*).—Accumulators have been mentioned in "Shop" on pp. 477, 541, 749, 829, Vol. I.; on pp. 44, 206, 245, 266, 307, 622, Vol. II.; and on pp. 136, 172, 204, 285, 443, 475, Vol. III. of WORK. An illustrated article, showing how accumulators are made, appeared on p. 740, Vol. II. of WORK. The articles on Model Electric Lights were published in Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104, all in Vol. II. All back numbers and indexes are in print.—G. E. B.

**The Horizontal Dial.**—J. M. (*Aberdeen*) finds a difficulty in setting out a dial satisfactorily by the method given in WORK. It is possible that he may not have worked out the rule correctly, or fixed his dial with sufficient care. Another and perhaps simpler (though less compact) method for finding the hour-lines is, however, given below, with which, it is hoped, he may have better success. His opinion that the same hour-lines ought to serve for any place, irrespective of latitude, is not tenable: why it is not, he will see if he consults any work in which the principles of dialling are explained, as they are in most encyclopædias. *For setting out an horizontal dial for any proposed latitude*, draw the line 12 A B as the meridian or 12 o'clock line: parallel to which draw a second line (12 *a b*), at such a distance as will give a proper thickness for the gnomon. At right angles to these draw 6 *a*, A 6, for the 6 o'clock line: make the angle 12 A C equal to the latitude of the place, and from 12 let fall the perpendicular, 12 C, upon A C. Make 12 D upon A 12 prolonged, equal to 12 C. From D draw lines, D 1, D 2, D 3, etc. (to terminate in the line 12—5, perpendicular to 12 A), and to make angles, 12 D 1,




Horizontal Dial.

12 D 2, 12 D 3, etc., equal to 15°, 30°, 45°, etc. Then from the centre, A, draw A 1, A 2, A 3, A 4, and A 5 for the hour-lines of 1, 2, 3, 4, and 5 in the afternoon. Take on the other side of the meridian or substylar line, 12—11, 12—10, 12—9, etc., respectively equal to 12—1, 12—2, 12—3, etc., and from *a* draw the lines *a* 7, *a* 8, *a* 9, etc. All the hour-lines from 6 in the morning to 6 in the evening are LOW drawn, and it only remains to produce the afternoon lines, 4 A and 5 A, to give the morning lines, *a* 4 and *a* 5, and the morning lines, 7 *a* and 8 *a*, to give the evening lines, A 7 and A 8. The thickness of the gnomon has already been determined: the elevation of its style will be that of the angle 12 A C (equal to the angle of the latitude). It will be placed perpendicularly to the plane, on the space left for it with its angle, A, at *a* A, and its substyle extending towards 12.—A. Y.

**Intensity Coils.**—A. J. L. (*Gloucester*).—All instruments in which there are two coils of wire—a primary coil through which the exciting current passes, over-wound with another coil of wire in which an induced current of electricity is formed—are "induction coils." The name "intensity coils" is given to those which develop a high tension current in the secondary wire. "Medical coils" are induction coils constructed specially for medical and surgical purposes in the relief and cure of disease. The tension of the current from these is not so high as that from an intensity coil. By "ordinary coils" is meant the instruments made for and sold by opticians and dealers in electrical sundries, and advertised in the papers at low prices. These are nearly all imported from France. The ordinary coils mentioned by Dyer are the ordinary shocking coils furnished with a regulating core or a sheath to the core, to lessen or increase the inductive effects of the current. The various kinds of coils met with are all described in "Induction Coils," published by Messrs. Whittaker & Co. The principles of coil construction are given in a series of articles now in the Editor's hands, and I shall be always pleased to give you instructions in "Shop" on how to make spark coils and their accessories.—G. E. B.

**Winding Manchester Dynamo.**—W. D. (*Belfast*).—This correspondent sends me a tracing of a Manchester dynamo of the following dimensions, and asks: "About what quantity of wire will be required to wind it to give a current of three ampères at a pressure of 45 volts?" The dimensions are: yokes, 2 in. in width, 10 in. in length, ¾ in. in thickness; cores, 8½ in. in length between flanges; body, 1¼ in.

in diameter; flanges, 3 in. in diameter; armature, built of laminated Pacinotti punchings, 3 in. in diameter and 2 in. in depth. I cannot see any flaw in your excellent tracing, but think you will not be wise in reducing the thickness of the yoke from ⅝ in. to ½ in., as the heavier yoke will be an advantage in securing a steadier magnetic field. If the cores are of well-annealed cast iron, they will do equally as well as if made of wrought iron; but thinner flanges of wrought iron would be advantageous in yielding you more wire space. If you can manage to get 1½ lbs. of silk-covered No. 20 copper wire on the armature, and 6 lbs. of No. 22 on the cores, and connect the wires in shunt, you may get the current you require by driving the machine at a speed of 2,500 revolutions per minute. To get this result, the wires must be very closely and neatly wound.—G. E. B.

**Electric Lamps.**—G. W. (*Chelsea*).—I reply to your questions in order as they appear in your letter: (1) An electric lamp of 5 volts and 5-c.p. will take a current of 3 amperes, and this is a rate too rapid for a battery; 8-volt lamps are preferable. (2) All lamps, from 2½-c.p. to 20-c.p., are retailed by Mr. Bottone, Wallington. (3) A chromic acid or bichromate battery of four cells, each having a capacity of half a gallon, will supply current to an 8-volt lamp for from five to six nights with one charge of solution, if only used for three hours each night. If you only want a small night-light to see the time by night, and so on, see my reply on this subject to FRISKY, on page 683. (4) When using the current from a primary battery, such as that mentioned above, it is not necessary to employ a dynamo; but if you employ the portable secondary batteries supplied by Messrs. Cathcart, Peto and Radford, Hatton Garden, E.C., a dynamo will be needed to re-charge the cells when they are exhausted.—G. E. B.

**Marine Boiler.**—G. A. S. M. (*Birmingham*).—It is difficult to answer such a question without knowing more about your requirements. Do you want a regular marine boiler with internal tubes and smoke-box, for coal or charcoal, or do you want an externally fired one heated with spirit lamp, or a vertical one heated with coal or lamp? If you will give me an idea of your wants I will send a dimensioned sketch to suit you.—J.

**Common Sealing-Wax.**—A. W. (*Caterham Valley*).—A cheap strong wax may be made with powdered resin, 6 oz., and red lead, 4 oz., carefully melted over a slow fire. The *quality* of this may be improved (if cost is not objected to) by the addition of shellac up to 2 oz., and the *colour* by vermilion to a like weight. For sealing bottles, a sufficient wax may be made with two-thirds resin and one-third beeswax, coloured with a little venetian red.—M. M.

**Phosphor-Bronze.**—A. X. E. (*Nottingham*).—This is not really an alloy with a definite quantity of phosphorus, but a bronze which has been subjected to peculiar treatment. Bronze usually contains a quantity of cuprous oxide, which has been formed by the oxidation of some of the copper during fusion, and the presence of this oxide reduces the strength of the alloy. By adding phosphorus, the cuprous oxide is reduced to metallic copper, and a pure bronze of great strength and resistance is obtained. If the quantity of phosphorus added be the exact amount required to completely reduce the cuprous oxide, no phosphorus will be found in the resulting bronze; but, all the same, it will be still called a phosphor-bronze. Thus it is not a special alloy, but all bronzes can be converted into it. The phosphorus is added in the form of copper phosphide or tin phosphide, or some of each. Copper phosphide is made by heating a mixture of four parts superphosphate of lime, two parts granulated copper, and one part fine pulverised coal in a crucible at a moderate temperature. The melted copper phosphide, containing 14 per cent. of phosphorus, separates out at the bottom of the crucible, and should be quite black. Tin phosphide is made by placing a bar of zinc in an aqueous solution of tin chloride. The deposited tin is collected and put moist into a crucible, on the bottom of which are placed sticks of phosphorus. The tin is tightly pressed into the crucible, which is then gently heated till flames of burning phosphorus no longer issue from the crucible. The resulting tin phosphide is a coarsely crystalline mass of a tin-white colour. To convert ordinary bronze into phosphor-bronze, the alloy is melted, and small pieces of copper phosphide and tin phosphide are gradually added. The quantity added depends on the purpose for which the phosphor-bronze is required. Ordinary phosphor-bronze contains 2 per cent. or 2½ per cent. of phosphorus, and the best 3 per cent. or 4 per cent., although there is very little in the following analyses:—

| | | | |
|---|---|---|---|
| Copper | 90·34 | .. | 90·86 |
| Tin | 8·90 | .. | 8·56 |
| Phosphorus | 0·76 | .. | 0·20 |
| | 100·00 | | 99·62 |

A bronze containing 7 per cent. to 10 per cent. of tin gives a phosphor-bronze of greatest hardness, and suitable for bearings, etc.—F. B. C.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Steel Springs.**—WING writes:—"Can any reader of WORK inform me where I could procure a supply of steel springs, similar to those used for American clocks, about ⅜ in. wide, but in lengths of 22 in., and coiled to a diameter of 3 in?"

**Mounting Old Engraving.**—F. E. D. (*Bridgend*) writes:—"Will some kind reader of WORK give me a little instruction in the following? I have an old and, I think, valuable engraving, which is pasted on an old newspaper, and has been folded so many times that it is nearly in four pieces. Can someone tell me the proper way to mount on canvas stretcher previous to framing?"

**Early Riser's Friend.**—WILL writes:—"Can any reader who has made that Early Riser's Friend, described on pp. 423-425 of No. 131, Vol. III. of WORK, tell me through 'Shop' how much brass and zinc I should require to make same, where I could procure them, and at what price?"

**Photography versus Painting.**—A. B. (*Glasgow*) writes:—"Could any reader of WORK oblige me with the best method of photographing from an oil painting, if there is any special preparation put on the painting, or any special lens in the camera? I have had this tried with several first-class cameras by men experienced in copying photos, both landscape and portraits. They have always failed at the paintings, and have spent largely both in time and money in experimenting. We all think it rather strange, as the picture is quite distinct on ground glass before dark slide is put in, and the exposure has been tried at all stages; but still there was something wrong, so I am anxious for the information."

**Quick Drying Medium for Oil Colours.**—JUNIUS writes:—"Can any reader inform me as to the medium used by rapid painters (known as lightning artists) which causes the colours to dry on the canvas in less than an hour? I want a similar process for some work I have in hand to be executed on card for novelties, etc. Also what ought I to use for priming the card, which is straw-board, to prevent colours from sinking?"

**Dexter Fret Machine.**—E. W. (*Cupar, Fife*) will thank any reader for the address of the maker of this machine, or of a *depôt* where parts may be bought.

**Telephone.**—A. J. (*Lhanbryde*) writes:—"Could any reader kindly inform me where I could get directions, with an accompanying sketch of a Pulsion Telephone, whereby I could construct an instrument of that kind?"

**Roasting-Jack.**—NEWSTEAD writes:—"Will any reader kindly inform me (1) How to remove the gold from some gold blocking on leather? I want it to appear as only blind blocking. (2) How to make an inexpensive roasting-jack to work automatically, but without clock-work arrangement?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Glass Blowing.**—C. G. M. (*Penistone*) writes, in answer to SPES MEA (see p. 542, No. 138):—"By blowing glass on a small scale, I presume you mean, making such things as ignition-tubes, bulbs, T-pieces, etc., out of glass tube. This you can do with a blowpipe, but it requires perseverance."

**Water Colours.**—CHROMA writes, in reply to J. P. (*Belfast*) (see p. 574, No. 140):—"The pigments should be ground on a glass slab with a glass muller or flat-bottomed bottle, and mixed towards the end of that process with the medium; in this case a solution of gum senegal in distilled water—proportion, 1 oz. of gum ground to powder, carefully added to two fluid ounces of hot distilled water, and stirred and filtered. This should be kept in a large-necked bottle, covered, but not corked. Its keeping quality is improved by the addition of a lump of camphor. In the process of mixing with the pigment, a very little glycerine is incorporated, and it is this which keeps the colour moist. Sometimes honey is used for the latter purpose, and was invariably so. Of course, different colours require different proportions of medium, but these can only be ascertained by practical experience or experiment; but roughly speaking, the less the medium and the more the pigment the better, but always pure distilled water."

**Book on Locks.**—W. H. (*Edinburgh*) writes, in reply to J. G. (*Bloomsbury*) (see p. 478, No. 134):—"There is a book on the subject of locks, etc., in 'Weale's Series,' published by Lockwood, late Weale; the price is about 2s. 6d."

**Ivory Tablets.**—LIFEBOAT writes, in reply to SEA GULL (see p. 574, No. 140):—"Try the Endolithic Ivory Company, Limited, 61½, Fore Street, London, E.C. They make a speciality of this kind of thing; at any rate, they are largely patronised by organ and harmonium manufacturers for draw knobs."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—J. A. (*Halifax*); E. & S. (*Blackburn*); PROFESSIONAL; R. L. G. (*South Shields*); S. W. (*South Darenth*); J. A. (*Parsonstown*); W. B. MCG. (*Dumfries*); C. L. (*Beverley*); IRON FRAME; A. D. (*Sheffield*); J. W. B. (*Birmingham*); W. L. (*Oldham*); ORGAN BUILDER; J. W. R. (*Liverpool*); CREDE SIGNO; W. T. (*Newcastle*); CONSTANT READER; R. L. (*Ruabon, North Wales*); J. H. (*Keighley*); J. P. (*Accrington*); WICKER; VICTOR CYCLE CO.; L. T. (*Liverpool*); J. H. T. (*Earlsheaton*); A NEW READER; W. T. (*Leicester*); H. M. (*Acton*); W. R. (*Dulwich*); T. B. (*Clapham*); D. S. R. (*Cambuslang*); G. H. A. (*London, W.*); M. T. (*Edinburgh*); G. W. (*Bournemouth*); J. S. H. (*Chatham*); W. J. (*Newchurch*); LEARNER; H. S. M. (*Ripon*); J. R. (*Burnbank*); BRISTOLIAN; SEMPER FIDELIS; MENDIP; T. S. (*Bognor*); TURNER; C. R. (*Ealing*); T. H. B. (*Halifax*); A. M. B. (*Dublin*); SUBSCRIBER, A. D. (*Birmingham*); C. R. S. (*Boston*); J. F. W. (*Leicester*); P. P. (*Withington*); H. M. S. (*Bootle*); A. MCK. (*Manchester*); J. C. (*Manchester*); W. S. (*Cambridge*).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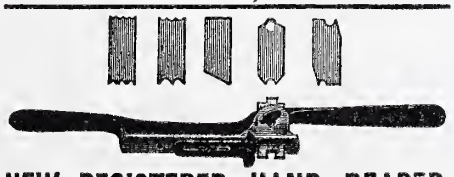

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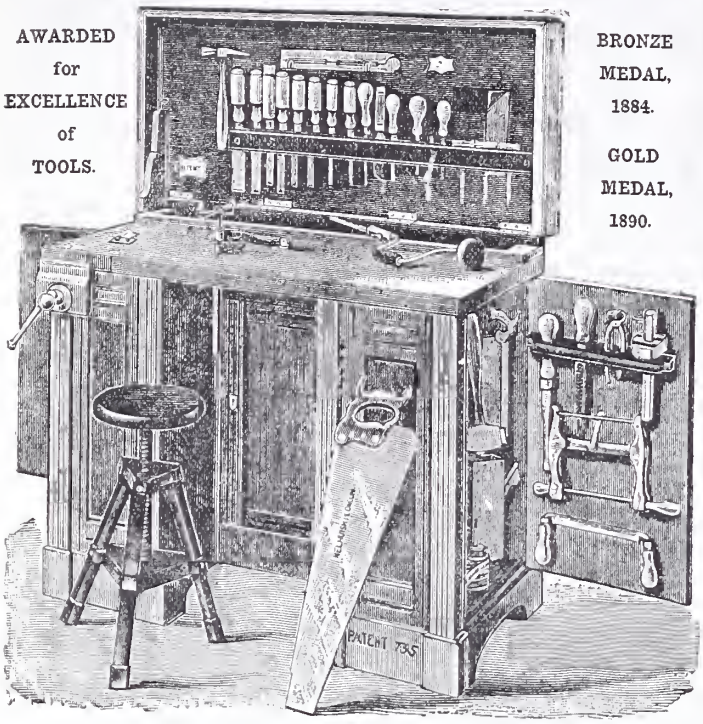

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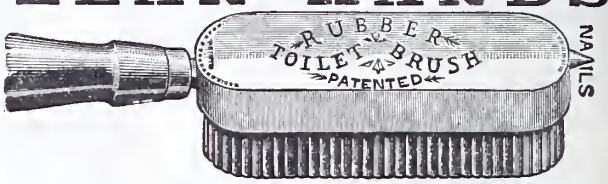


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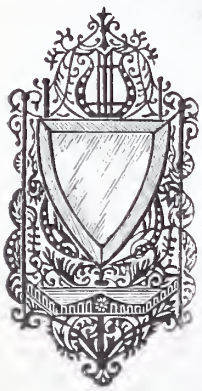

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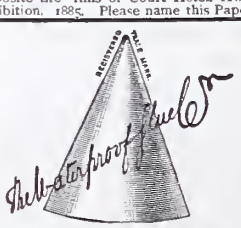


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## An Illustrated Magazine of Practice and Theory

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VOL. III.—No. 148.] SATURDAY, JANUARY 16, 1892. [PRICE ONE PENNY.

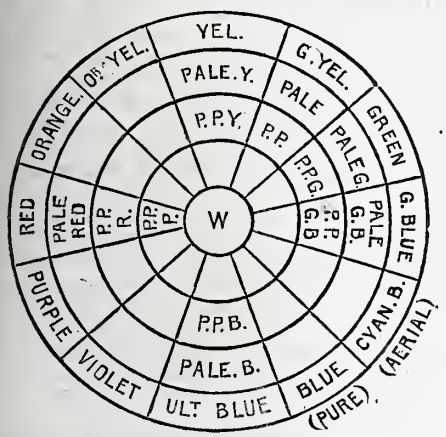



Fig. 1.—Contrasting Colours opposed in Sectors, with Corresponding Tints by addition of White. After O. N. Rood.

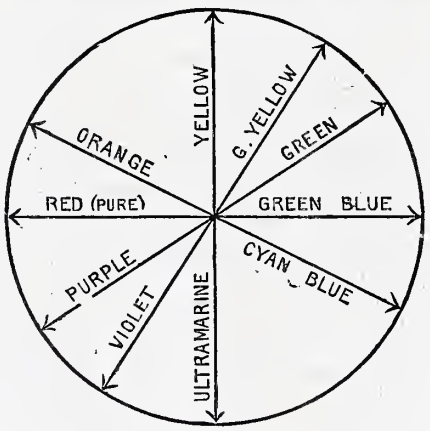



Fig. 2.—Pure Spectral Colours arranged in a Circle to show Exact Complementaries. After O. N. Rood.

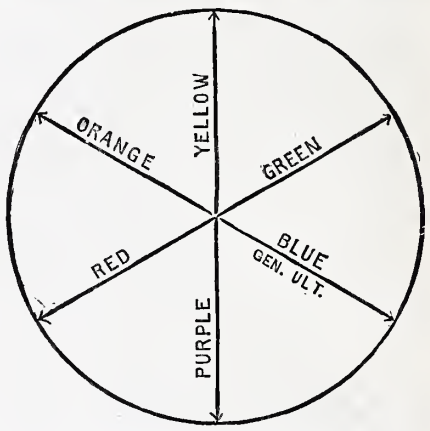



Fig. 3.—Complementary Colours of the Old Theory. After G. Field.

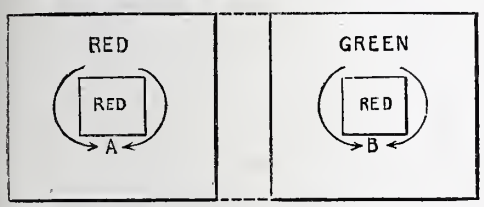



Fig. 4.—Pieces of Red and Green Paper with Red Squares placed thereon. Result—B appears brighter than A.

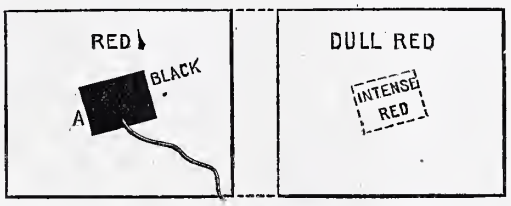



Fig. 5.—Red Paper with Black Disc. Gaze intently, draw A away, leaving Image of Brighter Red.

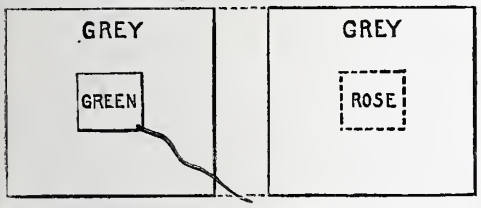



Fig. 6.—Grey Paper with Green Slip. Gaze intently, then remove, leaving Rose-tinted Image.

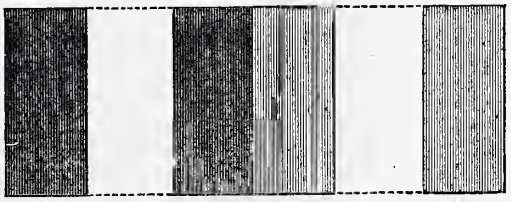


Fig. 7.—Forced Contrast of Shade. Two Tints of One Colour placed thus, the difference appears greater.

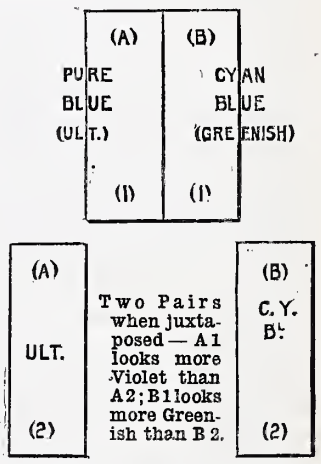



Fig. 8.—Forced Contrast of Hue or Colour Contrast.

*** Figs. 1, 2, 3, showing Complementaries, and Figs. 4—8 for Experiments with Contrast Effects, should be reproduced with properly Coloured Surfaces three or four times larger.

## COLOUR IN OUR HOMES.

BY FREDERICK PARSONS, F.S.Sc.

COLOUR—ITS PRACTICABILITY—ÆSTHETIC PROVINCE AND VALUE—SENTIMENT AND ITS EXPRESSION IN COLOUR—FOR DINING AND DRAWING ROOMS—HALL AND STAIRCASE—STUDY AND SLEEPING ROOMS—COLOUR CONTRASTS AND CONCLUSIONS.

"OF all God's gifts to the sight of man, colour is the holiest, the most divine, the most solemn."

Although a considerable period of time has elapsed since Ruskin sent forth into the world this remarkable sentence, its truth and importance are still almost unknown and unappreciated by the mass of workers. Notwithstanding the reproach that same prophet levelled against us, that as a nation we are insensible to the value of colour, has been of recent years to some extent removed, to the great majority of to-day my opening lines read more like the far-fetched outpourings of an eccentric art critic than as the simple statement of a beautiful fact. That which the art of music is through the sense of hearing—a source of pure enjoyment and elevation of the mind—so a bountiful Creator intended colour to fulfil a like mission through the medium of our vision. Were it not so, for what other reason could the fields be clothed with soothing hues of green, the ripened corn reflecting back, as it were, the glory of the golden orb of day? Why do not the ethereal vaults of illimitable space ever appear a dreary expanse of wintry grey? These and a thousand other like questions have one common answer. Their colour is to cheer and brighten the soul of man. The necessities of our present purpose, however, require that we forsake metaphysical consideration of colour for its more definite and ministering visual aspects. In this latter course we are at once confronted by various difficulties. Teaching colour without being able to appeal to the mind by the aid of samples is akin to attempting to learn a musical instrument upon a dummy keyboard. Worse, indeed, since Do. is the same on all pianos, whilst *my* "aërial blue," "old gold," or "terra cotta" may be considerably different, my reader, from *your* interpretation of these indefinite colour terms. Beyond this fact, successful application of colour demands a foundation of some practical and theoretical knowledge, and here we have but little space for considering either. Incompleteness must, therefore, characterise my paper; nevertheless, if it be the humble

means of arousing the interest of some readers to the dormant claims and pleasures of "colour in the home," to those, at least, this effort will not be unsuccessful.

*The practical utility of colour* is a consideration well worthy a few lines herein. An eminent scientific man and author of valuable works on colour, the late George Field, in answer to a query on the subject, says that colour is of *no use!* This is too sweeping an assertion for us to pass by unnoticed, for although, as he truly writes, the colours of flowers are not known to serve any real purpose, we must discriminate a little when dealing with nature's colour painting and colours applied by man. It would be worse than useless, however, to endeavour to argue this point by the aid of suppositionary deductions from a world without colour. The bare suggestion of a gloomy earth of monotone ranging but from ghastly white to a blackness "that may be felt," is depressive enough for all of us. The colours of ordinary oak-grained or marbled surfaces, the ever-durable range of "stone," "buff," "drab," and brown tones are, however, familiar to us owing to their *usefulness* more than to any considerations of beauty; whilst many of us would strongly object to an exclusive usurpation by the world's creative or purely material objects and forces of the term "useful." In its application to moulded form, as shown in a preceding paper, colour has very definite properties, and especially in the Gothic and Mauresque styles of architecture and decoration it is a form-creative power, giving results entirely beyond the effects of light and shade, or monotone.

It is for its *æsthetic value*, however, that colour must be chiefly studied and employed. As a medium for conveying the poetic sentiments of one mind to the understanding of others; as a pleasure-giving factor in this world of commercialism. This is the cause we are trying to plead. Every year finds musical powers and culture, the source of tonal harmonies, more general to all homes. The province of colour is equally as definite as music, and perhaps more widespread, for Nature gives us all lessons in colour, and evidently meant us to have pleasure therefrom.

*Sentiment* is without doubt the inward and intellectual force of outward, visible colour signs. The faculty of expressing poetic thought by the medium of colour and form does not come naturally to us all, any more than do the powers of poet and musician. Neither, from the same reason, are we alike all able to appreciate and interpret elaborately poetic or, as it is commonly termed, *harmonious* colour. Modern civilisation and scholastic training teach us to dislike harsh discords of sound and colour, but will not enable us, intuitively, to produce harmonious combinations. Even as a limited power of discrimination is common to all of us, so it must further be recognised that natural faculties or "gifts" of expressive power in either music, language, colour and form are but the happy privilege of a limited few. Study and perseverance can work wonders towards the acquiring of these powers, but it is seldom that the highest degree of excellence is reached without the co-operation of the natural, pre-existing faculties. Thus having unburdened one's mind so far as appeared necessary respecting colour "in the abstract," we may now consider it as a power of visual expression.

*Expressions* of colour is a term here used solely with respect to colour language conveyed to the brain through the medium of our vision. The sun's rays—the first cause of all colour—may be considered and analysed both from visual and chemical standpoints, the latter being only intimately concerned, for instance, with photographic and kindred processes. We will content ourselves by now broadly stating a few accepted scientific facts. (1) That white light is composed of all colours; (2) that all colour sensation or vision is caused by the stimulation of the optic nerve; (3) that light reaches the vision in infinitely small wave formations; (4) that the different colour sensations are owing to the various differences in length of these undulating waves; (5) that, with perfect vision, there exist certain colour nerves corresponding to certain colour wave-lengths; (6) that different coloured lights will in some cases produce by their union white light; (7) that coloured lights, and hence coloured surfaces—coloured light necessarily and naturally forming the basis of practical colour study—which so combine are known as complementary colours; (8) that complementary and contrasting colour combinations provide us with a scientific foundation for the principles and practice of *colour harmony*—foundation only! The successful superstructure must be the outcome of knowledge, experience, and faculty.

Having thus briefly set forth the source of colour sensations and the theoretical basis of colour harmony, so far as present considerations required of us, we will again take up the thread of our subject—colour expressions.

The "language of colour," if we may so term it, finds its elements in Nature; whilst the particular sentiments usually associated with particular colours in the ancient science and art of heraldry, and also in symbolism of colour, fully accord with our natural colour impressions. Let us consider the principal colours, commencing with *Yellow*, the nearest in position to white. Yellow immediately turns our thoughts to the source of all light, and—to quote Baron F. Portal—"the heat and brightness of the sun designate the love of God which animates the heart and the wisdom which enlightens the intellect." Heraldic distinctions further associate with it "gold," the richest and most brilliant metal; the glory of midsummer "July" and "noontide;" also "blitheness" and "force"—all of which are characterised by one vein of sentiment.

With *Red* colour we naturally associate fire and heat, or, in its milder sentiments, warmth and comfort. In ecclesiastical decoration red signifies the consuming, never-failing fire of Divine love; whilst heraldry classes with it the age of "manhood," the activity of "passion," and the virtue of "charity"—*i.e.*, love. *Blue* finds its corresponding sentiment in the expanse of the heavens speaking of illimitable space; the truths of immortality; the faith as of childhood; and in heraldry of justice, of the summer season and the element of air. The common association of blue with the cool sensation of water is owing to the sky colour being reflected in the latter; to the blue appearance of snow-clad mountain tops; and, particularly, by reason of blue being a strong and direct colour contrast to yellow and red, viz., light and heat, it follows that coolness and distance are the particular expression of all blue combinations. With *Green* we associate the cheering vegetation of spring-time. Pure green is much more scarce in Nature than we imagine. The coolness and soothing characteristics of Nature's varied green tones is due to a large admixture of cool, grey atmospheric hues. Green in heraldry is classed with "youth" and strength, but as in temper it is designated by the term *bilious*, we still get a suggestive rendering of its dangerous expression when used in a *pure* state. If for the moment we here accept the three colours, red, blue, and yellow, as being primary or source colours, and which by admixture produce every other colour, such being true *respecting pigments*, but totally *wrong in relation to colour* waves, or coloured light, it follows that their colour expression may be equally varied and combined. In addition to the foregoing, however, we must analyse the two extremes, or neutrals rather, of white and black. The sentiment of *white* is pre-eminently "purity," of the "unstained." It is associated with the "morning" of day, the "infancy" of existence; of the "beginning." In heraldry, again, its associates are the element, water; the whiteness of silver, and its floral type is the "lily." Lastly with *black*, as we all know and feel, the mind is stirred to the depressions of winter and night. Old age and decay in their natural order answer not to the colour sensations of childhood, youth, or manhood. The things of this perishable, material earth lose themselves in physical decay, and so, as with colour, the end of the course is neutrality. One point in its connection with the ancient heraldic art we must not overlook, namely, that black in connection with the virtues is consistently interpreted as "prudence."

Now for the practical value and service of the foregoing — its connection with "colour in our homes." In the first place, let us note that as white light contains all and mixes with all colour, so white bodies have the same province in using material colour, both being necessary in great proportion to the service of colour. Taking now the *drawing room* of present civilisation, what should be its colour expression? White ought to predominate either in mass or in combination as tints with other colours—and these colours? First yellow, then its contrast blue. Yellow to add richness and brilliancy, blue to relieve and enhance it—just as the "field" of blue sky in contrast to the sun. But why not pink or green sentiments, it may be asked? For these general reasons—that light, not heat, should predominate, that light and heat together are inconsistent with the sentiment of such a room, and, further, that true green is not only bilious of temper but almost fatal to mixed combinations. Next consider the *dining room*. Its modern purposes are chiefly displayed by artificial interior light, hence white plays but a humble part in its treatment. Red tones for comfort and warmth are most natural. Red also, although classed as a stationary colour, is safer in practice when toned down with black, or in positions naturally shaded. Try a mass of fiery red, then add an equal proportion of black and note the resulting sentiment, "prudent heat"—red toned with black. Again, add white to red, result—heat still too powerfully dominant. *Halls* and *staircases* are not used for living purposes, hence their colour expression may not be so arbitrarily stated. If well lighted by Nature we must restrain our hand in the positive sentiments generally; but if badly lighted, then we aim to give expression to brilliancy and cheer. In our own country, where dull and cheerless weather predominates, the warm and cheerful tones are the most successful. The *study* and *library* are open to much divergence

of colour treatment. Either of the positive colour sensations are in keeping with the use of the room; but expediency must be studied, and unless the natural light is very poor, white and yellow are "bad language." The book or the epistle is the mind's light and cheer; the surroundings, therefore, must not rival its attraction. In *sleeping apartments*, pure and simple, white must stand pre-eminent as correct expression. The pure slumber of childhood, hopeful hearts for greeting the possibility of each day, and the wished-for brightness and freshness of morning are thoughts at one with its use. Nevertheless, we wish not for either in the extremity of their force and agitation, and probably prefer the dominant white toned down with a little warmth (red), or the soft peace of truth and repose (blue); or, again, if our apartment is badly served with Nature's brilliance and strength, we may surround us with *blithe* yellow.

We have now discovered how our homes may be made pleasing *melodies* of colour—visual expression of our minds. But we have not learnt of the *harmonies*, the chords, so to express it, of poetic colouring. The little of this that can be taught by pen and ink is still far too much for this paper. The fringe of the subject we, however, must touch, in conjunction with the foregoing and this with respect to contrast. Good *contrasts* in *colour* are such opposing sensations as heighten and improve each other when juxtaposed; contrast is therefore an important feature in harmony, corresponding to the factor, *interval*, in music. If we have various sentiments of colour under one roof, we also must have satisfactory contrast between them. It has been before stated that in perfect vision there are colour nerves—nerves excited by distinct colour. If one's eyesight is minus its red colour nerves, colour blindness to red is the result; so with other colour. If we tire the red colour nerves by long-continued gazing at red, the remaining nerves which combine with red to convey to us perfectly balanced or "white" sensations have still their strength unimpaired. From this cause, when we glance rapidly from a spot of red upon a field of white to a surface of all white, the space corresponding to the former spot is tinged with the corresponding tint of the unexcited colour nerves. The simple diagrams shown on page 689 will provide experiments for the interested. The scientific aspect of colour contrast concerns us here in this much—that due allowance must be made for it in "home" colour schemes, otherwise we may be disappointed in the complete *ensemble*. For instance, colour a dining room red, of any intensity. Have the hall, or room approach, afterward coloured intense green-blue. The result will then be that the red appears doubly intense and brilliant after looking at the hall colour. Harsh or strong contrast is a matter irrespective of harmony, like a chord, *piano*, and then the same again, *forte*. We live in an age of temperance and moderation, therefore let our colour contrasts be consistent therewith; not autocratic and overbearing in sentiment, like the ancient Egyptian and Chinese colourings, nor depraved and sensuous like the Pompeian, but simple, temperate, and expressive.

For our diagrams on contrasts and complementaries we have borrowed from that invaluable little volume, "Modern Chromatics," by Ogden N. Rood. Although it may not happen that many of our readers will continue the search for colour enlightenment, which we have here endeavoured to initiate, by studying the modern works of Professors Rood and Church, we hope that these results will be found in each case—viz., a perception that untrained "taste" alone, in dealing with *colour*, is little more than an imprudent usurper of the province of study and experience; and further, that successful combinations and colour-studies require something more than a haphazard shuffle of the colour-cards or their accidental kaleidoscopic re-arrangement.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Setting Out—Halving—Dovetail Halving.

Although the two forms of joining wood already mentioned are of great importance, being so frequently used, halving and dovetail halving are of great use in many cases, especially where alterations and additional rails are to be placed in a piece of work already glued up. In such a case, mortise and tenon are out of the question. The setting out for halving is simple, but must be well done to obtain good results. A mortise gauge is not required, but a finely sharpened marking gauge. As halving, so called, need not be exactly what its name implies, the part cut away in each of the pieces may be modified as any special circumstances direct. The gauge is to be applied to the marked surfaces of the wood, cutting up to the lines when making the joint; in one case the front is cut away, and in the other the back. At exterior angles halving needs the assistance of glue or nails, etc., as, unlike dovetails or tenons, there is no retaining property in the joint itself. Nor is dovetail halving much better in this respect; but where halved or dovetail halved joints occur in other places—that is, at the end of one timber and somewhere between the ends of the other—there is a retaining power, and therefore the joint is stronger. I have seen frames for overmantels, all the joints halved and glued, and when slight inequalities of either pieces were removed, and the whole overlaid with ¼ in. walnut glued on, the rebates for glass being formed by the walnut being wider than the pieces composing the frame, a simple but strong construction results. Dovetail halving only differs from halving in the form of the tongue or end, which is cut with the reversed wedge shape which is common to dovetails; only one dovetail is, as a rule, required, and the best use of the joint is when two pieces are to be joined like the letter T. This joint also can be used for work in progress, without the unbuilding which a mortise and tenon would involve.

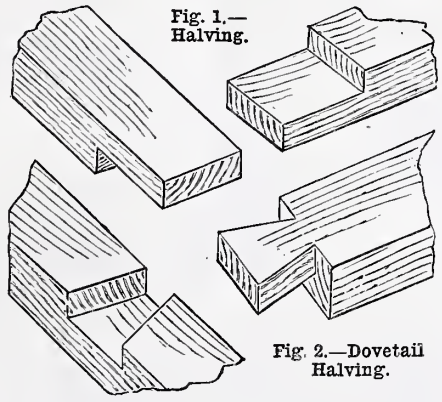


Fig. 1.—Halving.

Fig. 2.—Dovetail Halving.

It is not easy to separate the setting out of this joint from the work of doing it, because the dovetail is generally sawn by the aid of the eye and judgment of the worker, and the socket made afterwards, either by marking with the saw *in situ*, or with a fine scriber or a well-pointed pencil, on the piece of wood in which the socket is to be cut. It is best, however, to mark the intersection of each piece on the other, for such lines form part of the shoulder of the dovetail. When the pupil has mastered these joints he will be able to make a bench, and in so doing he will use each of those already mentioned. The legs will be united in pairs by mortise and tenon, while a continuous sideboard may with advantage be dovetailed at each corner. The cross pieces at the top of the legs may be halved or dovetailed, and the rails which support the top may with advantage be dovetailed or dovetail-halved into the sideboards.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

Toasting-Forks—Block for Formation of Four-Prong Forks—Three-Prong Forks—Machine for Twisting Fork Wires—Gridirons—Their Formation—Steak-Toasters—Gravy Pans, etc.—The Frames—The Hooks—Ladles—The Framework and Spring—Straightening Wires—Second Kind of Ladle—Framework, etc.

**Toasting-Forks.**—In the winter, when a blazing fire is exposed in full glare before us, and we can hear the horses' hoofs continually slipping over the icy roads outside, amidst the struggles of the unfortunate animals; when the hands and face are scorching hot, the eyes dried up, and the vision obliterated by the heat of the fire; and the toes feel cold and are covered with chilblains, while a cold shiver runs up the back now and again, travelling no one knows whither—then is the time when a slice of toast is welcomed, with a cup of tea.

Several of us, no doubt, can testify to the personal discomfort experienced when the operation of toasting is performed by means of an ordinary dinner fork. The fire *will* burn our fingers—and the toast in addition. The man who first invented toasting-forks truly deserves our gratitude. How he was accustomed to make them I cannot tell, but they are at present extensively made in the manner I am about to describe.

*Block for Formation of Four-Prong Forks.*—A wooden or metal block, with four holes drilled through its length (as represented in Fig. 158) is fixed in the vice. Two wires of the proper length are bent as in Fig. 156, their ends being level with each other. A twist is given to the top by means of a small rod (A in Fig. 159), making that part appear as in that diagram. Each of the four lengths is then passed through a hole in the block, as shown in Fig. 158. The rod A (Fig. 159) is inserted in the loop at the end and turned round and round, as in winding a clock. The wires are consequently regularly bent or twisted round each other. When they are twisted a certain distance they will be as shown in Fig. 164, the two outer ends at this point being bent outwards, as appears in Fig. 164, and the two inner ends in a similar manner. The outer ones are again bent as in Fig. 165, and the inner ones also again

as in Fig. 169. The final bending is accomplished by their being placed under a cylindrical object and the remainder of the fork bent upwards, appearing afterwards at the prong ends as in Fig. 168. A wire is then secured across the prongs for purposes of strength.

*Three-Prong Forks.*—Three-prong forks are very numerous, and can be made in a somewhat similar manner to the four-pronged articles just described. Instead of four there must in this case be three holes in the block (as in Fig. 160). And there will also be three wires of the same length as each other. One end of each wire will be bent as in Fig. 157, and all three passed over and under each other as there represented, in order to make a secure and strong job. All are, of course, pushed close together, my purpose for showing them open being to give a clear view of the manner in which they are interlaced. The wires are then placed through the holes in the block, and served in a similar way to the wires composing the four-pronged forks. The instructions given in reference to the latter will be equally applicable to those at present under consideration, with the exception that the middle wire is only bent once, and that as in the curve shown in Fig. 168.

These forks are made in a great variety of lengths. When a particular size is decided upon, a large amount of superfluous wire should be allowed to remain until the rest is twisted up, as during this latter operation, the four or three lengths of wire, as the case may be, will twist up into a much shorter length than they will originally be.

*Machine for Twisting Fork Wires.*—For the sake of expeditious manufacture an arrangement similar to that shown in the drawing could be utilised. A comparatively heavy block, such as, for instance, one made of iron, would have to be used in conjunction with it in this case. A reference to my article on "Twisting" must be made. It will there be seen that this simple contrivance corresponds in a great number of particulars to the one there shown, therefore, the remarks I make in relation to the one described in that paper can be appropriately applied where necessary to the one given herewith. The difference between the two can be seen. The arrangement fitted on the one at present requiring further description is intended to receive the loop of a toasting-fork in order that it may be turned, and thereby twist the wires, by being placed over the rod, B (Fig. 166), and the handle then revolved.

Fig. 166 shows the arrangement by itself. A is a hinged plate, shown alone partially in the same sketch. The rod, B, revolves in a socket at each end, and at the top end of it there will be a catch, as shown in Fig. 166. When about to place the fork loop on the rod, B, the latter is turned in order that the catches may be released, and the plate, A, is lifted. When the loop is upon B, all is again replaced as in Fig. 167.

It is understandable that with such a wheel as this the wires can be twisted in an exceedingly shorter period of time than by the more laborious and tedious manner just described.

The wire trade does not vary from other industries in so far as the various modes of procedure connected with it are concerned; for it may happen that several shops have different processes which they are in the habit of following for the manufacture of the same description of articles. When a master, foreman, or workman hits upon an idea for obtaining by a new method certain results in a particular direction, it is the earnest desire of all connected with that shop to keep such as a secret from outsiders: thus it happens that a description of certain work performed in a certain manner in one shop would be scorned by workmen in some other places, for the simple reason that they are used to doing things somewhat different. Sometimes it will be found that a majority of shops follow a particular method, and wonder is created as to how it is that the minority are ignorant of their fellow-workmen's procedure. Why is it? Because each shop jealously guards its acquired knowledge, and thinks that but a few possess the same information; and if it were not for the fact of workmen leaving one shop and entering another and communicating the secret to their new fellow-workmen, such trade items would still remain unknown to outsiders.

I have slipped these few notes in because it has just struck me that some wire-workers may find that many of the modes here described differ somewhat from those they may have been used to following to obtain the same results.

**Gridirons.** — The homely gridiron is a very useful article, but its brother, the steak-toaster (honoured by other names as well as this), excels it in a great measure. The first is made, like the proverbial cat is killed—in more ways than one. A few years ago a man used to parade the streets with a quantity of stout, straight wires in his possession, and when he had collected an appreciative and apparently speculative audience, he commenced work by taking a straight wire from his bundle, quickly twisting it this way and that way by the humble aid of his fingers only, and in almost as little time as it has taken me to speak of him, he had formed a gridiron similar in appearance to that shown in Fig. 145. He certainly deserved what he obtained—a ready sale for his impromptu manufactured goods.

*Their Formation.*—I am not going to ask any of my readers to perform the task in this manner, although it is really not a difficult one; it was the celerity with which the man accomplished his work which surprised his onlookers. A block, similar to that represented in Figs. 142, 143, and 144, will be required for accurate work. A straight

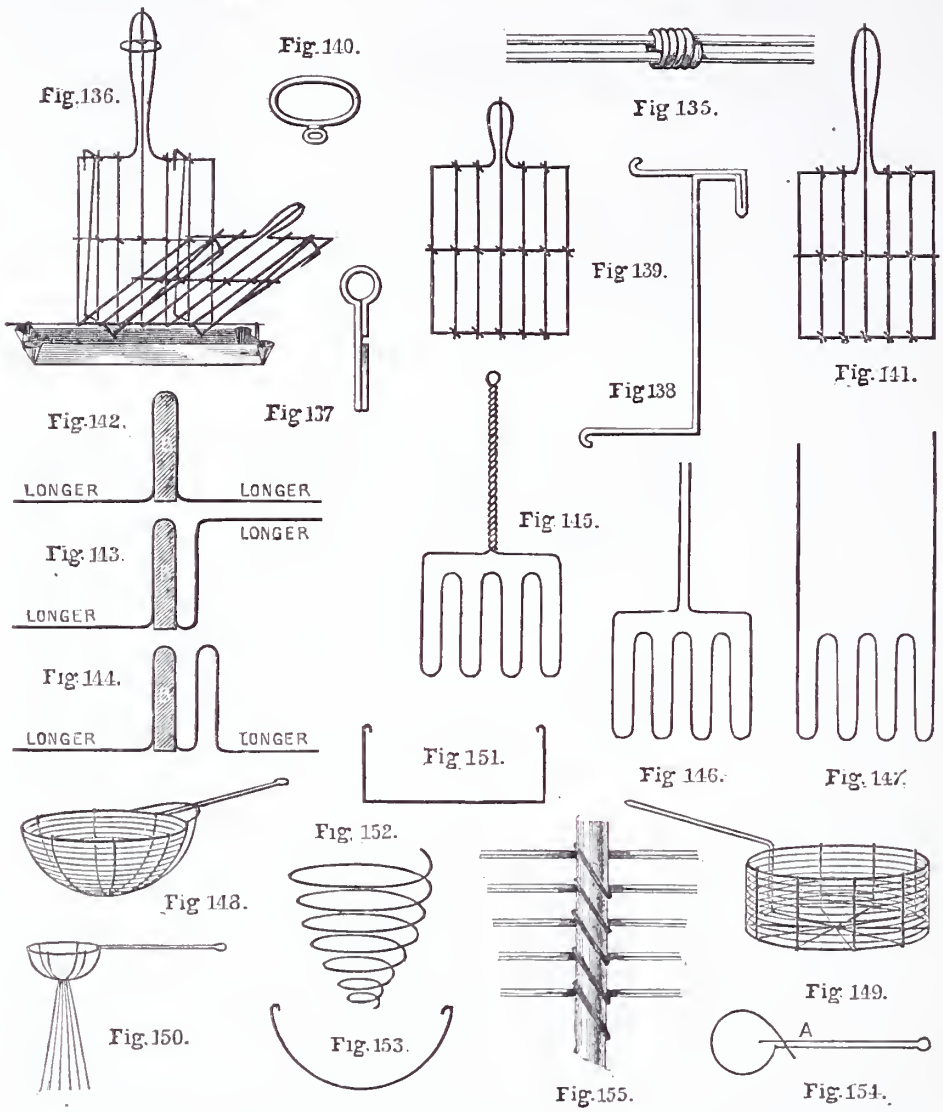



**Fig. 135.—Hinge for Steak-Toaster. Fig. 136.—Steak-Toaster. Fig. 137.—End of Gridiron Handle. Fig. 138.—Hook for Steak-Toaster: four required. Figs. 139, 141.—Frames of Steak-Toasters. Fig. 140.—Drop Catch for Toaster. Figs. 142, 143, 144, 146, 147.—Various Stages in Formation of Gridirons. Fig. 145.—Gridiron. Fig. 148.—Vegetable Ladle. Fig. 149.—Alternative Pattern for ditto. Fig. 150.—Lacing Wires hanging loosely on Handle. Figs. 151, 153.—Framework Wires of Square and Round Ladles. Fig. 152.—Ladle Spring. Fig. 154.—Ladle Handle, etc. Fig. 155.—Section of Ladle.**

wire would first be bent round it as in Fig. 142, in which diagram B is the block. The wire would then be reversed and bent round the block as in Fig. 143. Next it would again be reversed and bent, as in Fig. 144. These operations would take place until the sufficient number of bends had been accomplished. It would then appear as in Fig. 147.

Each clear portion at the sides would then be bent twice, when the shape would be as in Fig. 146. These bendings would be performed by means of a peg driven into the bench. The longer portion would then be shown in Fig. 140. The latter is attached to the wire just mentioned by means of the small eye in it. The front frame is secured to the back one by having three or four pieces of wire twisted around both, as in Fig. 135, thus forming hinges for them. When the steak or other commodity is to be cooked, it is placed between the frames, and the ring wire which travels up and down the longer handle falls over the shorter one, and retains both frames firmly together.

*Gravy Pan, etc.*—Between the frames at the bottom is placed a long loose wire, the ends of which pass through holes or staples handle inclusive, and is turned over in the usual way. Four other wires, two at each side of the long one just alluded to, are also turned over on to the frame, and duly laced, in addition to the latter. Five wires are sufficient for the front frame, and will be turned over and laced similarly to the others. Sometimes a lesser or a greater number of wire bars are used, but the number I state will be conveniently suitable. Across each frame will be a stay bar, also laced in position to strengthen the article.

*The Hooks.*—My notes on hooks in my paper on "Fire-Guards," recently published,

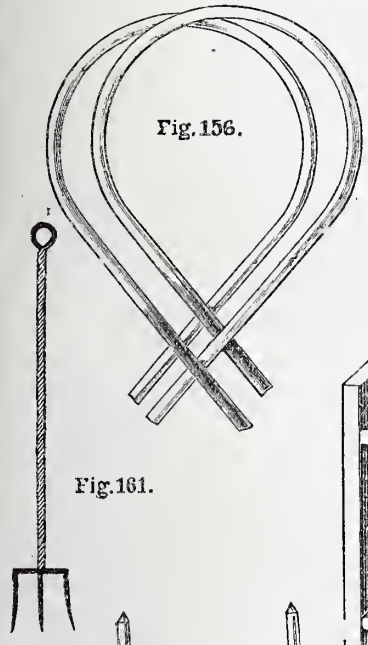


Fig. 156.



Fig. 161.

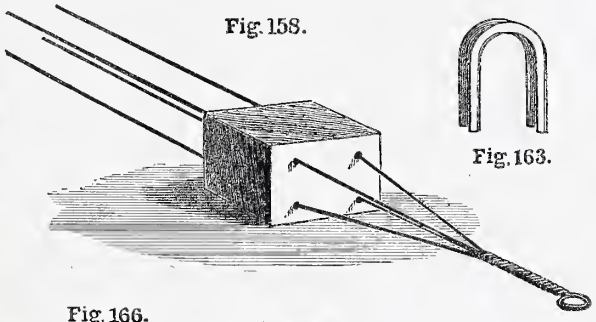


Fig. 158.

Fig. 166.



Fig. 163.

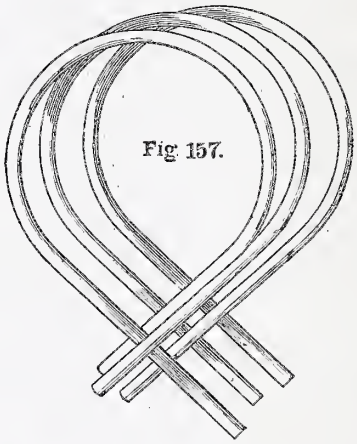
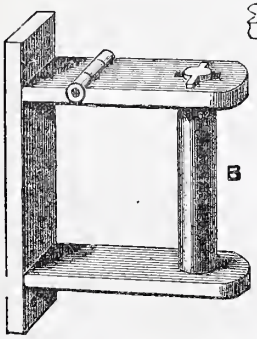
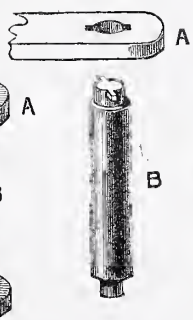


Fig. 157.

Fig. 162.



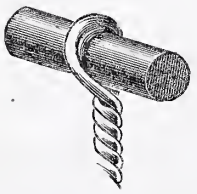




Fig. 159.

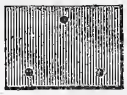


Fig. 160.

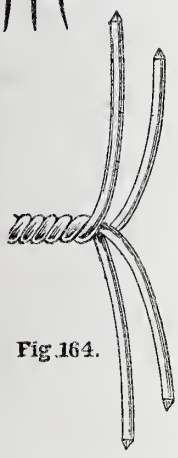


Fig. 164.

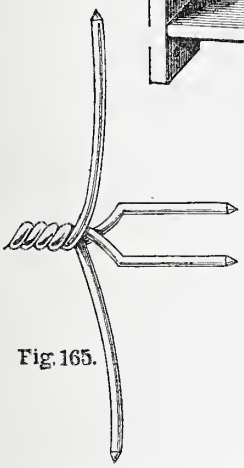


Fig. 165.

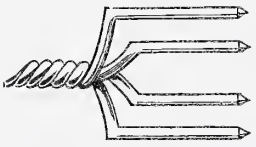


Fig. 169.

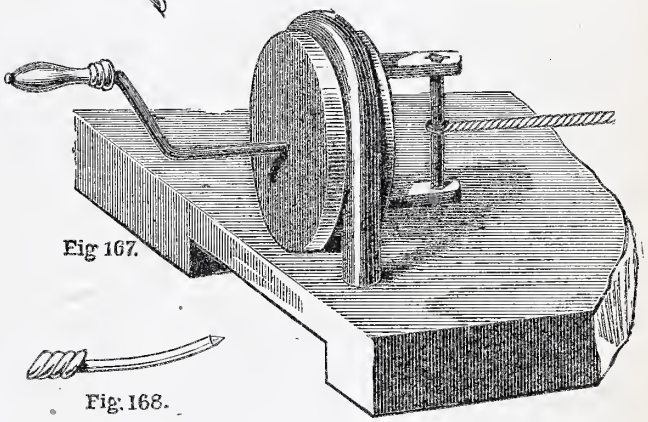


Fig. 167.



Fig. 168.

**Figs. 156, 157.—Loops (loose) of Four-Prong and Three-Prong Toasting-Forks respectively. Fig. 158.—Block for formation of Four-Pronged Forks. Fig. 159.—Peg for twisting Forks. Fig. 160.—Section of Block for forming Three-Prong Forks. Fig. 161.—Three-Prong Fork. Fig. 162.—Four-Prong Fork. Fig. 163.—Top of Four-Prong Fork before being twisted. Figs. 164, 165.—Formation of Prongs of Fork in Fig. 162. Fig. 166.—Portion of Twisting Machine: letters show identity of different parts. Fig. 167.—Machine for twisting Fork Wires. Fig. 168.—Side Elevation of Prong. Fig. 169.—Completion of Figs. 164, 165.**

again bent round a large peg or small block, as in Fig. 137, the further end of it being so placed that it may be parallel to the longest part of the remainder of the wire. The shaft would then be held firmly together by means of a wire twisted around it, or by a strip of tin being similarly twisted.

**Steak-Toasters.**—Let us take steak-toasters—pardon me, dear reader, should the pronunciation of these words result in a slip of the tongue. These articles are made in two separate movable frames, opening from the bottom similar to a book, the handle of one frame being much shorter than that of its fellow frame. Between the wire forming the longer handle runs a straight wire, upon which travels a ring of the shape in a tin tray or gravy-catcher. On each frame are two hooks, their purpose being to hold the toaster to the bars of the grate at which the delicious morsel within is to be cooked.

*The Frames.*—The shape of the front and back frames respectively are shown in Figs. 139 and 141. The wire composing each is bent round pegs to the required pattern, the handle being formed either round a block or by the aid of the pliers. It matters little at which point the ends of the wires finish to form these frames, but the corner I show will be as suitable as any. Then, both ends are either twisted around each other or simply hooked. A middle wire in the back frame traverses the whole length of it, will give all particulars necessary to the formation of the hooks which are required for steak-toasters, the difference between the two patterns being that the latter are much longer, have no intermediate eye-holes, and have a longer bottom bent portion, in contrast to the former. When they are fixed by having their ends squeezed down over the bottom and top wires of the frames respectively, the lower parts of them project and are the means of keeping the toaster's frames away from the bars of a grate.

**Ladles.**—Two of the commonest forms of ladles used for various purposes in connection with vegetables are shown in Figs. 148 and 149. I will take the form represented in Fig. 148 for our first consideration.

The frame of it is shown in Fig. 150. The handle, etc., are made from one length of wire, so bent that the ends of it meet at a point near the part marked A in Fig. 154, where they are secured in the usual manner. To the circular portion of it are then attached two, three, or more nearly half-circular wires, so fastened that the knuckles of them are inwards.

*The Framework and Spring.*—Each loop or bend is so fixed that it crosses the others at a point terminating in the bottom of the article; and between each pair of knuckles the space must be exactly the same. The inside consists of a spiral spring (Fig. 152). I must ask my readers to refer to my article on "The Worm Block" in another number for particulars of the procedure adopted in producing spiral springs. As I there say, the spring will be extended in width. In fixing it to the ladle frame the lower end of it is tied or squeezed over the junction of the hoops, while the other part of it is placed properly within these hoops; and the top end, when cut at the right spot, bent over on to the circular top of the framework. It requires a little care to fix the spring neatly and accurately; but the operation cannot be said to be at all a difficult one to accomplish.

The spring has to be laced in position. It is usually the case that the necessary number of lacing wires are tied to the junction at the bottom of the ladle preparatory to their being finally secured. Each one is then worked along that portion of the ladle frame to which it is adjacent, and fastened off properly to the top of the frame. The second, third, and so on, are afterwards similarly treated, but each one is completely finished off before another is commenced; otherwise the lacing will not be done satisfactorily.

*Strengthening Wires.*—To give strength to the article, there are generally three extra wires attached; one passing from the handle to the bottom of the ladle, and each of the remaining two joined respectively to the straight and circular portions. The under one is sometimes straight.

*Second Kind of Ladles.*—The second form of ladle is perhaps the best for most purposes, on account of its having a flat bottom, thus enabling the user of it to rest it upon anything without fear of its toppling over, or the contents of it tumbling out, which would always be the chance if the round-bottomed ones are used. The remark that was made by Handy Andy concerning soda-water bottles, which he was pleased to say had no bottoms because they would not stand up, has just struck me; and I feel that I ought to follow the example of such a curious authority, and not allow myself to term any part of the first ladle as *round-bottomed*; and in truth there is something philosophical in Andy's ideas, for whoever would dream of speaking of the *bottom* of the world? But there! one must have names for things and parts of things, although a still higher authority has said, "What's in a name?" therefore I term them round-bottomed.

*Framework, etc.*—For the ladle shown in Fig. 149, a frame of the pattern there shown is necessary. My notes upon the round-bottomed articles can be applied to the construction of the flat-bottomed ones in every respect, with the exception that the under parts are shaped as in Fig. 151, and the handle sometimes bent as in Fig. 149. A spring is fitted within in a similar manner, the proper portion of it being flattened against the bottom of the ladle. The lacing will also be the same. Here I might remark that in Fig. 155 I have shown a section of a ladle when laced.

## A USEFUL METAL LATHE.

BY SELF-HELPER.

Preparing Hand-Rest—T's—Fly-Nuts—Bed—Fly-Wheel—Crank—Pitman—Treadle—Driving Band—Conclusion.

The *Hand-rest* casting may now be taken in hand, and is usually found to contain a good deal of sand and grit in the T-slot.

This should be cleaned out as well as possible, and the head of a half-inch bolt filed so that it could run easily from end to end. Sometimes little knobs of metal are found in castings, and if one of them is in the slot, it might cause a great deal of trouble, and should be now removed with a file. The sole of the rest must be made true, either with a file, or, what I find very efficient, a good grindstone. Of course, if it could be planed or milled, so much the better. The hole for the shank of the T-rest may now be bored. It is important that it should be at right angles with the sole, and to secure this the best plan is, I think, to clamp the rest against the face-plate of the working lathe, and bore the hole with a drill pressed forward by the back centre, or held in the slide-rest. A light cut taken off with an inside tool would true it still farther. A 6 in. centre lathe, or one swinging so much in the gap, would be required for this; but those who cannot get the use of such a tool may make a very good job by drilling the hole to a smaller size, and then enlarging it with a reamer. The hole, when finished, may be $\frac{7}{8}$ in. or $\frac{7}{8}$ in. in diameter; preferably the latter, if the shanks of the T's will turn up to that size. A little hole, $\frac{3}{8}$ in. in diameter, may now be drilled in the projection *b* (Fig. 10, page 453), and tapped to take a steel set-screw with a hardened point. Better arrangements for clamping the T-rest are sometimes employed, but this plan will do for all practical purposes.

T's.—With regard to the T's themselves, it is not easy sometimes to turn their stems, owing to the absence of a centre at the upper end; but if the amateur himself makes the patterns, he has it in his power to leave a projection which will take the centre during the turning, and can afterwards be removed. I turned a set of wrought-iron T's once by cutting a channel across a piece of wood screwed to the face-plate into which the top of the T went, the other end being supported by the back centre. This channel will not be across the centre of the wood, but will deviate more or less, according to the forward cant of the T. Some makers of cheap lathes have solved the difficulty of fitting the hand-rest by putting a cored hole in the support, and casting the T-stalk small enough to fit into it; the only fitting then necessary is the set-screw, which is one of the square-headed sort, at so much a gross. As we are not makers of cheap lathes, such a proceeding would be unworthy of us; but the suggestion may be worth something to a man whose spare time is limited.

With regard to the *set-screw*, it would be well to have its head spherical, with a hole across for a tommy; and if a fixed tommy, like a vice handle, were put in, it would be found very convenient.

*Fly-Nuts.*—At this stage the *fly-nuts* will be prepared. Holes must be bored in the bosses for tapping—$\frac{1}{2}$ in. for the hand-rest and $\frac{5}{8}$ in. for the poppet. If, however, the poppet is attached by means of a nut overhead, the fly-nut for the hand-rest only is required.

The hole being bored and tapped, it would be well to take a cut off the upper surface of the boss. This may be done by running it on the tap, or on a mandrel screwed for the purpose, and putting the latter between the centres of the working lathe. The surface so treated should not be quite flat, but slightly spherical, the centre thus bearing first upon the clamping-plate. It is scarcely necessary for me to say that the clamping-plate should have a hole made in it large enough to let the bolt pass freely through.

*Mounting.*—The heads of a lathe are of little service without being mounted, and so the bed, fly-wheel, treadle, and crank next demand our attention.

The character of the mounting may be determined by the success or non-success of the work so far completed. If the heads are worthy of it, a planed bed and turned fly-wheel may be got from some of the lathe-makers who advertise in the pages of this Magazine; whereas, if the heads have been put together in any sort of a way, and it is questionable whether they will ever work at all, the roughest wooden bed and fly-wheel may laugh them to scorn.

*Bed.*—A wooden bed is not by any means to be despised. If a piece of beech or mahogany, 2 in. thick and 4 in. or 5 in. wide, well seasoned and straight in the grain, can be got, it will make a very good bed. The top would be the better of being plated with iron $\frac{1}{4}$ in. thick, which could afterwards be filed smooth and bright; or T or L iron might be used, and a good strong section will serve well. In any case, the upper surfaces and inner edges should be as nearly straight and true as possible. A reference to my former papers on lathes in Vol. I. of Work will teach a good deal as to the mounting of these heads.

*Fly-Wheel.*—It would be a distinct advantage to have a fly-wheel with several steps, as a piece of work of small diameter ought to be driven much faster than a larger piece. Such wheels can now be procured either cast in the rough, from 4s. or 5s. each, or turned, bored, and key-wayed, from £1 to 30s. The last-named run much smoother, and are well worth the difference in price.

A wheel about 26 in. in diameter at the largest step would get up a good speed, and if there was a small step of about a foot in diameter, a considerable amount of metal-turning could be successfully accomplished in this lathe.

*Crank.*—The crank best suited to a wood-turning lathe would, I think, run on centres passing through the legs, as such a plan produces very little friction. The centres of the crank should, however, be bushed with hard steel, as otherwise the points on which they run are apt to produce distorted holes.

The crank should be turned, at least where the fly-wheel comes, and, if appearance is aimed at, all over. A part very important, but usually neglected, is where the hook of the pitman goes. If this cannot be turned, and it is not easy to do so without some special apparatus, it should be filed with the aid of a semi-circular template, cut from a piece of tin or sheet iron to the size of the part on which the hook goes.

The bearing part should be about an inch long, and the hook of the pitman made of flat steel turned over to fit, tempered and hardened. The entire pitman need not be steel, a chain or piece of bent $\frac{3}{8}$ in. iron doing nicely for the lower part.

*Treadle.*—The treadle could well be a

light frame of iron, pivoted, like the crank, to the back part of the legs, or attached with hinges to a bar running from leg to leg, as I formerly described.

A wooden footboard would be attached to the front of the treadle, to take the pressure of the foot during pedalling. The throw of the crank is an important item in small lathes. It should not be more than 2½ in. from centre to centre, which will cause the foot to move 9 in. or 10 in. A higher stroke than this is unpleasant, and causes the lathe to jar.

*Driving Band.*—The best driving band for any high-class lathe is certainly gut, which is secured with hooks and eyes at the ends. It may be shortened or lengthened by twisting the gut more or less. The hooks and eyes are screwed into the ends, and if a portion protrudes into the eye, it is charred off with a hot iron.

*Conclusion.*—If any of my readers make this lathe as it should be made, they will have a tool which will be a credit to them, and do work during their whole life.

I will be most happy to answer any questions on lathe building, or supply any details which I may have overlooked, through the medium of "Shop."

## PHOTOGRAPHY AS A MEANS OF HOUSEHOLD DECORATION.

BY WALTER E. WOODBURY.

### Transparencies.

According to a statement in a contemporary, there are at present upwards of 20,000 amateur photographers in the United Kingdom. When one considers, however, the pleasures to be derived from the art, the figures do not seem so startling. During my life I have met with many hundreds of persons who have taken up with photography as a pastime, and it has often struck me that there are few—a very few indeed—who ever try to turn their work to any useful account. They go through a lot of trials and inconveniences to master the art, and this done, their only desire seems to be to make a lot of silver prints of inferior quality, and stick them in an album. This album usually becomes the terror of their friends, as they are usually compelled to look through it upon each occasion of their visit, and have recounted to them by the amateur scores of hair-breadth escapes and awful and appalling difficulties which had to be encountered—usually told as apologies for the defects which are so plainly visible. I have been a victim of this kind several times, and having some slight knowledge of photography, have often smiled to myself at the awful crams of the "dreadful amateur photographer."

Now, there are so many ways nowadays that photography can be employed for really useful and ornamental purposes, that it really seems a pity that the amateur does not turn his attention to some of them; then, instead of being a nuisance to his better half (if he is fortunate enough to have one, of course) with his "nasty messy chemicals," he will be able to assist her in the ornamentation of the home. In order to be healthy and happy it is necessary that we be surrounded by beautiful things. If we are not fortunate enough to live in a part of the world where we can have trees, flowers, and beautiful scenery, we can at least have representations of them.

Now, in my opinion there is no pastime which affords so much pleasure and genuine satisfaction as that which leaves permanent records of ingenuity and skill. Every time we glance at some useful or pretty object, the construction of which has employed our leisure hours, the pleasure is revived. We recollect the difficulties we encountered and the energy with which we vanquished them, and thus gratification and delight are kept ever green. When, too, a friend rapturously admires some work of art over which we have spent days or weeks of time, with what pardonable pride and self-gratification is the heart filled when we remark in a cool, off-hand manner, "Oh yes, I made that myself," so that the friend will be led to imagine that to you the thing was a very simple task.

I do not think there is any art which lends itself as readily to so many applications. A member of our royal family has already discerned this. H.R.H. the Princess of Wales is an ardent amateur photographer, and has recently had constructed for her a china tea service decorated with views of Scotland made by herself. It is not, of course, possible that every reader of this Magazine is in a position to have 100-guinea tea services made with their photographs; it is my intention, therefore, to show how photography may be used in decorating the house, adding pretty ornaments, or converting unsightly objects into attractive ones, and all this without any very expensive outlay.

The first things we require are good and suitable negatives. Sometimes by scientific treatment indifferent negatives may be made to yield passable results, but it is always best to start with a firm and perfect base. The negative is the foundation, and, provided it be good, it will not be difficult to make almost anything we require from it. Let the amateur select, then, the best negatives he has in his possession.

*Transparencies.*—The first process we will consider is the manufacture of transparencies or positives on glass. There are many processes by which these can be made, the simplest being the exposure of an ordinary bromide dry plate under a negative to a gas flame, and developing with the pyrogallic or ferrous oxalate developer, the former giving brown tones, and the latter black. About the best plates for this purpose are the Paget Prize Plate Co.'s XXX plates. Chloride of silver emulsion plates, specially manufactured for lantern slides and transparencies, will be found to give better results than ordinary bromide plates. A great deal depends upon the colour of the transparency, and this is usually dependent upon the developing agent. To get warm black tones, use the following:—Solution I.: Potassium citrate, 200 grs.; potassium oxalate, 60 grs.; potassium bromide, ½ gr.; distilled water, 1 oz. Solution II.: Ferrous sulphate, 80 grs.; sulphuric acid, 1 minim; distilled water, 1 oz. Add these two solutions in equal parts before required for use. Another developer that gives very nice warm tones is this:—Solution I.: Magnesium carbonate, 76 grs.; citric acid, 120 grs.; common salt, 2 grs.; distilled water, 1 oz. Solution II.: Ferrous sulphate, 140 grs.; sulphuric acid, 1 minim; distilled water, 1 oz. In exposing the plate it should be laid on a printing frame behind the negative, and held about one or two feet from a gas burner. The exposure can be tested with pieces of emulsion paper usually sent out with the plates. No rule for it can, of course, be given, as it varies according to the quality of the negative, the rapidity of the plate, the strength of the illuminant, and the distance from it.

Perhaps the finest method of making glass transparencies is by the carbon or autotype process. This process is based upon the peculiar action of gelatine mixed with an alkaline bichromate to become insoluble when exposed to the light. Sheets of paper coated with gelatine containing a suitable pigment are required. These are obtained from the Autotype Company, and may be had either plain or sensitised. If purchased ready sensitised it should be used as soon as possible, as it does not retain its good qualities for any great length of time. It is better to purchase unsensitised carbon tissue for transparencies, and sensitise it in small quantities as required. This is done by immersing it for two minutes in hot and three minutes in cold weather, in: Potassium dichromate, 1 oz.; liquor ammonia sp. g. ·880, 5 drops; distilled water, 20 oz. It is then dried and preserved in an air and damp-tight box. In printing, pieces are cut to the required size and laid behind the negative on the printing frame. The action of the light being invisible, an actinometer will be necessary to judge of the right exposure. It will be necessary to print much deeper than for ordinary carbon prints, as the images are to be viewed by transmitted light. While the printing operation is taking place the glass to receive the picture can be prepared. This should be of good quality, colourless, and free from bubbles and defects of any kind. It is first well cleaned, and all trace of greasiness removed. It is then coated with a solution made as follows:—Soak one ounce of Nelson's gelatine in one pint of cold water, and when thoroughly swelled, place the vessel containing it in a pan of hot water, and gently dissolve it. Next add sufficient potassium dichromate to give it a golden sherry colour, vigorously stirring the solution the whole time the addition is being made. While warm the glass plates are coated with it and dried in the daylight. We have now the exposed tissue and the prepared glass. These are both placed under water. The tissue, after it has curled up, and again become flat, is laid face downwards upon the gelatine surface of the glass, and the two are withdrawn from the dish. The tissue is then pressed well into contact with the glass by the aid of an indiarubber squeegee. They are then placed between blotting boards for a few minutes, and afterwards immersed in a bath of hot water raised to a temperature of about 105 deg. Fahr. When the pigmented gelatine begins to ooze out from the edges it will be found possible to strip away the paper which had supported the gelatine, leaving most of the latter upon the glass plate. By next laving the warm water on the glass plate all the soluble parts of the coloured gelatine may be washed away, leaving an insoluble picture firmly attached to the glass. It may be found necessary to increase the temperature of the water slightly, especially if the tissue has been somewhat over-exposed. As soon as development is complete, or, in other words, as soon as all the soluble gelatine has been washed away, leaving the image perfect and clear, the plate is thoroughly rinsed under the cold water tap and placed in a bath of: Powdered alum, 1 oz.; water, 20 oz. This has the double effect of hardening the gelatine and discharging the yellow colour produced by the dichromate salt. This glass plate, with the image, is now well washed in cold water, and, when dried, is ready for mounting. This is done by first procuring a piece of ground glass and binding the two together with thin black

gummed paper. Small thin strips of cardboard should be fixed round the edges to prevent the two surfaces from touching.

Transparencies produced by any of these processes can be fitted into neat brass frames made for the purpose, and, if hung in a window, form a very pleasant relief to the eye. Indeed, the windows offer a very large and attractive field for decoration. If a room is nicely and tastefully furnished, the blank left by the window is in many cases a shock to the eye unless it looks out upon a lovely and pleasing scene. In order to relieve this, a framed transparency hung in the window often acts like a charm. Fig. 1 will give some idea of the appearance of a transparency framed complete.

Fig. 2.

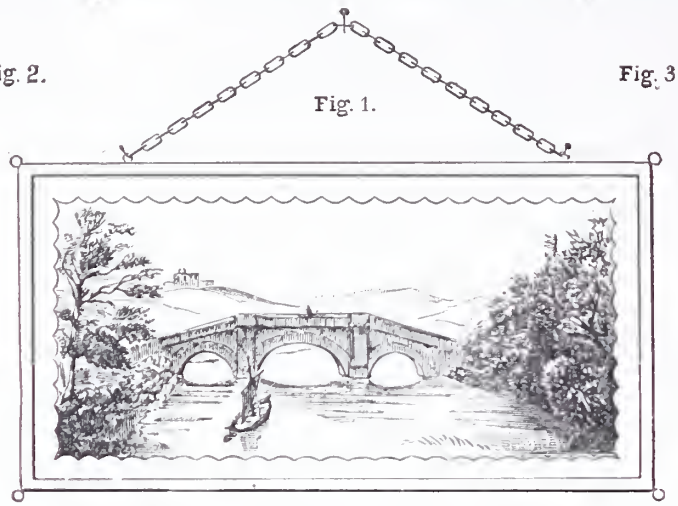


Fig. 1.

Fig. 3.

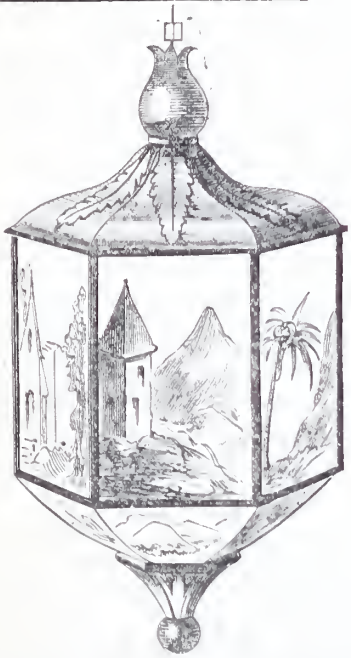


Fig. 4.

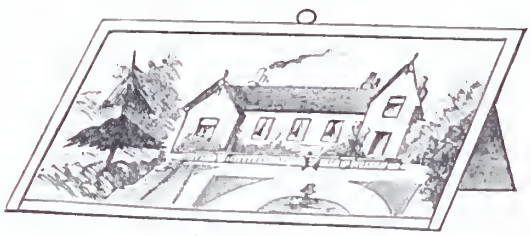


Fig. 6.

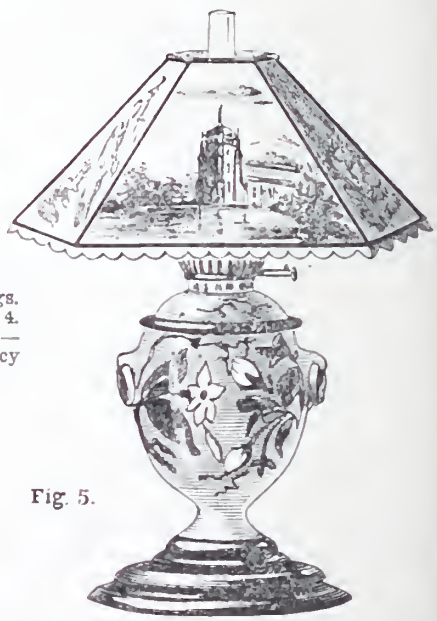


Fig. 5.

Fig. 1.—Framed Transparency to hang in Window. Figs. 2, 3.—Window Sashes treated as Transparencies. Fig. 4.—Hanging Lamp formed of Transparencies. Fig. 5.—Lamp Shade of Transparencies. Fig. 6.—Transparency framed with Sap.

There are few, I fear, who have the good fortune to dwell in a house the windows of which all have pleasant outlooks. In London we are often driven to gaze for ever upon extensive and decidedly unpicturesque views of tiled roofs, smoking chimney-pots, etc., occasionally relieved by the appearance of a few stray cats in search of a convenient place to hold their nightly concerts. These unsightly windows are often filled in with coloured glass or transparent paper, which, unless of superior and costly quality, rarely present any very pleasing effect. Much superior is the photographic transparency. By inserting positive transparencies produced by any of the methods previously described, and fixed in with putty, the distasteful view of chimney-pots entirely disappears without the light being obstructed to any very serious extent. Figs. 2 and 3 will give some idea of a window before and after this treatment.

There are a variety of other uses to which these transparencies may be put. The ordinary hall lamp will rarely suffer by the removal of the glass panes and the insertion of artistic glass views. Fig. 4 will give some idea of a lamp thus decorated, or a very effective lamp shade for an ordinary lamp may be made with a little ingenuity. Any brass-worker will construct the framework, when the transparencies have only to be cut to the required size (see Fig. 5). Smaller shades can be made, and are very effective for a card table or reading candles.

There is one special point to be noted in the manufacture of these ornaments which are subjected to heat—the glass used must be of a good quality and free from air-bubbles; and, further, it must not be made to fit too tightly in the framework, otherwise the expansion by heat will crack it.

I am fully aware that I have not yet enumerated one-half of the uses to which these transparencies may be put for household decoration, but the ones I have given will, no doubt, suggest many others to the reader.

We will now pass on to the uses of ordinary silver prints for our purpose. Every amateur knows how to make these, so no instructions will be necessary. Silver prints, however, even when mounted on cardboard and rolled or burnished, do not form a very attractive ornament. They soon curl and twist about into all sorts of shapes, and appear also to collect all the dust and dirt that is possible. A very effective way of showing off photographs is to mount them in optical contact with glass. The bevelled glass, with backing of leatherette paper leg to stand upon, with a ring to hang to the wall, can be purchased complete, it only being necessary to mount the print. This is done in the following manner:—After the prints have been toned, fixed, and well washed, the superfluous water is blotted off and they are placed between blotting-boards under pressure to dry. Now soak about 2 oz. of gelatine in cold water until it is all swollen, then add sufficient boiling water to make a thickish solution. When all the gelatine is dissolved, filter the solution through a piece of fine muslin or flannel into a porcelain dish standing in a hot-water bath, the temperature of the gelatine solution being kept by this means at about 100 deg. Fahr. The glasses are thoroughly cleaned, all trace of greasiness removed, and the gelatine solution carefully skimmed to remove all bubbles and scum. A print is now laid in the gelatine solution, avoiding the formation of bubbles, and when quite soaked it is removed and laid quickly on to the glass plate. With an indiarubber squeegee it is next pressed well into contact with the glass, and then allowed to dry. The prints should be cut slightly larger than the glass plates, so that after they are dry they can easily be trimmed with a sharp knife to the exact size of the glass. The pictures are made more effective if vignetted or masked, so as

to leave a white margin all round the edge of the glass. When the protective backing has been pasted on they form very artistic ornaments for the mantelshelf or sideboard (see Fig. 6). This method of mounting the print adds considerable brilliancy to it, and also serves to protect it from dirt or atmospheric influences.

## SOMETHING MORE ABOUT SUSSEX "TRUGS."

BY "CHOPSTICK."

INTRODUCTION—KIND OF WOOD REQUIRED—THE WALKING-STICK "TRUG"—THE "CAUL" OR WOOD "TRUG"—THE STABLE OR FEEDING BASKET—THE COAL BASKET—THE LADIES' WORK BASKET—DO., WITH FOLDING HANDLES—THE PARCEL-POST BASKET—FLOWER POT—DOLLS' CRADLES—BUTCHERS' TRAYS, ETC. ETC.—CONCLUDING REMARKS.

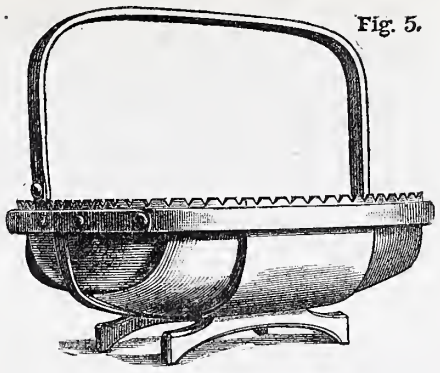
*Introduction.*—The number of letters and inquiries I have received since my previous paper on Sussex "Trugs" appeared in WORK (see No. 85), encourages me to think that the readers of that paper take some interest in the subject, and as I have reason to believe there has been, or will shortly be, several manufacturers starting in the business, I will endeavour to describe some other very useful, and also some very ornamental, forms of the "trug."

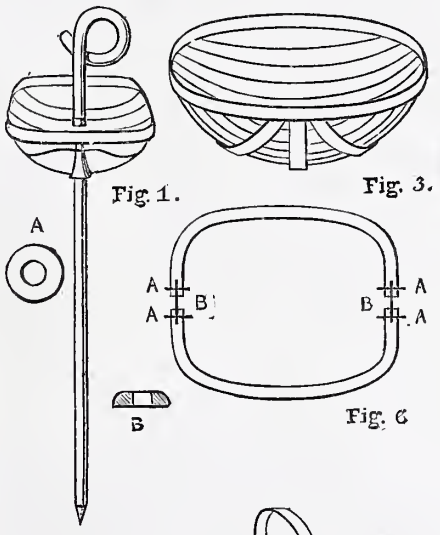
*The Kind of Wood Required.*—In my former paper I mentioned chestnut, and ash for the rims and handles, and "sallow" for the boards, but these seem to be difficult kinds of wood to obtain in some parts of the country; or, at any rate, the chestnut and sallow are. The ash, I should think, could be obtained anywhere. I have been asked by several correspondents to mention a substitute, but that is rather a difficult matter to do, though I think that alder might answer; but, again, I am afraid that would be as difficult to procuro as sallow.

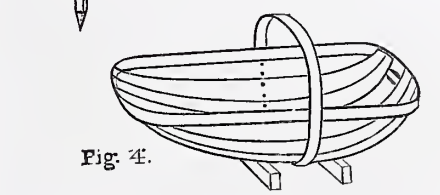
I mentioned the American bass or white wood to one of my correspondents, though whether that would cleave or not, I do not know. If my readers can find no wood suitable, I would advise them to get the toughest wood they can find, and get it sawn into boards as thin as possible. This will require more care in putting the boards in, but otherwise I do not see why it would not answer as well as the cleft boards.

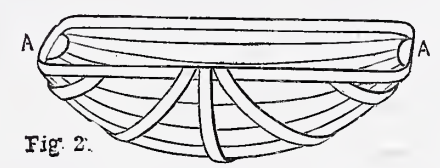
*The Walking-Stick Basket* (Fig. 1).—This, I think, is one of the latest novelties brought out in the "trug" line. Visitors to the Edinburgh Exhibition will remember it at once, as it was exhibited there. It is simply a combination of the trug with a walking-stick, and is very simple to make. First make the trug part, as per instructions in my former paper; only make it about 8 in. in diameter each way. Then make the stick, which is a straight piece of ash with the crook on the top, formed by steaming and bending in the same way as the rims and handles; then cut a hole in the bottom of trug, so as the stick will just go through; but before fixing the stick in, get from a turner's (if you cannot turn them yourself) two collars, as shown in Fig. 1, A (plan), and Fig. 1, B (elevation). Fix one of these on the stick, about 6 in. below the crook; then place the stick through the hole in bottom, so that the collar fits in the trug; then slip the other collar on the point of stick, and fix up close with a small nail, and the walking-stick is complete.

And now a few words as to its use. It is sold very largely in places frequented by tourists, who use it for fern and flower gathering, etc.; by geologists, for collecting specimens; by ladies, for fruit picking; and for many other uses too numerous to mention.



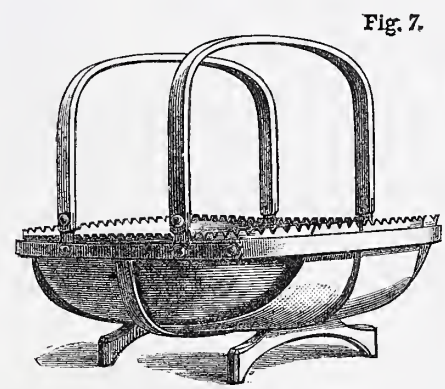




**Fig. 1.—Walking-Stick Basket—A, Collar; B, Section of ditto. Fig. 2.—"Caul" or Wood Basket. Fig. 3.—Stable or Feeding Basket. Fig. 4.—Coal Basket. Fig. 5.—Ladies' Work Basket with One Handle. Fig. 6.—Detail of Folding Handles—A, A, Rivets; B, B, Small Pieces of Tin to form Hinge. Fig. 7.—Ladies' Work Basket with Two Handles.**

*The "Caul" or Wood Basket* (Fig. 2).—This very useful basket I need say but very little about, as far as instructions for making are concerned, as it may be described as a trug of the common kind, only of larger growth. It is made from 3½ ft. to 5 ft. long; and as this would be a very unwieldy burden for one to carry, the handle is dispensed with, and instead a hand-hole is cut at each end, just under the rim (A, Fig. 2). This enables one person to take a firm hold of each end, and carry a considerable load of firewood or coal, or whatever it is being used for. You will notice that it has a rim the same as an ordinary trug, and instead of the handle going over the top, it stops at the rim, to which it is nailed. There are also two other rims (or rather braces, as they are called) on each side. The boards are thus nailed in five different places, which makes it very strong and durable.

*The Stable or Feeding Basket* (Fig. 3).—This form of trug has, I believe, been sold in thousands since its introduction a few years ago. It is, as its name implies, for the purpose of feeding cattle and horses in their stables, and is largely used by the army. I think this fact will convince anyone of its usefulness. It is made in the same way as the trug, except that it is quite round, and about 20 in. in diameter, the framework consisting of the rim and three braces, as shown in the figure. Further instructions are, I think, unnecessary, so I will pass to—

*The Coal Basket* (Fig. 4).—This is very similar to the common trug, except that it is made smaller at one end than the other, and the handle is placed closest to the wide end. A hole is also made under the rim at the wide end, in the same way as in the caul basket. This makes it very convenient for the purpose it is intended for—viz., to throw the coal on the fire, and thus dispense with the ordinary coal-scuttle and shovel. As this basket is made the same as the common ones, instruction is unnecessary.

*The Ladies' Work Basket* (Fig. 5).—These very handsome baskets are in great demand wherever shown, and are also used for many purposes, as well as the one mentioned. They are made in various sizes, ranging from 5 in. in diameter to 15 in., and are ornamented in various ways. I think, perhaps, I cannot do better than give a few detailed instructions for the making of these. The rims and handles are made on blocks in the same way as the common variety, but, of course, more care must be taken with the work, and they must be made much lighter. The boards also must be shaved as thin as possible, and a good finish is given to the basket by nailing them together with silvered upholsterer's nails. After the boards are put in, they should be trimmed round, about ⅛ in. above the rim, and then small notches cut with the knife. This gives the basket an ornamental appearance, without requiring much time to be spent on it. A good effect is also given by staining each alternate board a different colour. Needless to say, this must be done before the boards are nailed in.

These baskets are much improved by making the handles to revolve, or, more properly speaking, to fold down. This is effected by cutting the handle asunder, just above the rim, and inserting a piece of tin about an inch long, half of it in each part, with a tin-tack through each, which forms a hinge for the handle, and allows it to fold easily.

If I have not made it quite plain, Fig. 6 will explain it clearly. B, B, are the pieces of tin, and A, A, A, A, are the rivets. Figs. 5 and 7 are photos of these baskets, showing them with one and two handles respectively.

*The Parcel-Post Basket.*—This I need say but very little about, as its use is not so general as the other kinds, though for those who send game or fruit, or anything in that way, by parcel-post, it will be found useful. It is simply two ordinary baskets without handles, hung together at one end by the rims, so that, when folded together, they form a box. The rims can be tied together at the other end, which makes all secure. The chief recommendation of this article is its lightness, which saves postage, and its strength, which secures the contents from harm.

*The Flower Pot.*—Very handsome flower pots can be made out of the same materials, and in the same way as the trugs, though, perhaps, they can hardly be called trugs. To make them, first make an octagon out of ½ in. deal, of the size that the inside of the flower pot is wanted: this will form the bottom of the pot. Then make a rim of the same size: this is to fix the boards to at the top. Then prepare eight boards, if a small pot, or sixteen, if a large one, and proceed to nail them, first to the bottom, and then to the rim, with silvered nails; then trim off, and ornament in the same way as I mentioned for ladies' work baskets; and when you see the effect, you will buy no more ornamental flower pots. These can be used either as standing or hanging pots, and can be finished off with enamel, which gives a very pretty effect.

*Dolls' Cradles.*—These can also be made of the same materials, but the trug maker will now have gained such an experience that this and many other useful articles will suggest themselves to his mind; and to take up space in describing the process of making, would only be to waste both my time and the reader's as well, and the same will also apply to the last article on my list—

*The Butcher's Tray*, which is so exceedingly simple to make, that I will leave it in your hands, and pass on to my

*Concluding Remarks*, which will be very few.—In the first place, I wish to mention that, soon after my first article appeared, I received a letter from a firm in the trade, whose intention, I have no doubt, was to get a free advertisement; but if this should meet their eye, they will see that I have mentioned no names, as it would be very unfair to the others in the trade for one to be mentioned and not the others. The firm in question very much wished to know where I got my knowledge, and for their benefit I beg to inform them that I have been through not only their own works, but I believe every other one in the trade. This statement should also give my readers confidence that I know what I am writing about. I have said all I can say about "trugs," but I will repeat what I have said before—that I shall be pleased to answer any queries that may be put to me through the columns of "Shop"; and if this paper brings me as many letters as my former one did, I shall be satisfied that my efforts are, at any rate, appreciated by the readers of Work.

Those who have not yet gained experience in the work by actual manufacture, will note that if the cradle is to rock it will be necessary to put curved rockers under the tray itself, instead of the straight pieces of wood that are generally added to it as feet.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of Work for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of Work without charge, the notices given partake in no way of the nature of advertisements.*

### 102.—Hodgson's Registered Draught Excluder.

I may begin by saying that ventilation is one thing and draught altogether another, and that although it is imperative to promote and find proper means for securing the former, it is equally incumbent on us to guard against the latter and all the ill-effects which arise from it. A simple and apparently effective appliance for stopping draughts is to be found in "Hodgson's Registered Draught Excluder," the nature of which may be easily recognised from the accompanying illustrations, in one of which—namely, Fig. 1—it is shown in position when attached to a door and the door is closed, and in Fig. 2 when the door is in course of opening. From these it will be noted that the Draught Excluder consists of two mouldings, one of which is attached to the door-frame and the other to the door itself, and as both are fastened to the *outside* of the door, there is no unsightly addition within the room, and the use of curtains or portières, which are often in the way, is rendered unnecessary. It will be seen from the sectional views of the mouldings, which are not very far short of full size, that the one which is affixed to the frame or stop, which forms the uppermost member of the frame, has a hollow taken out along the inner edge or side, and the other has a bead run along the inner edge of the upper surface, which fits closely and with exactness into the hollow in the edge of the first moulding. It is fixed up the sides and on the top, but it is not available for the draught which comes under the door, and which must be cured in some other way. The mouldings, it may be pointed out, are effectual in keeping out dust as well as draught, and are applicable for outside as well as for inside doors and windows. There are no springs, and nothing to get out of order, thus the mouldings are as simple as they are strong and durable. They are easily fixed, and as they are inexpensive, they are within the reach of the poorer sections of society as well as the richer. To fix them, it is first necessary to close the door, and then attach the mouldings to the hinged side, adjusting the same with care, so that it does not rub or bind in any way on the other, and then apply them to the top and opening side in the same way. They have been used by many persons in Settle, Yorkshire, where they were first introduced, and are spoken of by those who have tried them in terms of the highest commendation.

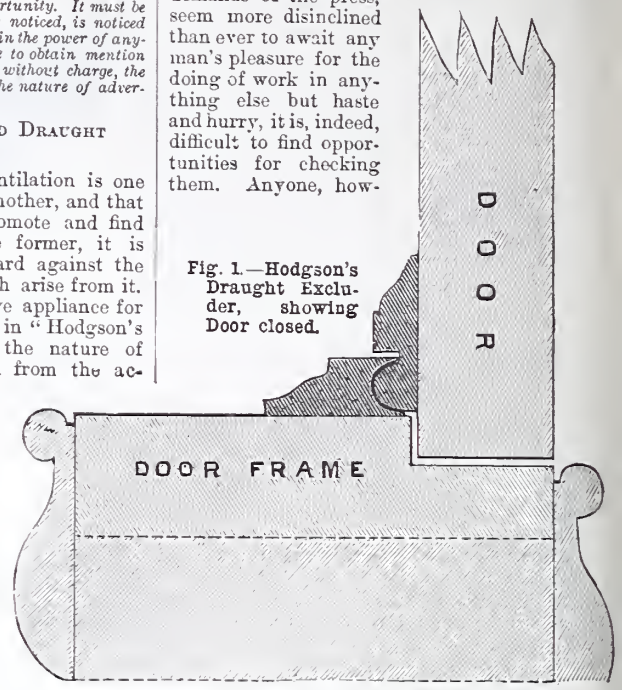



Fig. 1.—Hodgson's Draught Excluder, showing Door closed.

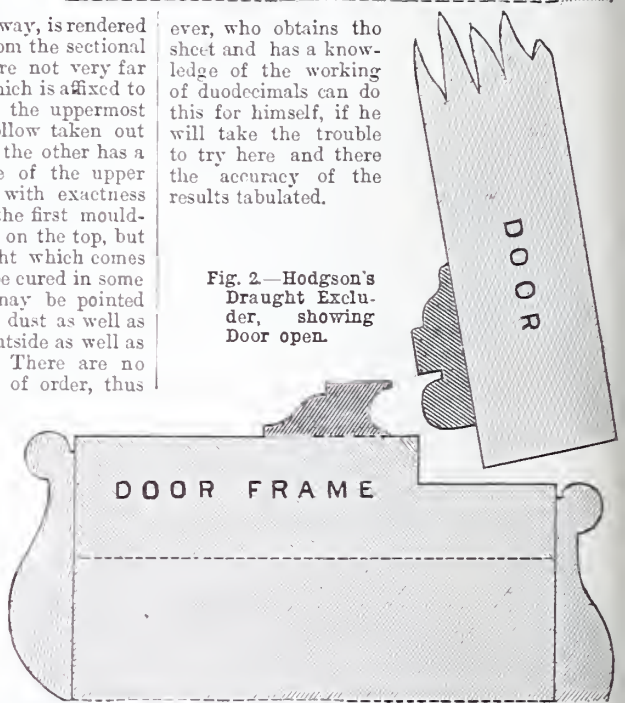



Fig. 2.—Hodgson's Draught Excluder, showing Door open.

### 103.—Tables for Ascertaining Area of Superficies.

In a recent number of Work, a Bradford correspondent inquired for joiners' and builders' tables showing the number of superficial feet in any given measurement of wood or glass. It is a feature that, if carried out at all in trade reckoners, has not been extended hitherto so far as to render the tables in which the matter is dealt with of any great use except in one instance, and that is in a broadsheet issued at a comparatively low price by "The Licensed Victuallers' and Hotel Keepers' Glass and Supply Company, Limited," which is somewhat inconvenient to use, although it is undoubtedly a step in the right direction. The correctness of the calculations given therein I cannot undertake to vouch for, and in the present day, when time and tide and, may I add, the imperative demands of the press, seem more disinclined than ever to await any man's pleasure for the doing of work in anything else but haste and hurry, it is, indeed, difficult to find opportunities for checking them. Anyone, however, who obtains the sheet and has a knowledge of the working of duodecimals can do this for himself, if he will take the trouble to try here and there the accuracy of the results tabulated.

### 104.—"The Amateur."

I have to acknowledge the receipt of various trade journals whose names have been already mentioned in these pages. Among these, attention may be specially directed to "The Amateur." This useful publication, whose utility lies chiefly in its suggestions for the ornamental work that may be so easily done at home in making objects and appliances for its adornment, is still published by Mr. Henry Zilles. It still deals in, and with, subjects for the fret-worker, wood-carver, painter, inlayer, poker-worker, and other work suitable for persons of the class after whom the serial is named, and still holds its own against all comers set on foot to deal with these matters.

The Editor.

## SHOP:

### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Hydrostatic Clock.**—C. W. C. (*Stockton*) writes:—"I here give a brief description and sketch of a clock which I saw at an exhibition at Darlington a number of years ago. I think your readers will not fail to understand it. It was driven by the weight of water in a cylinder which had a spindle through it—each end of the spindle being suspended by thin cord. The cylinder was divided into a number of divisions, each division having a small hole to allow the water to pass from one to the other as the cylinder unwound itself from the suspending cords. So far as I can remember it had to be wound up every twelve hours."—[This idea is no

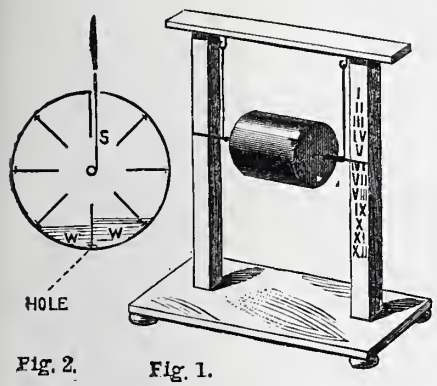
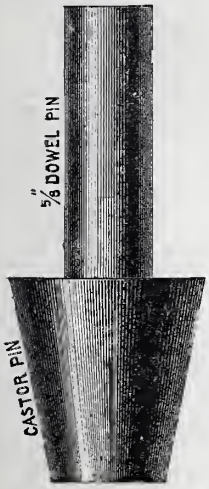



Fig. 2. Fig. 1.

**Fig. 1.—Water Clock Diagram. Fig. 2.—Section of Cylinder, showing Divisions and small Holes in each; also the Water and String (W S).**

doubt ingenious, and the arrangement of the water in the cylinder is curious and interesting; therefore, publicity is given to it in "Shop." As a clock, however, it can only be classed as a "fad." It might tell the time for a week or more, but the winding it up and collecting the water at the right spot, in order to start it at the right point, would be, we should think, a great difficulty. The holes might corrode or get blocked up, and then where would the time be? If a clock of an out-of-the-way kind be desired, a large sand glass would probably be a more correct time keeper. But why go so far into the wilderness when every market is deluged with Walthams and Waterburys?—ED.]




Castor-Pin.

**Worn-out Castor-Pin.**—A. X. E. (*Nottingham*) writes:—"To repair a chair or table leg having a broken or worn-out castor-pin, the following is a good way: Take a piece of birch, beech, or oak, about 4 in. long by 1½ in. by 1½ in., and turn it to fit the castor cup, with ½ in., ⅝ in., or ¾ in. dowel-pin, according to size of leg to be repaired; a ⅝ in. dowel-pin would be suitable for an ordinary easy chair leg. Cut off old castor-pin level with shoulder on bottom of leg; then bore a hole in the centre of leg with a dowel-bit, the same size as dowel-pin, taking care to bore quite true; now fit new pin and glue into leg, then refix castor, and the job is finished. If done carefully the leg will be as sound as when new."

### II.—Questions Answered by Editor and Staff.

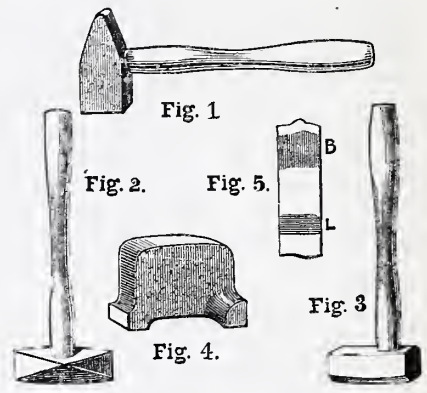
**Driers.**—E. S. (*Manchester*).—"Terebine" is the name given to a drying liquid, which, I believe, was so termed by the original maker, Powers, of Coventry. Every colour and varnish manufacturer, however, now makes a terebine or liquid drier, and its drying strength is usually that of 1 oz. to the lb. of paint, under favourable conditions. Terebine combines far more satisfactorily with linseed oil for drying than does japan gold size, a similar mixture. The latter is most useful in compounding "flatting" and quick-drying paints for varnishing upon. I am unaware of any reliable recipe for making this useful painters' commodity having previously been published; but, through the kindness of Messrs. Mathieson Bros. (Colour Manufacturers, Ardrossan, N.B.), I am able to contribute a simple but thoroughly reliable recipe, which I am further confident will prove very useful and valuable to many professional painters: Take 2 lbs. ground litharge, 2 lbs. red lead, 1 lb. sulphate of manganese, ½ lb. sugar of lead; put all these into a pot, and mix with them four or five gills of pale Japan gold size, until the lot can be easily stirred. Then add about ½ gal. of American turpentine. Now leave the whole to stand, with occasional stirring, for a few days (not less than three), and its materials will act without heat. After the expiration of the few days, the clear resultant liquid—terebine—may be taken off, and more "turps" put on the materials, for the *second* and *third time*, with equally satisfactory results. Half proportions of these component articles may be used with equally good results. Those subscribers, and professional painters especially, who desire to avail themselves of this recipe, cannot do better than write to Messrs. Mathieson for the dry articles named, from which firm all readers of WORK will receive courteous and prompt attention.—F. P.

**Shellac Varnish.**—W. L. C. (*New Cross*).—The subjoined recipe for making a reliable shellac or "spirit" varnish is one coming from a most reliable source, and which, should you determine to act upon it, ought to work out as well as it reads. Take 3½ lbs. orange shellac, ½ lb. gum benzoin, 1 gal. methylated spirits; put all these (or in same proportions for larger or smaller quantities) into a closed stoneware or earthenware vessel. Shake the mixture occasionally, or, if the varnish is required at somewhat short notice, the lac, etc., will dissolve more quickly by slightly heating. The fluid ought then to stand in an open vessel for a few days before being used, and requires, finally, straining through a piece of strong fine muslin or fine wire cloth. "For a cheap varnish for fretwork brackets" you might be satisfied with "Patent Knotting"—or knotting varnish—thinned down, if required, with naphtha or spirits. This gives a good and hard gloss, and dries almost immediately. The recipe above given gives a spirit varnish much favoured by cabinet-makers and fiddle-makers. The small proportion of gum gives a better surface, and also allows more time for working it.—F. P.

**Ox-Gall in Marbling.**—NO NAME.—Our querist on this matter should have stated more particulars, and what marbling process he means, whether on wall-paper, book edges, or painted walls. The subjoined may, however, aid him: *Ox-gall*, when mixed with water colours and pigments, acts as a binding vehicle, but is chiefly noted for the property which enables us, by its addition, to manipulate water mixtures upon polished or greasy working surfaces. *Borax* has the same property, however, and, for many purposes, is preferable to ox-gall. Oils and varnish may be mixed with water more readily by the aid of borax. I conclude you must refer to bookbinders' work.—F. P.

**Velocity.**—KNARF.—Air will flow into a vacuum at the rate of about 1,829 feet per second when the temperature is 60° Fahr. and the pressure 15 lbs. per square inch. I am not aware that this has been directly estimated, but it can be reckoned from the known absolute velocity of a molecule of hydrogen at 32° Fahr., and 29·92 in. Bar., which is 6,097 ft. per second. The velocities of the molecules of gases vary inversely as the square root of their specific gravities. Oxygen is sixteen times as heavy as hydrogen; hence the velocity of the oxygen molecule, for the same temperature and pressure, would be $\frac{1}{\sqrt{16}} = \frac{1}{4}$ that of the hydrogen molecule, or 1,524 ft. per second. Similarly the velocity of the nitrogen molecule, which is fourteen times as heavy as hydrogen, would be 1,836 ft. per second. Taking air as consisting of four parts of nitrogen to one of oxygen, the velocity of air molecules will be 1,774 feet per second at 32° Fahr. and 29·92 in. (= 760 mm.) Bar. You do not say what is the temperature and pressure of the air you are working with. If different to the above, you can reckon out the velocity from the general formula which applies to all gases—viz., $v^2 = 3\frac{p}{d}$ where $p$ is the pressure and $d$ the density of the gas; but the same fundamental units must be used for both $p$ and $d$. At 60° Fahr. and 2,160 lbs. per square foot (= 15 lbs. per square inch) pressure, the density of hydrogen is 0·00528275 lbs. in a cubic foot. Hence $\frac{p}{d} = \frac{2160}{0{\cdot}00528275} = 408{,}878$ in gravitation units, and if the intensity of gravity be taken as 32·2, then $v^2 = 3\frac{p}{d} = 1{,}226{,}634 \times 32{\cdot}2 = 39{,}497{,}615$, and therefore $v = 6{,}284{\cdot}7$. At ordinary temperature (60° Fahr.) and pressure (15 lbs. per square inch) the velocity of the hydrogen molecules will be 6,284·7 feet per second. Using this figure in place of 6,097 as above, we find that the velocity with which air will flow into a vacuum is 1,829 ft. per second at 60° Fahr., and 15 lbs. per square inch pressure.—F. B. C.

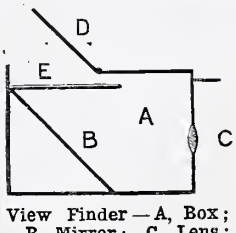
**Saw Hammers.**—A. C. R. (*Cardiff*).—It is a pleasure to me to give a description of tools required for saw hammering. I have given rough sketches of the three hammers and anvil used for the purpose. Fig. 1 represents the long cross-face hammer The face parallel with the handle is the long face, and the other the cross face. The faces are at right angles one to the other, so that the operator may strike blows that will be lengthways in one direction, as in Fig. 5 (L), and by turning the other face, as in Fig. 5, at B. Both faces of this hammer are rounded across the width and a little in the length. The amount of roundness regulates the hammer marks. The roundness of the faces of this hammer should not be so much as that in a hammer used for hammering saws after they have been ground, so that the marks may not be so plainly seen or be so deep in the plate. Fig. 2 represents a twisted




**Saw Hammers and Anvil.**

face hammer which is used for straightening saws and hammering plates that are thick, and long, and of greater diameter. The reason of this hammer being used on long and stout plates is that when a man is hammering a short saw, or one the diameter of which is not very great, he can stand close to the part he is hammering, and bend his elbow and see his work. When a long plate is to be hammered the end has to be held with the left hand, and being far from the anvil the twisted face hammer has to be used; then the operator can reach his arm straight out to reach his work, and by turning the twist hammer over he can vary the direction of the blow as with the long cross-face hammer. It will be understood that these hammers are used for straightening the plate. Fig. 3 represents a dog-head hammer, the face of which is rounded. This hammer is used to equalise the tension, as a blow struck with the dog-head will have equal effect Fig. 4 represents the anvil on which the saws are to be hammered, the face of which should be hard and slightly convex, so that the plate may have a solid bearing on the anvil. If the plate does not lay dead or solid on the anvil, the blow from the hammer will indent the plate, and the blows will not have their desired effect. I might say that, as a rule, the cross-faced and the dog-head hammers are the only hammers required outside of the smithy, or works where the saws are being made, and that the average weight of these hammers is about 3 lbs. The blows delivered should be regulated according to the thickness of the plate.—A R.

**View Finder.**—T. M. (*Liverpool*).—There are several kinds of view finders: those attached to the camera and forming part of it, and those entirely separate. The simplest kind is a double concave lens, mounted in a frame with an oblong opening of the same proportions as the plates to be used. This is either held in the hand or fixed on the top of the camera; the view will be seen in miniature in looking through it. Another is practically a small camera with the view reflected on the ground glass of the same proportion as the plate used, and may be carried as separate instruments or attached to the camera as in the usual hand cameras. The best is when two lenses of equal foci are used, as in the artist's camera, which is neither more nor less than a double camera, one for viewing the image, and the other for taking it. A useful finder may be made of a small box about 3 in. long, 2 in. wide, and 2 in. deep, with a simple double convex lens, of 2½ in. focus, arranged in the manner shown above.—D.




**View Finder—A, Box; B, Mirror; C, Lens; D, Shade; E, Ground Glass.**

**Grinding Stone.**—J. B. (*Castle Eden*).—You can procure a stone from John Dove & Co., St. Nicholas'

Buildings, Newcastle-on-Tyne. You must give them the size and say what you want it for. As it will most likely be a small one, they may not have it in stock, but will be able to get one for you. Do you think a stone will be suitable for razors? I should think a buff wheel—that is, a wooden wheel covered with leather on the edge, and sprinkled with fine emery—would be more suitable.—M.

**Slate Slab.**—G. A. W. (*Holloway*).—Draw a line on the slab at both sides where you wish to cut it, then take a joiner's tenon saw, about 12 in. long, and saw to the line. You must be careful to start the saw square, and have the slab firmly fixed. As 6 ft. is rather a long cut, you may have to sharpen the saw before you get through; but you will find it cut very well. I have sawn several in this manner. —M.

**Finishing Stove Grate.**—DOGIREM.—There is no method by which you can finish an ordinary mantel sham in the manner referred to, except by first grinding and glazing. You can, however, improve it in the following manner: Go carefully over the whole surface, and file level all projections: then take a piece of sandstone with a level face, and scour the whole surface, using circular strokes, till you get a fairly smooth surface, and finish with emery-powder and water, laid on with a level piece of wood; clean off and dry, and give a coat of paint. When the paint is quite dry, rub down with fine glass-paper stretched on a piece of board, and keep on painting and rubbing down till you get a satisfactory surface, when you can finish in any colour you wish. The paint should be of the best quality, and if you are not able to judge the quality of the ingredients yourself, you had best get a practical painter to mix it for you, telling him for what purpose you require it; as although you may know what ingredients to mix, if you cannot judge between good and inferior materials, your work may crack or blister. You will find a good deal of information on painting in Vol. I. of WORK, which, if you have not read, I should advise you to procure.—M.

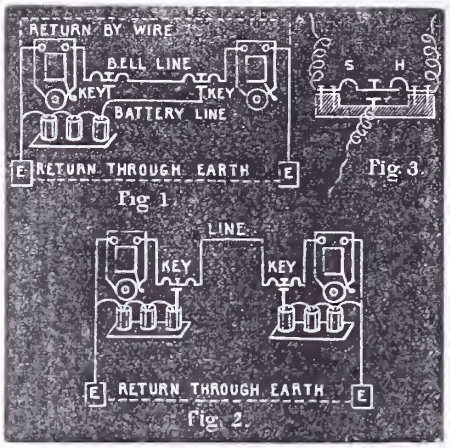
**Model Electric Lights.**—W. G. B. (*Wolverhampton*).—The series of articles on "Model Electric Lights" appeared in Nos. 76, 82, 89, 92, 94, 97, 99, 101, and 104 nine numbers; the whole set can be obtained post free from Messrs. Cassell & Co. for 1s. 1½d., or through your newsagent at the usual price of 1d. per number. In ordering from the office, always enclose an extra halfpenny stamp for each number, to cover postage; thus four numbers will cost 6d. This series of articles covers the whole ground of electric lighting likely to be taken up by amateurs. The first two treat of the principles governing electric lighting; the third gives instruction on lighting by battery power; the next four give detailed instructions for making four types of dynamos; the next deals with accumulators; and the last gives illustrations of the fittings required in an installation.—G. E. B.

**Electric Light Battery.**—G. J. S. H. (*Coventry*). —Always mix sulphuric acid with water by adding the acid *to* the water in a thin stream. If you do the contrary, and add water to the acid, the mixture will boil and spurt some of the hot fluid over the sides of the vessel. This will scald the skin if dropped on it, and will also destroy clothing. First make a solution of 3 ozs. of chromic acid in one pint of water, and add 3 fluid ozs. or a wineglassful of sulphuric acid *to* this mixture. If the connecting strips of copper are the thickness of two sheets of writing-paper, and half an inch in width, they will convey all the current you will get from four cells. The shape of the lamp is of very little consequence. A far more important factor, and the probable cause of failure, is the resistance of the carbon filament in the bulb. A lamp to be worked with four chromic acid cells must be an 8-volt lamp, as this represents the right resistance of the carbon filament. If a 6-volt lamp is used, it will probably burn up with a flash. If a lamp of 9 or 10 volts is used, it will not light at all, because the resistance of the carbon will be too great. If the filament is broken you cannot get a light from it.—G. E. B.

**Electric Light Dynamo.**—OSCAMAW (*Battersea*).—Get Nos. 92, 94, 97, and 99, back numbers of WORK, obtainable for 4d. from a newsagent, or for 6d. direct from the office. In these you will find full illustrated details of four different types of electric light dynamos. To get at the horse-power required to drive any of these, multiply the ampères by the volts, and divide 746 by the product. On p. 614, in No. 92, the No. 2 Siemens may be driven by a ¼-h.p. engine. In No. 97, p. 726, the No. 1 Gramme will serve your purpose. In No. 99, on p. 758, either the No. 2 Manchester or Simplex will come nearest to your requirements. If you take the Manchester type, kindly note that in the diagram 59, on p. 757, there is a slight error. The wire should be shown at the back of the core on the right, going from right to left instead of from left to right. As you are an engineer, you will understand how to make a dynamo by aid of these articles, which were written for amateurs.—G. E. B.

**Design of Small Dynamo.**—T. E. W. FIX.—I have not seen such a machine as that shown in your sketch, or cannot say what power you may expect from it, but should surmise that the results obtained from it as a dynamo would be equal to those got from it as a motor—that is, "very faint" indeed. Why waste time on such an unbeard-of type when good castings of tried machines can be had at low prices? You will find full information on dynamo making in Nos. 92, 97, and 99 of WORK, and will find therein some designs of four useful types.—G. E. B.

**Electric Bell Lines.**—J. M. (*Derby*).—You cannot ring two bells at two opposite stations with one battery working through a single wire. There must be a return wire on the circuit of each bell. Two bells can be rung with current from one battery if two wires and an earth connection be made, or three wires are employed together with special automatic switches or keys, as shown in the annexed diagram; or the two bells may be rung over a single line and earth, if special keys and two batteries are employed as shown in the second diagram. A diagram of the key employed in these arrangements is shown at Fig. 3. It may be made out of a few scraps of spring brass or German




Electric Bell Lines. **Fig. 1.—Diagram of two Electric Bells and one Battery, showing how to work the Bells through three Line Wires, or through two Line Wires and an Earth Return. Fig. 2.—Diagram of two Electric Bells and two Batteries, showing how to work the Bells through one Line Wire and one Earth Return. Fig. 3.—Sectional Diagram of Key employed in the above Electric Bell Systems.**

silver, bent to the form shown on the diagram, and fastened by screws to a wood base. All points of contact should be guarded with platinum. When the key is at rest, the long spring, S, is in contact with the hook, H. When the key is depressed the spring, S, comes into contact with the T-shaped piece below it, and thus connects the battery with the bell we desire to ring. When the key is at rest the home bell can be rung from the distant station, and thus a system of call and answer can be established. This system is more fully explained by me in "Electric Bells, and all about them."—G. E. B.

**Shield and Monogram.**—F. C. (*Belfast*).—Here is the shield and monogram you desire for fret cutting. To make the design a little more complete, some ornament has been introduced suitable for

J. D. B. Monogram for Fret Cutting.

metal or wood-work. Are you now convinced that we don't "think less of correspondents who live in 'Ould Ireland' than of English and Scotch ones?"

**Hour Globes.**—G. H. (*Leith*).—I do not know of any maker, and have been trying to find an importer who makes a speciality of them, but cannot do so; and I can only advise you to try the tool shops: say Haswell & Sons, 49, Spencer Street, Clerkenwell; or Grimshaw & Co., Goswell Road, Clerkenwell. Either of these, I feel sure, will supply you if you will give them the size, etc., you require. —A. B. C.

**Ploughs.**—F. W. G. (*Glasgow*).—I am very sorry if I have given the wrong address of the maker of ploughs, but the man I named had his place of business there when I was an apprentice in Glasgow, and I have ordered ploughs from him not *very* many years ago. In Glasgow you should not have much difficulty in getting what you want; any cabinet-maker can make them. But if you write to George Royle & Sons, Paternoster Row, London, you will get as many ploughs as you care to buy.—G. C.

**Band-Saw.**—AGRICOLA.—You say that you intend to fit up a band-saw. Do you mean a band-sawing machine? You should have stated the kind of work you intend to do with it, and by what power you intend to drive it. If by hand, my advice to you is to abandon all thoughts of fitting up such a machine, unless it is to do particularly light work. But if you have other than hand power to drive it, the machine may be very useful to you, and I hope you will succeed in your undertaking. To secure the satisfactory working of a band-saw, the pulleys or wheels over which the saw runs should be light, with consistent strength. The top wheel should be, say, one-third lighter than the bottom wheel. This is to prevent the top wheel overrunning the bottom wheel, and to lessen the breakage of saws. The wheels should be covered with indiarubber, to form an elastic bed for the saw. The top wheel should be so arranged that it may be raised or lowered so as to take saws of different lengths. There should also be an arrangement for canting the top wheel, so that the saw may be made to run on any part of its circumference. The last-named arrangement is of great advantage. Sometimes a saw may be shorter on the back edge than on the tooth edge, or *vice versâ*, when the strain will be greatest on the shortest edge; consequently, the saw soon breaks. By canting the top wheel the strain may be equalised on the width of the saw, and to some extent prevent breakage. The frame of your machine should be sufficiently strong to prevent vibration. The diameter of saw wheels should not be less than 24 in. Saws worked on wheels less in diameter as a rule do not give satisfaction. At the back of the saw, just above the cut and below the table, there should be a revolving disc to receive the back thrust. Be sure not to let the discs get deeply cut or grooved, or you will get frequent breakage of saws. Just above the cut and below the table there should be wooden guides on either side of the saw, to guide it as it enters and leaves the wood which is being sawn. In reference to joining a band-saw, except by brazing, there is a method, but it is not to be relied upon. In one end of the saw make two tongues, and in the other end make two corresponding openings; introduce the tongues into the openings, then press the ends together laterally, so as to cause the snugs on the tongues to hook on the bevelled edges in the openings. When the ends are in this position it will require a good strain lengthways to separate them. If you wish to disconnect the ends of the saw, separate the hooked and bevelled edges by applying lateral pressure, and at the same time draw the ends apart in the opposite direction. The only reliable way of joining a band-saw is to braze it, which process I presume you are acquainted with; if not, write again, or on any other point you wish made clear to you, and I will endeavour to help you. I might say that if you have not got Vol. I. of WORK, you can get it ready bound for 7s. 6d., wherein you will get some valuable information on saw repairing.—A. R.

**Gold Blocking.**—N. (*Finsbury Park*).—To remove gold blocking from leather may be done by washing carefully with paste water. If the leather is morocco or other grained leather, a clothes-brush may be used. Wash and brush over the gilded parts. Some parts will be more difficult to remove than others, but a little care will accomplish it. You will have to varnish the leather over with shellac varnish, which will make it look fresh again.—G. C.

**Phonograph.**—W. R. P. (*Hampstead*).—I cannot make out much from the sketch of your mouth-piece for above, so cannot tell you whether you have made it right. The cylinder of blotting-paper and candle-grease may be all right as an original dodge, but I do not wonder if you cannot get good results. Look up back numbers, and try something which has been already tried by others.—W. D.

**What Emery Wheels are Made of.**—T. P. (*St. Leonards*).—Made of an infinite variety of compounds, such as gum arabic, shellac, glue, bitumen, etc., to bind the particles together. Other kinds depend upon vitrification at high temperatures for binding the grains of emery. Vulcanite and tanite are also used, and these wheels are perhaps the safest from the danger of bursting. Every manufacturer has his own particular methods, which are not intended to be known. A simple emery grinder for an unusual shape, such as the inside of paring gouges, can be easily made by turning up a piece of wood to the correct sweep or sweeps to fit the inside of the gouges; then glue it quickly all over, and roll it in emery-powder. With

this the gouges can be ground in the lathe by dipping them constantly in water, to prevent overheating.—F. A. M.

**Work Volume.**—B. H. H. (*New Cross*).—Each year's weekly numbers of WORK are sold, bound in a cloth volume, price 7s. 6d. These and No. 4 of the "Popular Educator" are obtainable of Messrs. Cassell & Co., Limited, London, E.C., or of any bookseller.

**Rubber Stamps.**— COOKE.— Full instructions for making rubber stamps are given in Vol. I. of WORK, Nos. 38 and 40, pp. 594 and 630.—QUI VIVE.

**Stringing the Zither.**—H. R. (*Blackpool*).—Addresses of writers cannot be disclosed. Any stamped and sealed letter shall be forwarded.—ED.

**Rubber Foot.**—E. B. (*Dartmouth*).—I have too much sympathy with you in your affliction to willingly throw cold water on your proposals in this connection, but I am obliged to say that some of your suggestions are impracticable. (1) The sample of rubber sent is a good sample of vulcanised sheet rubber, but cannot be worked up again by you with advantage. (2) Solutions of rubber contain too little rubber to be of any use for your purpose. (3) Carving from a solid block offers a better chance of success, the only tool required being a sharp knife with a somewhat rough edge, moistened frequently with cold water. (4) Home-made vulcanisers would not suit the work, and a suitable one would be too expensive for use to recommend you to purchase one. "Rubber sponge" can be purchased at about 12s. per lb., and is very light; but I do not think it would be found elastic enough for you. May I suggest an alternative? If so, I would say, try cork instead of rubber. It is light, elastic enough for your purpose, and very easy to work—a knife, a half round bastard-cut file, and a sheet of glass-paper, being all that are required; it is also cheap. If thought desirable, a pad composed of, say, ten thicknesses of the sheet rubber of which you send a sample, might be placed between the wood and cork composing the foot. This would be even better if formed into a wedge, of which the thick end would be placed at the heel and the thin end at the toe end of the wooden part of the foot. On the whole, however, I would advise you to dispense entirely with indiarubber, and use cork as freely as possible.—QUI VIVE.

**Printers' Ink.**—A READER OF "WORK."—Printers' ink is not adapted for use with rubber stamps, which it would quickly spoil.—QUI VIVE.

**Induction Coils.**—T. E. W. FIX.—Dyer's book on "Intensity Coils" gives a few experiments to be performed with an induction coil and vacuum tubes; but I do not know of any book exclusively devoted to the subject.—G. E. B.

**Induction Coil.**—W. G. (*Long Lane, E.C.*).—The core should be made of iron wires annealed soft, and dipped in hot melted paraffin wax, to insulate the wires from each other. If for a small spark coil, this core may be enveloped in two or three folds of paraffined paper, and the primary wire wound on this direct. If for a medical coil with sliding regulating tube, the core must be fixed in the body of a bobbin, the tube made to slide over the core, and the primary wound on over the body of the bobbin. In the former case the paraffined paper insulates the wire from the core; in the latter case the body of the bobbin is the insulator. The wire must be insulated from the core. The quantity of silk-covered wire to be used in the primary must depend upon the size of the coil and its intended use. Just tell me the length of spark you wish to get from your coil, and I shall have pleasure in giving you dimensions, length, and size of wire, and other particulars. A wire goes from one terminal to the foot of break spring, and one end of the primary is connected to the break pillar. The ends of the secondary wire go to the handles. For further particulars, see my articles on "Induction Coils" when they appear in WORK. The battery of Leclanchè cells will work a coil giving an inch spark or more.—G. E. B.

**Castings of Dynamo.**—R. T. (*Paisley*).—Castings for the small Siemens dynamo, shown on p. 644, Vol. II., of WORK, can always be obtained from Mr. S. Bottone. The castings may not be as exactly as shown at Fig. 16 on that page, but will serve the same purpose. I think Mr. Bottone has introduced improvements favourable to the amateur since the sketches for those drawings were made. The castings sold by Mr. G. Bowron, Praed Street, London, for the same class of dynamo, differ in form from any of those shown on the page above mentioned, but may still be regarded as Siemens' dynamo castings. If you write to either of those gentlemen, they will send price lists.—G. E. B.

**Astronomical Telescope.**—A. G. (*Newcastle-on-Tyne*).—There seems, as you say, a mystery about telescope making; but it is only because the average man is quite ignorant of the art. The mystery begins to disappear as you get an acquaintance with the subject. The telescope you speak of as costing £5 would not show you planetary and lunar detail as they are shown in the average popular astronomy. Those engravings are carefully and exquisitely drawn by observers who have the use of the most powerful instruments. I tell you this because too often a would-be astronomer, fired with a desire to see for himself wonderful lunar and planetary pictures, full of the exquisitely delicate detail such as he sees depicted in the pages of text-books, pays £5 down for a popular telescope, and then is so grievously disappointed at the result of his star-gazing, that he gives up astronomy altogether. Yet a great deal that is wonderful and beautiful can be seen with a small glass, when you learn how to use its power to proper advantage; and even if this were not so, I shall show you that there is no reason why you should not finally possess a very powerful instrument. You have discovered the great obstacle to the possession of an astronomical telescope when you say that it is difficult for a workman to obtain one "without going to a very great expense." Now, there are two reasons why a good astronomical telescope is so very expensive. One reason is that the chief item in the production of a large telescope is the cost of the skilled labour required to prepare the lenses; and from this the other reason follows naturally, because, the instruments being so dear, there is a comparatively small demand for them. Telescopes are of two kinds—*refracting* and *reflecting*. The reflecting telescope is seldom seen outside the astronomical observatory. It is comparatively easy to make, and, with one or two exceptions, all the great reflecting telescope makers have begun as amateurs. But this is not the case with the refracting telescope, where four or more surfaces have to be ground and polished instead of one, and where many severe obstacles to perfection have to be overcome. It is well within your power to make a reflecting telescope, *grinding and polishing your own lenses for it*; but if you want to make a refracting telescope, you will have to buy the lenses ready made. The outside cost of the rough glass for the chief mirror of a 9 in. *reflector*—that is, a reflector with a mirror 9 in. in diameter—would be about 5s.; the market price of the finished mirror—*without any*

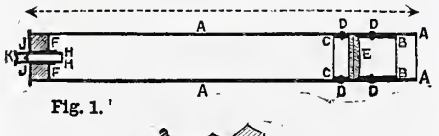


Fig. 1.

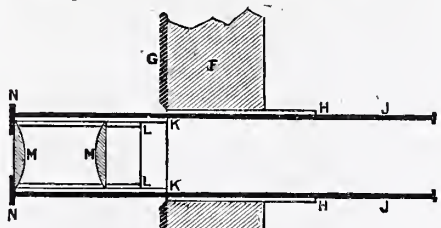


Fig. 2.

**Astronomical Telescope. Fig. 1.—Diagram for Refractor. Fig. 2.—Diagram of Eye-Piece.**

*mounting*—is, at a first-class optician's, about fifteen guineas. The difference in the price is the payment for skilled hand labour, no tools, properly so called, being necessary for its manufacture. But the cost of the rough glass for a lens of similar diameter for a *refractor* is about £25, and the market price of the finished lens, without any mounting but its brass cell, is £200. Here, also, the difference is in skilled hand labour. But you may see how much easier it is to make a reflecting telescope than it is to make a refractor. If you decide to make the reflector, you must watch the replies I am giving elsewhere in "Shop." You will get guidance there, and you must come to the Editor when you get into any difficulty. But if you decide to make a small refractor to go on with, above is a diagram to work from. I assume that you will purchase a 2½ in. achromatic object lens of, say, 36 in. focus. The price of this will vary from 30s. or less to £3, according to its quality. Then: A A A A is a piece of stout drawn brass tubing; B B and C C are rings cut from a smaller size tube, and fitting accurately inside A A, and turned or filed quite true at the edges. If they be true, and are stood on edge on a flat surface, the sides will be at right angles with that surface. The smaller ring, C C, should be slipped in, and fastened with the small screws, D, D. This forms a ledge for the support of the lens, E, which is then placed in position, and secured by sliding and screwing into position the ring, B B. At the other end of A is F F, a disc of wood turned to fit inside A, and pierced with a central hole, which receives a piece of smaller tubing, H H, which carries the eye-piece, as in Fig. 2. F F may be faced with a disc of brass, G, for appearance sake, if it be intended to polish the finished instrument. Required: Two plano-convex lenses, ⅞ in. in diameter and 1 in. in focus. Cost, about 1s. each; tubing, K K, into which the lenses will exactly fit. Fix them as shown by means of the smaller size tubing, L L. The lenses will require to be two-thirds of their focal (not joint focal) length apart, in this case two-thirds of an inch. The focal lens is kept in place by a pierced brass disc, N, soldered or screwed to K. It will be observed that the finished eye-piece, K N, slides into the longer tube, J, which in turn slides to and fro in tube H, fixed to F. By this means the eye-piece can be pushed towards or pulled from the object-glass to get the proper definition. This eye-piece is called the Ramsden eye-piece. The completed telescope will require to be mounted on a firm ordinary telescope stand, which I have not space left to describe here. It will be seen that I have chosen the simplest possible form of mounting—a form which entirely obviates the necessity for screw cutting. There are other methods and other eye-pieces, but this form contains all the essentials. The magnifying power could be increased by using an eye-piece made on the same principle, but with lenses of shorter focus. Finally, the cost of the whole instrument could be lessened by the use of an ordinary uncorrected single lens for the object-glass. Such a lens would cost about 2s. 6d. or 3s. 6d., but, of course, the object under examination would not appear clearly defined or free from colour.—E. A. F.

**Vulcanite Tubing.**—C. C. (*Clapham Road*).—This can be obtained of most of the manufacturers of rubber goods, of which there are several in London, and can be united by means of a thick solution of rubber in mineral naphtha or bisulphide of carbon, or by a solution of shellac in methylated spirit. Vulcanite can also be moulded when softened just sufficiently by gentle heat to enable it to take the requisite shape under considerable pressure.—QUI VIVE.

**Staining Xylonite.**—W. J. H. (*Reading*).—An address where xylonite can be bought was given in "Shop," p. 556 (No. 139). Xylonite, celluloid, parkesine, or ivorine, are practically the same, and mostly made in France and America. I am using some now which bears the impress, Celluloid Manufacturing Company, U.S.A., which, being white and used mostly for musical instruments, is obtained from wholesale dealers in musical fittings. Much information and useful hints on xylonite will be found in WORK, No. 101, p. 787, "Xylonite: its Nature and Use;" and in No. 113, p. 130, "Xylonite as a Material for Fret Sawyers." I have found the aniline dyes as sold by chemists and drysalters in packets and tubes a good staining medium. The chemical stains as used for ivory are in most cases impracticable in use, and should in all cases be used with caution, as owing to the acids and camphor used in the manufacture of xylonite, an opposite effect to that required might be given. As the material can be bought ready dyed in self and fancy colours, also in imitation of pearl, marble, and tortoiseshell, etc., you will see there is little need to use the stains oneself, unless you, as a stick-maker, require to finish your stick handles, engraved, or incised and coloured, as sometimes seen. In that case, the pattern is mostly incised and the inner portion stained; the incisions are then useful, as they prevent the stains from running. Pigments or oil colours will not do, as in the process of polishing by means of pumice powder, or tripoli and benzoline, they would be rubbed off again. After the polishing the incisions are generally finished gilt, which gives a pretty finish.—LIFEBOAT.

**Puzzle Purses.**—A POLE.—It would not be worth your while to follow this up. The possible profits to be derived from your idea are of a most slender kind.

**Canoe.**—B. B. (*No Address*).—If you have only a few joiners' tools it is hardly likely that you will succeed in building a canoe for that "large pond" near your house. You had better be less ambitious, and in your desire to be mechanical, make some experiments first with a small boat or other model.—ED.

**Ship Models.**—R. J. B. (*Whitby*).—It would occupy too much valuable space to give illustrations of the vessels you ask for as models; but any definite question you may ask shall be answered.

**Voltaic Battery.**—F. M. (*Thornton*).—In the first place, it would be better to test your cell currents by an *ammeter:* the ammonium sulphate test is rather delicate, and applied to a cell of so low a voltage as the Leclauché, may mislead anyone not accustomed to its use. In your "Fuller's Patent" cell you seem to have omitted the mercury, which should be placed in the bottom of the cell. You should remember that the zinc element is that which is used up—burnt, as it were—and also that the best of commercial cast zinc is impure, and therefore *local currents* are set up when the circuit is broken. To prevent this, amalgamation is resorted to, and the mercury in the "Fuller" cell preserves the zinc from local currents, because it keeps the zinc amalgamated. You seem to take a great interest in this matter. I should advise you to study the polarisation of low-power cells, with zinc and copper couples, with a view to arrange a *perfectly constant* battery. If you write again, I shall be glad to give any advice I can.—F. C.

**Ventilating Tunnels.**—D. D. (*Edinburgh*).—Your proposal is quite practicable, but unfortunately it is not new. It was proposed a good many years since. There are several practical difficulties in the way of its adoption, and unless a very large tube were used, it would only be suitable on lines worked by engines which exhaust into the tender or into a condenser. Your experiment does not include the effect of the powerful exhaust blast from a locomotive chimney.—F. C.

**Iron-work Book.**—J. S. W. (*West Bromwich*).—Working drawings are rather difficult matters to treat in a book. A good many are given in Humber's "Treatise on Iron Bridges," but that is a very costly work. There is a very simply written book showing how to calculate and design the details of iron bridges from which to make working drawings. Its title is "Materials and Construction," by F. Campin, published by Messrs. Lockwood & Co., London.—F. C.

**Delta Metal.**—IGNORANT.—I cannot answer your question, for the simple reason that Delta metal is a patented invention, and beyond the fact that certain materials are used in its composition, the general public know nothing of Mr. Dick's methods, which are the result of many years' experiments. The methods and proportions can be so greatly varied that Delta metal of any required grade, both cast and forged, is obtainable. You could not make it, even if you posscssed the secret of its preparation, because it is patented. If you write to the Delta Metal Company, Limited, 110, Cannon Street, E.C., and ask for their pamphlet on "Delta Metal," you will obtain from it nearly all the information available on this useful alloy.—J.

**Polishing and Upholstering Chairs.**—A. T. (*Canonbury, N.*).—Much has been given in the present volume on the subject of French polishing. Consult "Shop" and the indexes. You omit to tell us how you were going to buy the frames, whether in the *white*—*i.e.*, unstained or unpolished—or in the natural woods—*i.e.*, walnut or mahogany. Presuming that you buy them in the natural woods, ample instructions have been already given; on the other hand, if in the white, it will be necessary to first stain them, walnut or mahogany being the usual finish. In that case, I cannot do better than refer you to a reply given in "Shop" ("Staining and Polishing Cheap Furniture"), p. 476, No. 134. For a walnut stain, refer to "Means, Modes, and Methods," p. 439, No. 132. As regards the upholstering, you have set yourself a difficult task in desiring to take your first lesson on saddle-bag upholstery. Without in any way desiring to dishearten you, I should have thought it best to practise first at plain work. To give only a fair idea of how it is done, the materials required, and tools to use, would take up at least a whole page of WORK. You would do well to procure the second volume of WORK, or at least Nos. 78 and 100, in which will be found articles on "An Armchair: How to Make the Frame and Upholster it." I need hardly remind you that all necessary staining and polishing are done previous to upholstering.—LIFEBOAT.

**Painting and Graining.**—W. W. (*Nelson*).—A useful little manual for amateurs can be obtained from Brodie & Middleton, Long Acre, London, price 2s. Vol. I. of WORK contains much useful information on the first-named branch, and the present volume will eventually contain the required knowledge for studying graining. If you haven't Vol. I., *get it quickly*, its value will increase with each issue. As a practical worker, acquainted with all classes of technical literature, I look upon it as a wonderful collection of information and instruction, worth its cost a dozen times over.—F. P.

**Potash Solution.**—P. P. (*London*).—To make a saturated solution of any salt, the salt, as chlorate of potash, is added to and stirred up with water, until the water will dissolve no more. Hot water will dissolve more of most salts than cold; thus, boiling water will dissolve ten times as much chlorate of potash as cold will, and a convenient way to make a saturated solution is to dissolve as much of the salt as you can in boiling water. On cooling, the excess of salt will crystallise out, leaving a cold saturated solution.—F. B. C.

**Varnishes.**—KING BRUCE.—You do justice to your *nom de plume*, and we hope will now attain the desired success. I must confess your requirements of a varnish "which must not soften on exposure to dampness nor blister with heat," appear to the writer as two points which could scarcely be guaranteed by the most experienced of varnish makers. According to my promise in a previous answer, I have, however, consulted an authority more experienced in making varnishes than the undersigned, and append herewith the advice and recipe. With the fullest confidence in the source from which it is obtained, I commend it to you: Stained Varnish: 2 lbs. gum benzoin, 2 lbs. orange shellac, 1 gallon methylated spirits; put all in a stone vessel, and shake them occasionally until dissolved; then stand in an open vessel for a few days before using, and also strain through a fine strainer. The desired colours can be obtained by adding aniline colours to the desired shade. This varnish should be used in a warm atmosphere. For making the "white" varnish, use white shellac instead of the orange. The gum above specified is the real basis of the varnish; the shellac may be varied from 50 to 100 per cent.; but this I would not advise you to experiment with until you have succeeded with the proportions given and the colours you require for the various kinds of pipes. For the gums, etc., write to Mathieson Bros., Ardrossan, N.B., and watch the advertisement columns of WORK.—F. P.

**Wire Bird-Cages.** — RUFUS.—An article has already appeared on making wire bird-cages. (See Nos. 54 and 80 of WORK.)

**Wire-Work (Bending Tube for Surrounding).**—R. J. (*Burdett Road, E.*).—If you want to bend only one or two tubes for surrounding wire-work, the following method will answer: Select a tube composed of as thin metal as compatible with the desired strength, and secure it to the bench by means of small screwed blocks on each side, touching, but in no other way being connected to it. Pass a stick, as tight-fitting as possible, along the interior of the tube. Lever the tube by hammering a chisel through its upper surface, taking care that each cut is in a direct line with the previous one. When cut its whole length, withdraw the stick. Secure a hard wood or metal block to the bench, the outline of it corresponding to the desired curve to be given to the tube. If the latter is not too strong, you can bend it round the block by the assistance of your hands only; but it may chance that it will need to be hammered, which should be done with some soft material intervening, to prevent bruises. Begin bending at the middle; or if the tube is too strong for this, staple one end against the block, further securing it with an end nail, and then progress with it. Use nippers to squeeze the tube, thus split and bent, over the wire-work.—J. S.

**Cabinet Design.**—SCHEMER.—Thanks; but your designs are hardly up to WORK standard.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**False Hand.**—INDIARUBBER writes:—"I venture to ask if any reader of WORK could give the address of an indiarubber firm where I could get a false hand made, as I have had the misfortune to lose part of my hand and three fingers. If I made a model in plaster, could I get it cast in indiarubber with hollow fingers, to be as light as possible, but at the same time stiff—much the same as indiarubber dolls are made?"

**Asbestos.**—YENWILL writes:—"Will any reader of WORK kindly say if asbestos can be woven into a cloth or kind of tape without any foreign substance being mixed with it? I have a specimen of asbestos-woven cloth, but it appears to have a mixture of some sort, and I wish to get some without if I can. Also what is about the price of raw material?"

**Double Flageolet.**—S. (*Bristol*) writes:—"Can any of your readers inform me where I can procure a double flagcolet, and what would be the price, or give me information as to the making of one?"

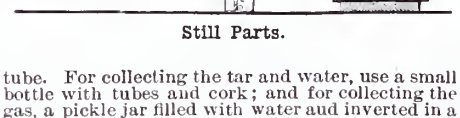
**Whip Handles.**—E. E. S. (*Bickington*) writes:—"Where could I get leather handles for driving whips? I have asked in shops about here, but they can't tell me. I know they are to be had, and I should say probably at Birmingham."

**Paper-Making.**—J. W. (*Plumstead*) writes:—"I shall be glad if any reader could give me information as to addresses of paper-mills, or aid me to find out prices paid for rags, bones, etc."

**Breeding Cage.**—GAMMA writes:—"I am about to make a breeding cage, introducing some fret-work and painted glass; the size I proposed making it to be 20 in. by 17 in. by 10 in. My idea was to make three of the sides of ¼ in. wood, with fret-cut windows, having tracery something in the cathedral window style; the windows to be afterwards glazed and painted like stained glass. Could any of your correspondents suggest a design for the cage—something in the Gothic style?"

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Still for Wood.**—H. B. S. (*Liverpool*) writes, in reply to LONDON (see p. 542, No. 138):—"If you want to distil the wood on an experimental scale, get a piece of iron pipe about a foot long and about an inch wide, with a screw plug to fit one end; to the other end fit a cork with hole bored, and bent glass



Still Parts.

tube. For collecting the tar and water, use a small bottle with tubes and cork; and for collecting the gas, a pickle jar filled with water and inverted in a tin or other bowl partly filled with water: heat the iron tube in a fire or over a burner up to about 2 in. from the cork. On the large scale wood is distilled in retorts similar to those used in the manufacture of coal gas, made of cast iron, and heated in a furnace suitably constructed."

**Cardboard Models.**—A. H. (*Woolwich*) writes, in reply to C. W. S. (*Northallerton*) (see p. 574, No. 140):—"You would be able to obtain them from Clarke & Sons, Hatton Garden, London, or by ordering them from any large newsagent in your town."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—CELL; J. B. (*Dalton-in-Furness*); B. J. (*King's Lynn*); B. R. (*Sandbach*); W. H. (*Brinscall*); LUDO VICUS; G. (*Sydenham*); T. W. (*Kendal*); R. W. (*Bold Heath*); W. B. (*North Woolwich*); BEGINNER; P. L. (*Selly Oak*); J. A. B. (*Camberwell*); W. S. (*Stourbridge*); R. C. (*Battersea*); E. H. J. (*Bishopston*); F. H. (*Battersea*); A. M. B. (*Dublin*); OLD BOAT; E. A. (*Sheffield*); F. H. (*Finchley*); R. S. (*London, E.C.*); F. S. (*Leek*); S. A. (*York*); N. M. (*Sheffield*); G. C. (*Stratford-on-Avon*); M. F. (*Oldham*); P. H. (*Bristol*); HOT WATER; M. W. (*Manchester*); P. D. (*Lincoln*); S. R. (*Newry*); T. W. B. (*Faversham*); W. H. E. (*Crewe*); H. M. (*Manchester*); EDNIFRA; C. W. L. (*Newcastle-on-Tyne*); W. W. (*Stalcybridge*); W. H. (*Egham*); GAS LIGHTER; RALPHO; J. W. & CO. (*London, W.C.*); LEISURE TIME WORKER; W. T. L. (*Battersea*); PUZZLED; REV. E. C. I. (*Kyneaton, Australia*); W. H. (*Failsworth*); W. C. (*Wandsworth*); P. H. (*Allandale Town*); J. H. (*Bury*); ANXIOUS; F. C. (*Slaithwaite*); R. F. (*Eastbourne*); D. C. (*Marsden*); B. J. (*Bingley*); W. A. (*New Radford*); A. H. (*Bridgeton*); F. G. M. (*Dublin*); A. W. (*Parsonstown*); J. W. B. (*Huddersfield*); W. B. (*Ramsey*); J. D. R. (*Leven*); F. W. M. (*Childs Hill*); P. & W. (*Kingsland*); ANGLO DANE; E. MCH. (*Hebburn-on-Tyne*); H. B. (*London, W.*); F. W. W. (*Bradford*); VERY ANXIOUS; W. H. C. (*Leeds*); E. G.; W. B. R. (*Westbury*); A READER; TRIPLE EXPANSION.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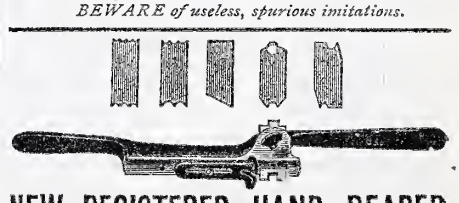

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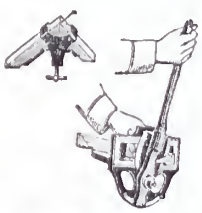

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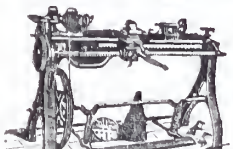

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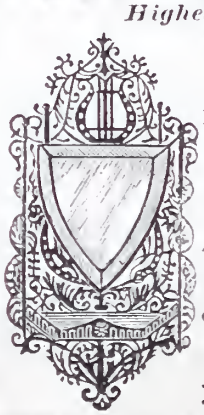

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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### A SMALL PORTABLE FORGE FOR AMATEURS' WORKSHOPS.

BY "CYCLOPS."

THERE are many operations required to be performed in an amateur's workshop which necessitate the use of a smith's hearth, and where this useful appliance is not possessed by the workman it becomes necessary to put work out, entailing loss of both time and money.

It is my purpose in this article to describe a simple smith's hearth or forge, which has two distinct advantages. First, of being easily made by the average amateur iron-worker; and, secondly, of great portability. The latter is of considerable moment in the amateur's workshop, which is generally rather cramped. The appliance consists of a wrought-iron frame, on the top of which is the tray, or hearth proper; and underneath the hearth, the bellows and blowing arrangement for the draught. A general idea of this may be gained from a glance at Fig. 1.

*Framework, etc.*—The framework consists of four legs, A, A, A, A (Fig. 1), braced to-

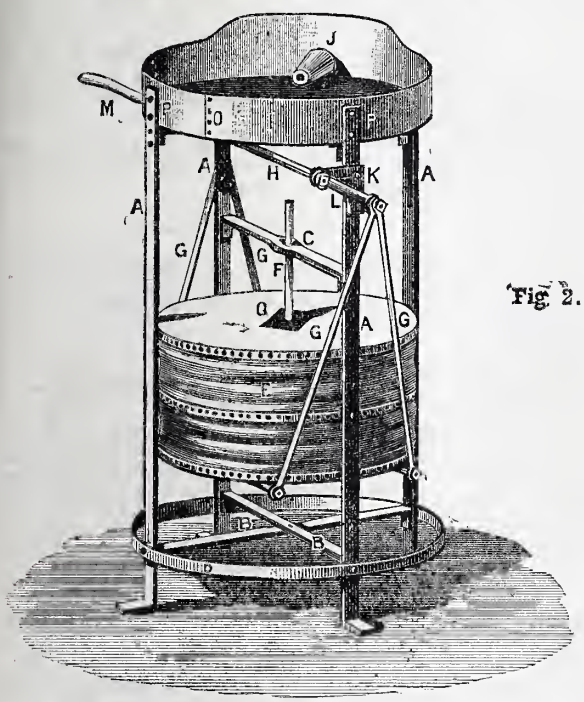



Fig. 1

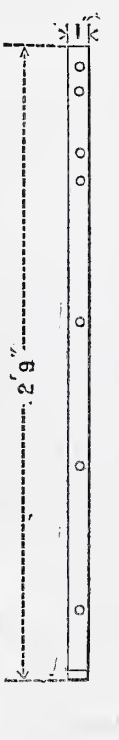



Fig. 2.

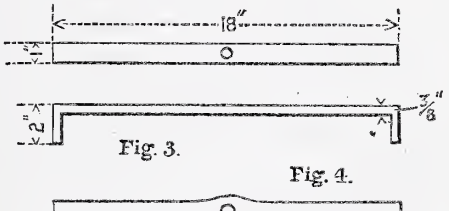



Fig. 3.

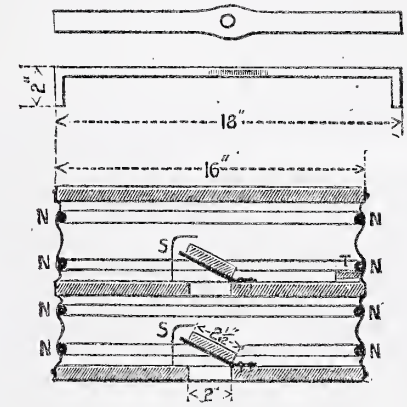



Fig. 4.

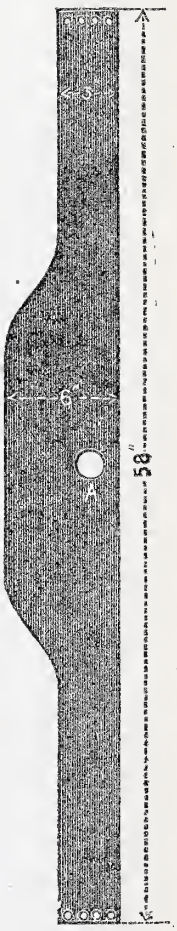



Fig. 5.

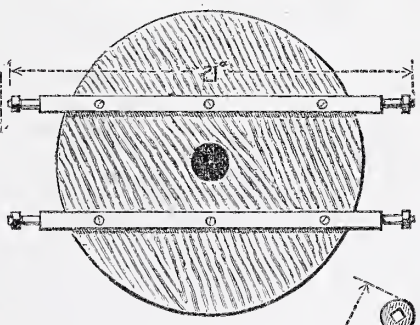



Fig. 6.

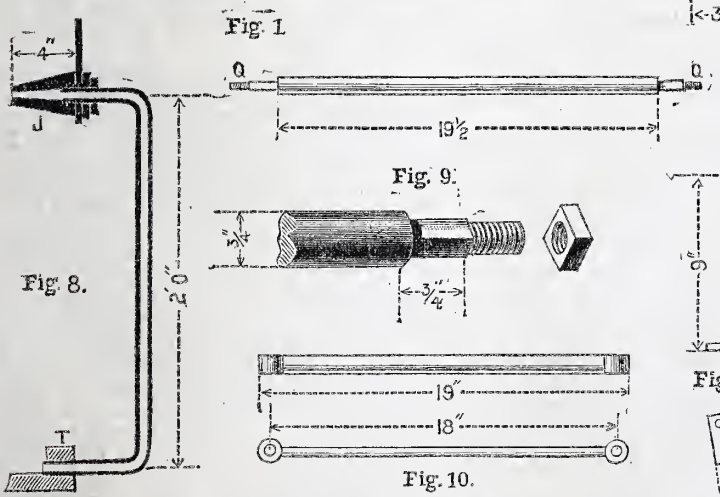



Fig. 8.




Fig. 9.




Fig. 10.

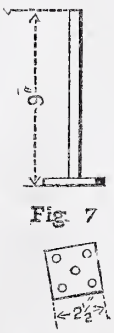



Fig. 7

Fig. 11.

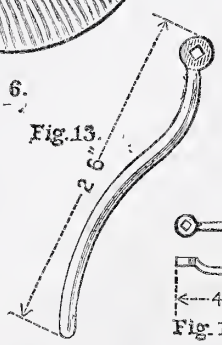



Fig. 13.

Fig. 12.

Fig. 14.

Fig. 1.—Hearth complete. Fig. 2.—Front and Side Elevation of Legs. Fig. 3.—Plan and Side View of Bottom Stays. Fig. 4.—Plan and Side View of Guide-Stay for Bellows. Fig. 5.—Sheet Iron cut to form Side of Tray. Fig. 6.—Section and Under View of Bellows. Fig. 7.—Guide-Pin for Bellows. Fig. 8.—Nozzle and Bellows Connection. Fig. 9.—Spindle. Fig. 10.—Bellows Links. Fig. 11.—Bracket. Fig. 12.—Crank on end of Spindle. Fig. 13.—Lever on end of Spindle. Fig. 14.—Links and Crank Connection.

gether by the cross-stays, B, B, two above and two below the bellows. The two stays above the bellows are not shown in the drawing, being hidden by the tray, etc. They are of the same form and dimensions as the bottom pair, except at the centre, where they cross each other, one of them being cranked down to allow the other to cross it at its own level, and thus make a level bed for the hearth-tray to rest on. One of the legs A, A, A, A, is shown separately in front and side elevation in Fig. 2.

The whole of the framework is made of 1 in. by $\frac{3}{8}$ in. square iron bar, and is riveted together by $\frac{3}{4}$ in. by $\frac{7}{8}$ in., and $\frac{3}{8}$ in. by $1\frac{1}{4}$ in. iron rivets, the holes being bored to allow the rivets to fit in rather tight. The dimensions of the various members of the framework being all marked in the drawings, it will not be necessary to mention them here.

The various parts of the framework should first be forged and cut to dimensions given in drawings, and fitted against one another to make sure that they are all exact before marking out for drilling. The two cross-stays, B, B (Fig. 1), are riveted together where they cross in the centre of the frame as shown. The ring, D (Fig. 1), is placed round the outside of frame at the points where the cross-stays are riveted to the legs, and the rivets pass through the ring, D, legs, A, A, A, A, and cross-stays, B, B, binding them all securely together.

*The Hearth.*—The hearth consists of a flat, round plate of iron, which should be a good thickness to withstand the heat; or, if a little extra expense is not objected to, it might be made of thinner material and a circular fireclay brick bottom placed on it. This would make a much more serviceable job.

The hearth-plate rests on the top pair of cross-stays, and is riveted to them by four rivets, two in each stay. The circular band, I, surrounding the hearth is cut out of $\frac{3}{16}$ in. sheet iron to the plan shown at Fig. 5; the hole A is for the introduction of the air-nozzle, J, from the bellows. The band is riveted to the top of each leg by two rivets, as shown at P, P (Fig. 1), and is also riveted together at its two ends, as shown at O (Fig. 1), by four rivets. The hearth-plate before-mentioned is cut to exactly fit inside the band, I, and to rest on the top pair of cross-stays.

*Bellows Fittings.*—The bellows work next occupies our attention. It consists of a spindle of $\frac{3}{4}$ in. round iron, working in two brackets, shown at K (Fig. 1), the form of which is better shown in Fig. 11, the dimensions being marked to it. These brackets are riveted, one to each of two opposite legs, by two rivets in each as shown in Fig. 1. The spindle is shown at H (Fig. 1), and also in Fig. 9, the ends, Q, being squared to fit the small cranks, L (Fig. 1), and the long lever, M (Fig. 1). These cranks are shown in plan and elevation in Fig. 12, and the long lever in Fig. 13. As will be seen from Fig. 9, the ends of the lever are squared and screwed. The dimensions marked for the square part is $\frac{3}{4}$ in. This is, of course, for the end carrying the long lever, as well as the crank; the other end, which carries only a crank, will have the squared part only $\frac{1}{2}$ in. in length.

The cross-stay, C (Fig. 1), is simply to act as a guide to ensure the top chamber of the bellows rising and falling perpendicularly. It is secured to one pair of legs by rivets as the cross-stays are; it is made of 1 in. by $\frac{3}{8}$ in. iron bar, swelled out and bored in the centre, as shown at Fig. 4, to allow the guide-rod, F (Fig. 1), to slide easily through it. The upright guide-rod and square plate are shown in Fig. 7. The rod is of $\frac{1}{2}$ in. round iron rod, and the plate is countersunk for four screws, with which to attach it to the top board of the bellows, the rod being riveted into the square plate. The bellows, E (Fig. 1), are fastened to the frame by four stout wood screws, one through each leg. Between the legs and the centre board of bellows are placed four pieces of $\frac{1}{2}$ in. iron pipe, about 1 in. long; the four screws pass through the legs into these pieces of pipe, and are driven home into the centre-board of bellows, holding them quite securely.

The bottom chamber of the bellows is supported by four links, shown at G, G, G, G (Fig. 1).

Each end of these links is swelled out and bored (as shown in Fig. 10) at the bottom ends to fit on the round ends of two flat bars running across the bottom board of bellows (shown in Fig. 6), and at the top ends for the reception of the $\frac{3}{8}$ in. bolts, which connect them to the short crank, L (Fig. 1.) This arrangement is better seen at Fig. 14, L being the short crank, G, G the links, and Z the $\frac{3}{8}$ in. bolt and nut.

The flat bars just mentioned, and shown at Fig. 6, are made of 1 in. by $\frac{3}{8}$ in. iron bar, and are drawn out to a round section at the ends, and screwed for nuts, which keep the links in their place. They are fastened to the bellows' bottom board by three screws in each, passing through holes drilled and countersunk to receive them.

*The Bellows.*—We must now consider the construction of the bellows proper. These are composed of three circular boards of inch stuff, $14\frac{1}{2}$ in. in diameter. The middle and bottom boards are provided with valves, one in each opening upwards. These are made by drilling a hole, 2 in. in diameter, in the centre of each of the two boards. Over each of these holes is placed a flat, circular piece of leather nailed to the board at one side, so as to be free to move up and down for the passage of the air. A piece of wood is glued on the top of the leathers, to ensure dropping down flat and closing the valve when the air is within.

A wire stop, S (Fig. 6), is driven into the board, to prevent the wood valves turning completely over, in which case they would not again close when required. The top drawing in Fig. 6 shows a cross section of valves and bellows.

The middle board has a block of wood fastened to it, as shown in Fig. 6. This is for the reception of the screwed end of the pipe conveying the blast from the bellows to the hearth.

The three boards are fastened together by a piece of leather 14 in. wide, which goes all round them, and is securely nailed to their edges by 1 in. clout nails, placed in two rows, and as near together as possible. A strip of leather, 1 in. in width, is placed round the edge of each board over the leather covering, and the clout nails are driven through this and the leather covering into the boards. Before fixing the leather on to the boards, we shall have to insert four iron rings, made of $\frac{1}{4}$ in. round iron bar, $14\frac{1}{2}$ in. diameter outside, two in each chamber. These are to keep the leather stretched outward, and to ensure it forming even creases when opening and closing. The two ends of the circular band of leather covering the bellows should be joined with copper rivets and washers, such as are used for leather hose. These should be put as near together as possible.

The pipe leading the blast from the bellows to hearth is of $\frac{3}{4}$ in. iron tube, and is shown in section, with its fittings, in Fig. 8. It is screwed at the bottom into the wood block, T, and at the top into the air-nozzle, J, through the iron band encircling the hearth, with a back nut and washer to keep it secure. The air-nozzle should be of very thick wrought iron, and tapped to receive the end of the $\frac{3}{4}$ in. tube as shown.

The leather of the bellows covering should be of thorough good quality, and may be obtained at any currier's. It is scarcely likely that a piece will be obtained sufficiently large to make it in one piece, so that it will have to be joined with copper washers as described.

Our forge is now complete, and it only remains to regulate the flow of air by putting weights on the top board of bellows. Weights should also be suspended from the bottom boards sufficient to draw the lever up when pressed down. We shall now have a thoroughly substantial hearth if the above directions have been faithfully followed. Of course, the measurements may be varied to suit the maker, and it could even be made of lighter material; but, owing to the great amount of knocking about such a hearth will have to sustain, it will be best to keep as near as possible to the dimensions given.

Should any further help be required, the writer will be glad to give it through the medium of "Shop."

## HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

### The Feed-Pump and Governor—Conclusion.

Why Pumps will not Work—How a Feed-Pump should Not be Made—Spanners and Nuts—The Governor, Bracket, Sleeve, and Mitre-Wheels—Turning the Bolts—Fitting Arms—Throttle-Valve and Case—Adjusting Spring and Sizing Driving Pulleys—Stauffer Lubricators—Lagging of Cylinder—Making Steam Joints—Foundation of Engine—Driving Belt.

A word needs to be said as to the design of the pump. Many pumps fail, or give trouble, on account of the presence of air inside. When the plunger is drawn up this air expands, but no water rises into the barrel; when the plunger comes back the air contracts again.

Several drawings of feed-pumps have been recommended in mechanical publications, which are open to such an objection: Fig. 57 will make this quite plain. Here the plunger is much smaller than the pump-barrel, leaving a wide annular space round it; when air gets into the pump—as it is sure to do with the water—it will, of course, rise to the top, and the upper part of the barrel at *b* will be full of air, whilst any water there may be will lie at the bottom, as seen in the sketch. Now, when the plunger is raised the air will expand, and the exhaustion will be so little that it will be insufficient to raise the suction-valve and the column of water beneath it, and the consequence is the pump will not "draw." The usual remedy for this is to place a pet-cock at *a* to let out the air, but the proper course would surely be to place the passage to the delivery-valve at *a*, because then the air would be the first to leave the pump; also the superfluous space at *b* should be filled up. Turning now to our pump, it will be seen the delivery-valve is

on the highest point of the inside of the pump, so that the air may be got rid of first. If anyone wishes to know where the air comes from, let him place a glass of water under the receiver of an air-pump, when he will quickly discover it comes from the water, being held in solution at atmospheric pressure, and boiling out as soon as the pressure is diminished. The valves are arranged to have a lift of $\frac{1}{16}$ in. When a valve of this sort lifts a distance equal to a quarter of its diameter, then the annular space opened under its edge is equal to the area of the valve. By this rule the lift of the smallest valve should be $\frac{1}{64}$ more than $\frac{1}{16}$ in., but it is well to allow a small lift; in the case of the upper valve, which must of necessity be of larger diameter, there is sure to be sufficient passage, and the lift might be rather less than $\frac{1}{16}$, which will diminish the shock and noise at each closure. Water confined in a pump or pipe is so incompressible that it must be considered almost as a solid; were the plunger of the pump to meet in the middle of its stroke a solid piece of heavy metal, there would be a thump and a shock; just such a shock may be expected in a force-pump, when the plunger, having filled up the empty space left in the body of the pump after the up-stroke, meets the column of water in the feed-pipe, and drives it a few inches further on. To prevent this shock, a cushion of air is provided in an air-vessel, and, instead of mounting a separate air-vessel on the top of the valve-box, the valve-box itself is prolonged upwards a little way, so as to imprison a small quantity of air above the delivery branch, which, by its elasticity, acts like the spring of a buffer to prevent a sudden shock to the passengers.

*Spanners and Nuts.*—With Fig. 5 (page 260) are shown two double-ended spanners; the larger one has an octagonal jaw at the large end, and it is intended to fit both the piston-rod and pump plunger-glands to tighten them up. The smaller end of this same spanner is hexagonal, and is intended to fit the gland of the slide-valve rod and the union-nut on the delivery branch of the pump, as also the hexagon upon the cap of pump valve-box. The smaller spanner fits all the other nuts about the engine except one; there are two sizes of them, for screws of $\frac{1}{4}$ in. diameter and $\frac{3}{16}$ in. The nuts, if made at home, should be carefully kept to the same size; and if bought, they should be obtained, all of them, from the same firm. They would be best of steel, hardened, as also the spanners, and spring-tempered, or let down to a blue, or simply "blazed off"—that is, hardened in oil; and then, while the oil is upon them, held in the flame till the oil "flashes," and then quenched. This leaves them hard enough, yet tough. This hardening will leave them black, but they will look very well so, forming a pleasing contrast with the bright work. The spanners may be made as steel forgings by the nearest smith. Saw out a pattern of fret-wood for him to work to. File up a tin template for gauging the large one, to get it the exact size; file the small one to fit the nuts, then harden and temper them both.

We may now undertake the construction of the governor. It appears in Fig. 4 and Fig. 6, but the details are best seen in Fig. 24 (page 328). The old Watt governor, as in old engines and text-books, has six joints; this one has but two. The newer forms of governors have a spring on the spindle or shaft, and some of them scarcely look like governors at all. The form here given has something of the orthodox look without the troublesome six joints; it will work as it is, or may have springs attached if desired. The only difficulty connected with this form of construction is the tubular spindle, $3\frac{1}{2}$ in. long, $\frac{1}{4}$ in. diameter, with a $\frac{1}{8}$ in. hole through it. This may be made from a bit of round steel, bored through, and then turned true with the bore; but steel tubing of this size can be obtained.

We will begin with the main bracket by bolting it upon the angle-plate upon its side, and after boring it through with a $\frac{1}{4}$ in. drill, turn the recess in the top which holds the oil and the rounded bead on the edge. Now turn the casting round upon the angle-plate and bore the long boss, also with a $\frac{1}{4}$ in. drill, and face the end. Take the brass casting for the body or sleeve of the governor, with the two arms on it; hold it in a universal chuck, and bore it with a $\frac{1}{4}$ in. hole. Now take the steel tube and put it between the centres of the lathe to get it perfectly straight by bending; when it runs quite true, try it into the standard or body, and reduce it by turning or simply by filing till you can drive it firmly in; then it will not need the little round pin, seen at the top, for securing the two together. Now turn the outside of the body, and then reduce still further the lower half of the tube till it will turn easily in the bracket, carefully squaring up and smoothing the bottom surface of the brass body where it rests and turns upon the top of the standard.

The little mitre-wheel underneath will be the next to fix. The under-side of the hole in the bracket would be first filed up square for the wheel to work against, and then the wheel may be fixed by the pin, as shown. This pin cannot go through the middle, because of the little $\frac{1}{8}$ in. rod which slides inside the tube. The wheel may be keyed if that be thought easier, or it might be fixed with a pinching-screw. These mitre-wheels can be bought ready-made for one shilling each.

Now take the governor-balls, 1 in. in diameter; fix a bit of sheet metal into a wood chuck, and bore an inch hole in it; then cut it in two, and it will serve as a template to guide you in turning up the balls. The template should be so cut that it will give you one exact half-circle. If these balls were for ball-valves, we should have to be most particular in turning them, and it would be necessary to make a special tool, but in this case we may proceed as follows:—Chuck the balls by driving them into a recess in a hard wood chuck till very slightly more than the half diameter projects; turn the projecting part to an exact half-sphere, using the template to test it; then bore a hole in the middle of the ball, and tap it ready to screw on to the arm. When both the balls have been treated so, alter the chuck so that you can fix them in the opposite way up to the shoulder left by the turning, so that exactly the half-sphere will now be contained within the chuck; now turn the projecting portion true to the template; if the template is exactly the half circle, and you are tolerably careful, you will not be far wrong. Of course you can re-chuck the balls at different angles and reduce the error, but I think for this purpose it would be unnecessary. There should be a small hole through the back of the wood chuck to drive the balls out by, and a little screw may be made on any bit of steel held in the lathe, on which to mount the balls to polish the whole of the outside. Now take the arms on which the balls hang, centre them and turn them up, cutting the screws to fit into the balls. The shoulder against which the balls screw is a collar $\frac{1}{4}$ in. in diameter, and that is just the thickness of the joint at the other end. File the flat of the joint parallel with the arms, laying them down sideways on the face-plate to try it, and file out the slot which forms the joint in the arms of the body of the governor. The file can be passed through both arms (see Fig. 27), so that it is easy to file out these two joints and make a perfect fit. The arms of the governor carry small levers at an angle of 120° with the longer part of the arms, which short arms or levers meet in the centre, in the slot of the brass piece which forms the top of the governors, and are halved together in that slot. The shape of one of these small levers is seen projected above (Fig. 24), and the top piece with slot at Fig. 26. This little piece is pinned on to a $\frac{1}{8}$ in. steel wire, which passes down the centre of the governor and revolves with it, but can be raised up or down $\frac{3}{8}$ in., according as the balls are hanging down or flying out. Upon the lower end of this steel wire is pinned another piece of brass in which is turned a deep groove; in this groove enters the forked end of a small lever, clearly seen in Fig. 25, which lever is also shown projected above; it is secured to a piece of $\frac{1}{8}$ in. brass wire, which passes straight through the gland of the throttle-valve (see also Fig. 28). The lever might have upon it an arm, as dotted, with an adjustable weight for regulating the speed at which the governors would control the engine within small limits. But if our engine is simply required for driving a lathe, etc., in an amateur's workshop, a high degree of regularity will not be required.

The wire which controls the throttle-valve is made of brass, because, like the pump and its plunger, it would be liable to rust if it were of iron, and that would cause unnecessary friction in the stuffing-box. This stuffing-box is clearly seen in section in Fig. 25. It requires to be carefully packed and screwed up as lightly as may be, only just enough to prevent the escape of steam. It would be very easy to screw it so tight that the governor could not rise at all, and would have no control whatever over the engine.

Coming now to the throttle-valve and its case, shown separately at Fig. 28, it may be held in a universal while the oval flange is faced; then the holes for the bolt might be made through this flange, and then it could be clamped by the flange upon a face-plate, the hole inside bored out true and smooth, the screw-thread cut (gas thread) to fit the stop-valve, the shoulder faced, and the edge turned bright. It is supposed that a stop-valve would be bought, and not made. It will cost about four shillings. A $\frac{3}{8}$ in. stop-valve is large enough for this engine, and $\frac{3}{8}$ in. piping for the steam-pipe; but $\frac{1}{2}$ in. would be better for the exhaust. That being the case, it will be simpler to have both steam and exhaust $\frac{1}{2}$ in. bore, and then the stop-valve must be $\frac{1}{2}$ in. too. A $\frac{1}{2}$ in. stop-valve is shown at Fig. 4. There will be required a $\frac{1}{2}$ in. "nipple" to connect the stop-valve with the standard, since both these have female threads. A "nipple" is a short ferrule of pipe with threads on the outside; it would be screwed firmly into the standard, and the stop-valve would screw upon that. The throttle-valve case, or standard, may be mounted upon the angle-plate chuck to bore and tap the stuffing-box, which is to be done at an angle of 45° with the flange. The casting for the throttle-valve itself appears at Fig. 29. It will be

centred and turned till it will fit into the bored hole in the standard. The hole for the brass wire which carries and controls it may, perhaps, best be bored by placing the valve in position in the case or standard, and then passing the drill in through the stuffing-box and gland. Next, the governor standard would be fixed and screwed down in position, and the hole for the other end of the brass wire bored through the arm of the bracket made to sustain it, when the wire would be put through that arm and the stuffing-box of the throttle-valve standard, while the latter was placed in position on the valve-box. Thus arranged, the holes through the oval flange could be correctly marked upon the steam-chest. The stems cast on the throttle-valve to aid in turning it may now be cut off, and the hole through valve and wire drilled, and the little brass pin, seen in Fig. 28, inserted. All that is required now to complete the connection between the governor and the throttle-valve is to make the little lever which embraces the grooved piece at the bottom of the small rod which passes down the centre of the governor. Now fit the shaft in the long boss, bore the small pulley which receives the band, drive it on at one end, and turn it up in position; bore and fix the little mitre-wheel at the other end, adjusting it to gear to the correct depth, and fixing it with a key or a pin driven right through.

It must not be supposed that the throttle-valve will stop the steam without any leakage: it could not do so fitted in this way; the stop-valve will do that; but the throttle-valve will stop nearly all passage of steam, and when closed by the governor there should not be sufficient leakage to work the engine. The parts of the governor are so proportioned as to allow the engine to run at about 100 revolutions per minute. The pulley on the horizontal driving shaft is the same size as the groove in the boss of the eccentric, so that both engine and governor would run at the same rate. If it were desired to make the engine run twice as fast, that could be done by replacing the pulley on the horizontal shaft by one of twice the diameter, so that the governor would still turn at the same speed, while the engine was going twice as fast. It would increase the power of the governor to work the throttle-valve, if it were allowed to run at 200 revolutions whilst the engine made 100; to do this we might make a brass or hard-wood pulley of 3 in. diameter, and key it upon the boss of the eccentric, over the present groove; then a spring or weight would have to be so arranged as to bring down the arms of the governor, when making 200 revolutions, to their normal, or midway, position—the one they now occupy when revolving at 100 revolutions. A weight could be arranged as shown dotted in Fig. 25; and springs might be applied as shown sketched at Figs. 58 and 59. It is not proposed to show how to calculate the spring or the weight, because it is a very easy thing to test the governor by spinning it, counting the revolutions, and then making the pulleys to the correct size. In Fig. 58 it is supposed that four small eyes are screwed into the centre of the balls on both sides, so that a couple of springs can be fixed to draw the balls together. A neater plan is shown at Fig. 52; here two notches (*n*, *n*) are filed in the knuckle of the governor arms, into which enter the ends of the bow spring (*s*); these ends are kept in place, sideways, by the slot in which the arms move, whilst the middle of the bow is pierced with a small hole, and passes over a small pin (*p*) screwed into the lower part of the little ball, the upper part of which has been cut away. Supposing it be decided to use a spring, a little flat one of this kind would be very easy to make and apply; the pulley on the horizontal shaft of the governor could be driven off a groove on a chuck in the lathe, then the governor could be spun till the arms took up their midway position, when the revolutions would be counted; if the rate were evidently too great, the spring would be taken off, and weakened by grinding it a little thinner. When the arms of the governor come to the mean position at about 250 revolutions, the adjustment would be correct. It would be

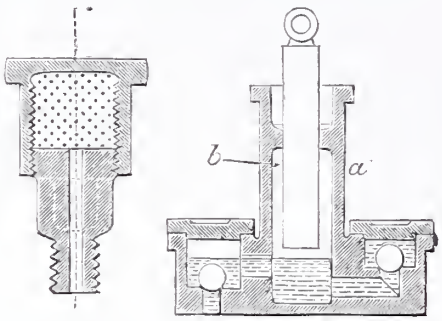



Fig. 60. Fig. 57.

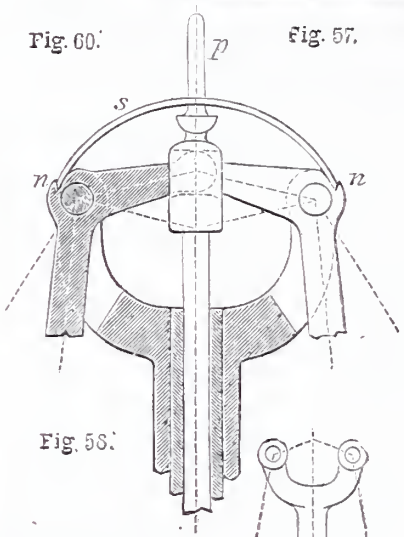



Fig. 58.

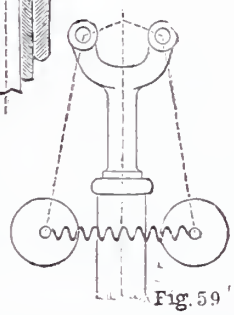


Fig. 59.

Fig. 57.—How a Feed-Pump should not be made. Figs. 58, 59.—Two Methods of applying Springs to Governor. Fig. 60. — Section of Stauffer Lubricator.

well also to ascertain what speed is required to raise the arms to their highest point and close the throttle-valve, and, again, at what speed the arms begin to rise; we might expect to find 240 revolutions would raise the arms, 250 bring them half-way up, and 260 raise them to the highest point; then, if the engine is speeded to run at half the revolutions of the governor, it may vary in speed from 121 to 130 revolutions per minute, but would not in practice vary more than ten revolutions, except under exceptional circumstances. It might be impossible to count the revolutions of the governor, but it would be easy to count the lathe mandrel, and the groove on the chuck could be made twice or three times the size of the pulley on the governor shaft.

I cannot say, certainly, that our engine with such a governor as we have now described would be sufficiently steady to drive a dynamo: I think it would; and with a good boiler, large enough to run the engine at 200 revolutions, I am led to believe it would light about six lamps of 10 candle-power.

*Lubricators.*—Something must now be said about the lubricators. These, it will have been noticed, are not of the usual kind; should anyone wish to use the common kind of oil cup, they can of course do so, or they can do without any cups. The ordinary oil cup, however, requires to be set in a vertical position, which these do not. The lubricators shown in our engine are the smallest size of Stauffer's patent lubricator, and cost one shilling each. They are filled with a kind of grease which looks like yellow cold-cream. A section of one of the lubricators is seen in Fig. 60. It consists of two parts: a cap, which is filled with the grease, is screwed down upon the other part till the grease is forced down the small hole into the bearing; as the shaft revolves it distributes the grease, which soon begins to ooze out at the sides of the brasses; the bearing is then ready for work, and will require no further attention for a day or so, or even, perhaps, for a week; even when a fresh supply of grease is required, it is only necessary to give the cap about half a turn with the fingers, so as to force out a little more grease into the bearing; when the cap has been screwed quite down it must be re-filled. No oil runs or drops about to make a mess, and nothing could be cleaner or more convenient. This form of lubricator can be used in any position: it may be horizontal, as on the eccentric and connecting-rod; it may force grease into several rubbing surfaces at once, as that on the top of the cross-head; it may be placed upside down, or it may revolve with the boss of a loose pulley. No lubricator has been provided for the slide-valve and piston, because when working at moderate pressures the water contained by the steam lubricates sufficiently. A simple way to lubricate both slide-valve and piston at once is to arrange an oil cup so that it may deliver into the steam-pipe; by thus lubricating the steam-pipe, the oil is carried to all the rubbing surfaces inside.

The exhaust-pipe is supposed to be simply screwed into the cylinder casting: it leads downwards, to carry off the water; it may be led down towards a drain and a hole made at the lowest point there, to allow the water to escape; after which it may turn upwards to carry the bulk of the exhaust steam into the air.

Cylinder cocks are shown to carry off the condensed steam from the cylinder; they are opened at first starting the engine, when the cold metal of the cylinder condenses a good deal of steam; they are both moved by one handle. These taps cannot really be considered necessary on such a small engine, especially with a descending exhaust.

All drips or leakage about the engine should be prevented as far as possible. Engines are often seen working without the slightest whiff of steam appearing even at the stuffing-boxes. It would be very undesirable in an amateur's workshop to have an escape of steam, as it would be liable to rust the bright work about the lathe, tools, etc. The stuffing-box of the stop-valve is liable to leak, and this valve-cock should be screwed on the right way up—that is, in such a way that when closed the steam should be shut off from the stuffing-box. A little tin tray may be hung by a wire under each stuffing-box gland, so as to catch any

drops that may fall; the pump gland is one especially liable to drop and make a mess.

*Lagging of the Cylinder.*—The "lagging" or wood casing surrounding the cylinder appears in Figs. 4, 5, 7, and 25; it is useful in two ways: first, it prevents loss of heat from the cylinder, and consequent loss of power; and secondly, it prevents the engine from unduly heating the apartment in which it works; also it looks well if nicely fitted, the wood polished, and the brass bands kept bright. The cylinder would first be clothed with felt or, say, part of an old blanket; then the wood lagging in strips of mahogany; and then the brass hoops secured as seen in Fig. 7; or, otherwise, instead of the hoops there might be a piece of thin sheet metal bent round the wood and painted.

*Steam Joints.*—Making the steam joints is a very simple thing. Buy a little red-lead powder and some white lead (in paste) from the ironmonger or colourman; mix a little red-lead powder into some white lead just to stiffen it, work it well together, and rub this on to the threads of the screws of the pipes before screwing up. It is usual to spread some of this same cement between the flat surface joints, such as those of the cylinder cover, valve-chest, etc., but I have used a piece of red blotting-paper with complete success. It was cut out with holes for the bolts, and when cut round the edge of the joint, looked as if it were a red-lead joint, with the advantages that you could take it apart as often as you wished, whilst none of it squeezed out of the joint into the inside of the cylinder. It would be an advantage to oil the blotting-paper before screwing up the joint.

*Foundation.*—There are three lugs provided on the bed-plate, by means of which the engine can be bolted down upon a foundation. The foundation may be a frame of wood made so as to raise the engine high enough to allow the fly-wheel to run clear of the floor; or it might be a stone, the foundation bolts being fastened in with lead. It is convenient and suitable to have the engine raised above the floor, at any rate as high as a chair, because it is more easily got at. When not at work, it should be carefully covered with a cloth or piece of green baize, to keep it from dust and damp, remembering that dust and grit, and above all emery-dust, must not be allowed to get on to the sliding guide nor into the bearings.

*Driving Belt.*—The fly-wheel, being 16 in. in diameter, a flat belt round this wheel should transmit all the power the engine is capable of exerting without being unduly tightened. It is well to arrange for the belt to run upwards, because then it may relieve the bearings of most of the weight of the fly-wheel; and it is better, if the belt must be inclined upwards, to arrange it to incline forwards, from the engine, not backwards, towards and over the engine; because, in the first case, the pull of the belt would tend to cause wear upon the middle of the upper brass of the crank shaft bearing, which wear can be taken up by tightening the cap of the bearing; but in the second case the wear would come upon the sides of the brasses, where they are divided, and here the wear cannot be taken up.

I will now take leave of my readers, heartily wishing them good success.

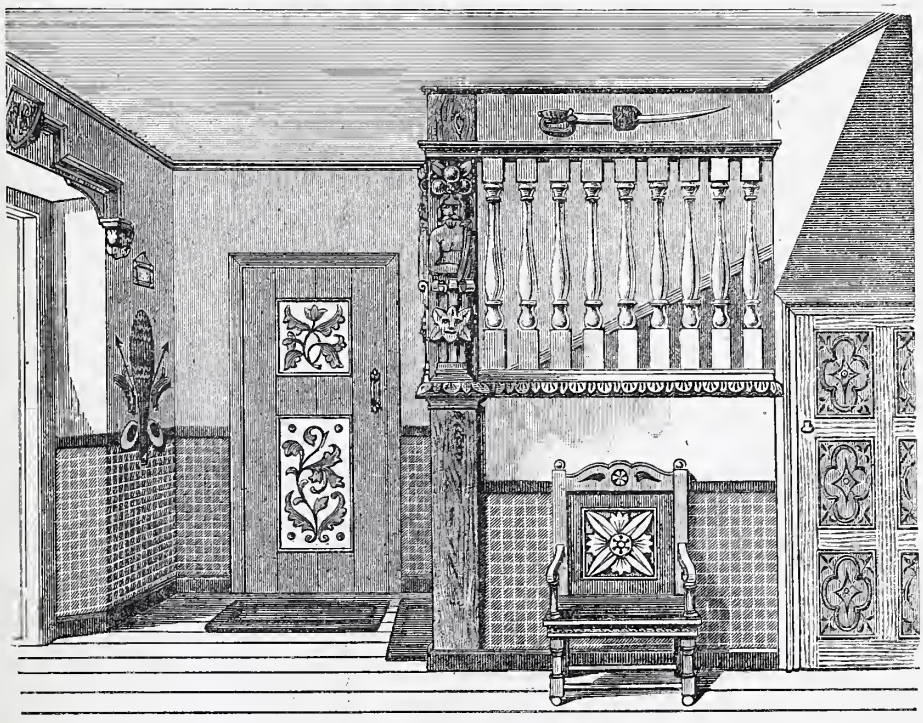


Fig. 16.—The Entrance Hall as re-arranged, showing Staircase.

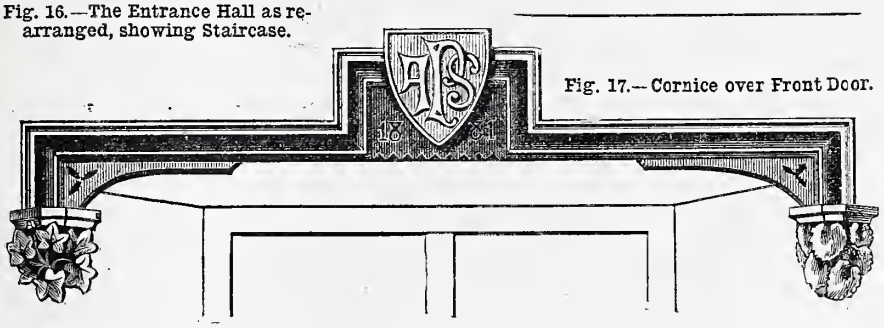


Fig. 17.—Cornice over Front Door.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

THE ENTRANCE HALL—THE STAIRCASE—THE FRONT DOOR—THE STUDY DOOR—THE WALLS.

*The Entrance Hall.*—All those among us who find pleasure in the tasteful arrangements of our homes are, I believe, of one mind as to the desirability of having an entrance hall deserving of that name, and one which can properly be called by it. Comparatively few, however, of those who, like myself, are not born to fortune, can indulge in the luxury, for the majority of small houses have, instead, nothing better than a miserable passage. Fortunately, in my house I found a real hall, though but of small dimensions. It was not passage-shaped, but almost square, viz., 12 ft. by 11 ft. On each side of it was a door—westward to the public street, northward to the study, southward to the dining-room, and eastward to a parlour (for it seems absurd to dignify this little apartment, scarcely more than 12 ft. square, with the title of "drawing-room"). The stairs also rose from it, and, indeed, much of the northern side was occupied by the lower part of the staircase.

*The Staircase.*—When I entered upon the house this same staircase was by no means a sightly feature. It was, in its lower part, completely enclosed; at its side it was shut in by a lath-and-plaster partition, and at its foot by a door. It thus detracted from the apparent size of the hall, and prevented its giving a due impression of its shape. As for the stairs themselves, they were of bare elm board, strong, certainly, and sound, but bleached with the soft soap and scrubbings of a long course of years. They looked unpromising, but elm is always a hopeful kind of wood: under proper treatment it will generally develop a pleasing grain and a good colour. Accordingly I brushed them over with hot boiled oil, so far as they would not be covered when carpeted, and polished them with beeswax and turpentine. I found that they repaid my trouble.

The door at the stair-foot I cleared away, and removed all traces of it. A reference to Fig. 16 will show in what manner I dealt with the partition at its side. To have removed this partition bodily, and substituted a balustrade, would have been too serious an undertaking for me, nor did I see any pressing necessity for so doing. Among other wreckage of "restored" churches, I had secured a set of discarded communion rails, which were good solid oak-work of the seventeenth century. I cut out a portion of the partition, as shown in Fig. 16, and in the opening inserted a length of this railing. For the remaining portions I found employment as balustrades on the landings of the two upper storeys, where some shabby painted deal rails had to be removed. Of the alteration in the

entrance hall, I may say that it sufficiently lights the previously dark stairs, and throws the staircase open to view; moreover, its quaint and unusual appearance renders it, to my thinking, more pleasing than a regular balustrade could have been.

As with the new arrangement the post at the stair-foot had a somewhat bald appearance, I looked through my stock of old oak carvings, and found two demi-figures, which I nailed upon it in the manner shown in Fig. 16.

Beneath the staircase was a closet opening from the hall by a shabby painted door. This door I also took away, and substituted for it that which appears in the illustration (Fig. 16). The carving seen upon it is of the same kind as that on the dado of the study, though of a different pattern, and is my own work. The door itself is of old oak panelling of the time of James I. The view of the staircase in its present form (Fig. 16) is as it appears through the open door of the dining-room.

*The Front Door.*—The opening to the street door as seen from within was by no means pleasing. It was of considerable width, the walls, which were very thick, being splayed away inwards; and I had to consider how, whilst improving its appearance, I might also arrange for the hanging of a heavy curtain during the winter months. Fig. 17 will give some idea of the plan adopted. The cornice there shown is made from a bold steam-struck moulding (of which it will be presently seen I used more elsewhere), and which, like the board to which it is attached, is ebonised. On the scutcheon in the centre I emblazoned my monogram on an azure ground. The curtain itself is not there, nor is the rod shown by which it may be hung. This is another fragment of the wreck of the four-poster, on which it once figured as the foot-rod. Like its fellows in the "den," it is enamelled vermilion. The cornice is made to rest on two corbels, which were cut by me from the soft stone of the country (white lias), and which are let into the wall for that purpose.

*The Study Door.*—I have mentioned that the study had old-fashioned ledger doors—doors of plain boards nailed upon cross-pieces—and as the other doors which opened from the hall were panelled, that to the study, which was close by the stair-foot, looked out of keeping in its original state. Accordingly, with some strips of narrow moulding, I marked out two panels; throughout their length I carefully puttied up the central chink, and upon them I painted in monochrome a sort of conventional foliage scroll, as shown in the illustration. The panels are of a Pompeian red; the other parts of this and the other doors black.

*The Walls.*—These I contented myself with papering with a dado paper; and, in the absence of any other cornice round the ceiling, I fixed up one of ebonised moulding similar to that in the study, namely 1½ in. deep; but, as will be seen from the illustrations, I arranged no frieze here.

My entrance hall being thus reorganised, I furnished it with a small, dark, carved oak table, and two ancient carved chairs, one of which shows in Fig. 16. Its walls were now no unsuitable place round which to hang antique weapons, scraps of carving, fragments of armour, and such like curios which men of the tastes of its owner ever find delight in accumulating, and which are as appropriate in this position as old china, bits of bric-à-brac, and Japanese fans, and screens and other fanciful means of ornamentation are in the drawing-room.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

TEMPERING MIXTURES: WATER—MEDICAMENTS—OILS AND FATS—LEAD BATHS—HARDENING BETWEEN COLD METAL—FICTION *v.* FACT—EXTREMES OF TEMPER—EXAMPLES—TAPS—DIES—DRILLS—MILLING CUTTERS—AXES—MILL PICKS—SPRINGS.

My remarks in this article will have reference to the different kinds of tempering mixtures used, and the special treatment adapted to various tempered articles. Owing to pressure of business I have not been able to send in these "Practical Papers for Smiths" as quickly as I could wish; I shall, however, do my best to complete the section of my subject selected for treatment in the present volume of WORK in two more short papers.

*Tempering Mixtures: Water.*—Water is the commonest medium used for quenching steel, and hard water is not so suitable for tempering as soft or rain water. Moreover, smiths do not change the water in their tempering tanks, but simply add fresh in sufficient quantity to make up for waste. They have an opinion that water which has been long used is preferable to fresh water. It is supposed that the virtue attributed by smiths to that which has been long in use may be due to this: that the frequent warming of the water by red-hot metal has driven off the air contained in it, and allows the fluid to come into more intimate contact with the surface of the steel than when normally impregnated with air. The belief that boiling the water is beneficial may be explained in the same way.

Pure cold water is very commonly used for ordinary tools, such as chisels and drills; but for other and more difficult work, warm water, or water medicated with various substances, is found more suitable.

*Medicaments.*—Thus, a good tempering bath is made by adding half a pint of common salt to a gallon of soft water, and brine of various degrees of saltness is one of the most favourite mediums employed for quenching tools. But many other salts are also extensively employed. The salts of potassium, ammonia, mercury, and boron are in much request. Ferro-cyanide of potassium is frequently used in tempering baths, along with salt and borax. About half a pound each of potash and borax, and about six ounces of salt, pulverised and dissolved in ten gallons of water, make a good bath.

But the hardening effect of water is too intense for many classes of articles, for which oils and fats are better adapted.

*Oils and Fats.*—Linseed oil is very suitable for tempering small springs and other articles in. Beef suet, grease of various kinds, refuse of fats and oils, used alone, or mixed with pitch and resin in various proportions, are also used for spring steel.

*Lead Baths.*—A bath of molten lead is a good heating agent for many articles up to the temperature for tempering. In it also articles of unequal thickness can be heated uniformly. The lead is prevented from oxidation by covering its surface with powdered charcoal.

The temperature of a bath of pure lead is of course uniform, but by making alloys of lead and tin in various proportions, an extensive range of temperature is obtainable, suitable for work of different classes. The following table, taken from Dr. Percy's "Metallurgy of Iron and Steel" (p. 854), will serve to show what can be done by means of such tempering baths of alloy:—

TABLE OF THE COMPOSITION OF METALLIC BATHS FOR THE USE OF WORKING CUTLERS.

| *No.* | | *Composition of the Bath.* | | *Temp.* |
|---|---|---|---|---|
| | | *Lead.* | *Tin.* | *Fah.* |
| 1 | Lancets ... .. ... ... | 7 | 4 | 420° |
| 2 | Other surgical instruments ... | 7½ | 4 | 430° |
| 3 | Razors, etc. ... ... ... | 8 | 4 | 442° |
| 4 | Penknives, and some implements of surgery ... ... | 8½ | 4 | 450° |
| 5 | Larger penknives, scalpels, etc.... ... ... ... ... | 10 | 4 | 470° |
| 6 | Scissors, shears, garden hoes, cold chisels, etc. ... ... | 14 | 4 | 490° |
| 7 | Axes, firmer chisels, plane irons, pocket-knives, etc. ... | 19 | 4 | 509° |
| 8 | Table-knives, large shears, etc. | 30 | 4 | 530° |
| 9 | Swords, watch-springs, etc.... | 48 | 4 | 550° |
| 10 | Large springs, daggers, augers, fine saws, etc. ... | 50 | 2 | 558° |
| 11 | Pit saws, hand saws, and some springs ... ... ... | Boiled linseed oil. | | 600° |
| 12 | Articles which require to be somewhat softer ... ... | Melting lead. | | 612° |

*Hardening between Cold Metal.*—It is not even necessary that hardening should always be done in liquid. If a thin heated plate is placed between two pieces of cold metal, it will become hardened as effectually as if in water or oil. This is often done, because it tends to lessen risk of warping of the plate.

*Fiction v Fact.*—It may be suspected that many of the various medicaments employed in hardening mixtures, and the use of so many different proportions of oils and fats, are more fanciful than valuable—more of the nature of supposed trade secrets than of vital importance. This may be the case in some instances, but I doubt if it is often so. A workman finds that he can obtain certain excellent results by the use of such and such compounds, which he cannot, or does not, obtain by the use of any others. That man is always working in that line, and surely ought to know what is best. Tool makers often keep their knowledge to themselves, thereby giving the best possible proof of their belief in its value. It is also certain that a knowledge of the relative conductivity of many of the mixtures employed often fully bears out the wisdom of the smith's practice. Mr. Godwin Austin referred to this matter in an address delivered before the British Association in 1889. He remarked: "But cold water was far too simple a material for many a sixteenth century artificer to employ, as is shown by the quaint recipes contained in one of the earliest books of trade secrets, which, by its title, showed the existence of the belief that the 'right use of alchemy' was to bring chemical knowledge to bear upon industry. The earliest edition was published in 1531, and the first English translation in 1583, from which the following extracts may be of interest:—'Take snayles, and first drawne water of a red die, of which water being taken in the two firste moneths of harvest when it raynes; boil it with the snayles, then heat your iron red hote and quench it therein, and it shall be hard as steele. Ye may do the like with the blood of a man of xxx. yeres of age, and of sanguine complexion, being of a merry nature and pleasaunt . . . distilled in the middst of May.' This may seem trivial enough, but the belief in the efficacy of such solutions survived into the present century, for I find in a work published in 1810 that the artist is prettily directed to 'take the root of blue lillies, infuse it in wine, and quench the steel in it,' and the steel will be hard. On the other hand, he is told that if he 'takes the juice or water of common beans and quenches iron or steel in it, it will be soft as lead.' I am at a loss to explain the

confusion which has arisen from this source. As must always be the case when the practice of an art is purely empirical, such procedure was often fantastic, but it is by no means obsolete, for probably at the present day there is hardly a workshop in which some artifice could not be found with a claim to possess a quaint nostrum for hardening steel. Even the use of absurdly compounded baths to which I have referred was supported by theoretical views. Otto Tachen, for instance, writing of steel in about the year 1666, says that steel when it is 'quenched in water acquires strength, because the light alcaly in the water is a true comforter of the light acid in the iron, and cutlers do strength it with the alcaly of animals;' hence the use of snails. Again, Lemery explains in much the same way the production of steel by heating iron in the presence of horns of animals." How much are modern theories nearer the mark?

But the belief, as old as Pliny—who maintained that the quality of steel depended on the nature of the water used in the process of hardening, and who mentions the use of oil for tempering where water would have too great a hardening effect—is still held and acted on by every smith in large factory and country forges, and is in the main correct, both in practice and theory.

It is not surprising that different men differ so greatly in their statements respecting the working of steel. Welding and temper depend for their efficiency not only upon minute differences in grades of steel, but also on the minute alterations of colour that indicate grades of temperature. Intensity of colour is a matter of individual opinion, and depends also on the light in which it is observed. A colour that looks bright in a dark shop or on a dull day will not be so bright under contrary conditions. Matters like this have to be borne in mind when endeavouring to reconcile statements apparently at variance. Much also depends on what previous hammering a tool has undergone. Hammering at a low red heat closes up the fibres and renders the steel better adapted to take a good temper. The thinner a tool, the more difficult it is to temper. The greater the length of that portion of a tool which is tempered as distinguished from that which is hardened, the better will be the temper. That is, if a tool is only dipped for a length of ½ in., and then let down, it will not be so reliable as one that is dipped 1 in. or 1½ in. There is no end of little matters that affect the ultimate temper of steel articles. A man may spend his whole life in such work, and still confess himself ignorant of many matters of an apparently occult character. For this reason, no one should dogmatise about the virtue of his own special methods to the exclusion of others, probably equally good.

*Extremes of Temper.*—In tools the maximum of hardness and elasticity combined is obtained by tempering at a straw colour. Quenching at a red heat makes a tool intensely hard, but brittle. Quenching at a blue makes it elastic, but soft. Between these extremes the whole practice of hardening and tempering lies.

I instanced the chipping chisel in the last article as a typical case of hardening and tempering; I will now refer to some other tools.

*Taps.*—Screw taps are conveniently heated in an iron tube, large enough to allow not only of the admission of the tap, but also of the tongs by which it is manipulated. The tap must be kept slowly revolving within the tube, in order that the temperature may be equally distributed throughout. The same method will be employed for heating the tap, both for hardening and for tempering. The tool is first hardened by heating to a dull red in the tube. The temperature must be raised gradually and very slowly, and equally throughout. If heated rapidly, the edges of the threads will be at a higher temperature than the interior, and being probably too hard, will crumble off in use. A dull red must not be exceeded; in fact, it must be an invariable rule to harden and temper taps at the lowest heat practicable. It is better to make two or three attempts, increasing the heat each time, rather than to rashly overheat at once and spoil the tool. It is then plunged vertically into lukewarm water, and held there until quite cold. Afterwards the flutes are brightened with emery and oil, and heated to a light straw in the tube, and quenched for temper.

Some use linseed-oil baths for quenching taps and dies. It is, however, a good precaution to use soapy water. Also the points of the threads may be protected with a coating of soft soap, or with a paste made of prussiate of potash and flour, or yeast.

The specific gravity of hardened steel is less than that of unhardened steel. Hardening, therefore, has the effect of slightly expanding the steel, and taps are screwed very slightly less in diameter than they are required to be after hardening. Other tools that are turned in the lathe before hardening, such as D-bits, fluted reamers, and rose-bits, are also for the same reason turned bare to size.

*Dies.*—Dies are first heated to a cherry red, and hardened in salt water. To diminish the risk of cracking, they are covered with prussiate of potash or with a paste of soap and oil. The faces are polished, and the dies heated on a hot piece of iron, taking care to turn them over and over until they are of a straw colour, dark, bright, or medium, according to circumstances. A bath of linseed oil may also be used for tempering.

Worn dies are not thrown aside, as a rule, but are re-cut. Before they can be re-cut, the temper must be completely drawn by annealing. This is done by heating the dies to a light cherry red in a clear fire, and covering them with sawdust and ashes until cold. Or they are enclosed in an iron tube, and heated with charcoal or leather cuttings, and allowed to cool. Other tools, such as broaches, milling cutters, reamers, and lip drills, when worn, are similarly annealed preparatory to re-cutting. Afterwards they are tempered just as in the case of new tools.

*Drills.*—Drills for cutting iron are tempered at a dark straw at the cutting edges. The remarks made in reference to the hardening and tempering of cold chisels in the last article apply equally to drills for iron.

Drills for boring hard steel will be heated and quenched in a lump of lead, and not drawn afterwards. Glass may be drilled with such tools by the assistance of paraffin or petroleum for lubrication, placing a cork underneath the glass beneath the drill to deaden vibration.

*Milling Cutters.* — Milling cutters are heated to a red, dipped into oil until the red colour disappears, and then transferred to water, and left till cold; then heated to a light straw, and cooled.

*Axes.*—Axes are hardened and tempered very much like chisels. They are heated first to a red, and quenched to a depth of two or three inches in water. A face is polished, and the changing tints observed until the appearance of a deep blue, at which total immersion is made for temper. As in other tools, different shades of blue, inclining towards a brown straw, will be required for different grades of steel.

*Mill Picks.*—Mill picks are not tempered in the common acceptation of the term, but hardened only. They are heated to a dark red, and quenched finally, the temper thus obtained not being drawn, or let down, as in the case with most of the tools already noticed. Pure soft water is quite suitable for these, and yet most smiths use medicated mixtures, into the composition of which salt, alum, sal-ammoniac, etc., enter.

*Springs.*—Springs are first hardened in the usual way by heating to a cherry red, and quenching in water. Then they are smeared with tallow or lard, and heated in the fire or over the fire, moving them to and fro until the tallow catches fire, and blazes and burns off. When burned off, the springs are laid upon the forge, or on the ashes to cool down. If the work is of irregular thickness, the burning of the oil should be repeated two or three times.

Small springs made in quantity are often put into a sheet-iron pan and covered with oil, and held over the fire until the oil blazes and burns off. Moving and shaking the pan about causes the temper to be more uniform. In the case of heavy springs the operation may be repeated twice or three times.

## A GIRTH-TIGHTENING WHIP CROCK.

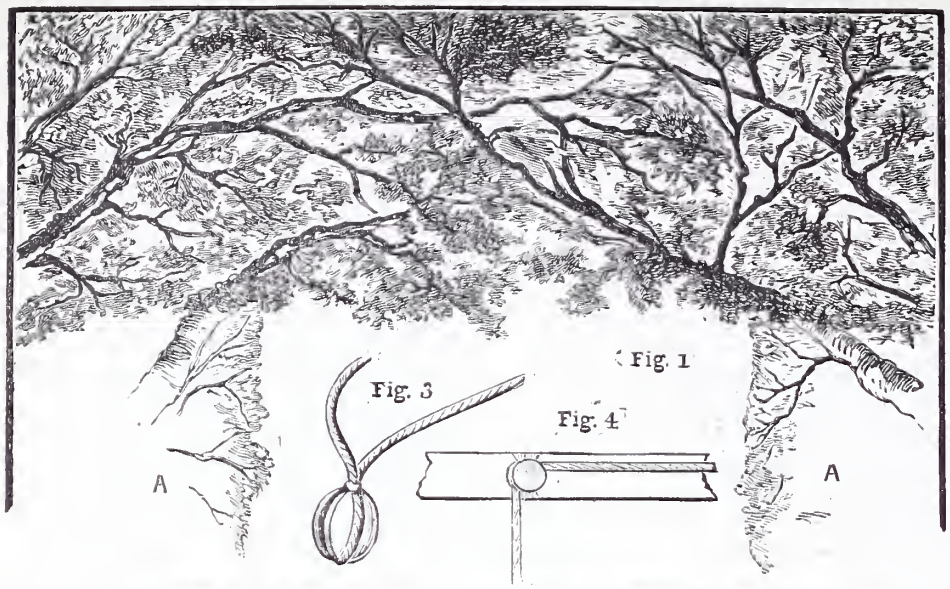
BY J. C. KING.

THE buckhorn of a hunting whip is termed a "crook" or "crock," but sometimes iron, nickel, or brass is used; a whistle is often formed in the crock, sometimes a spring loop to take the rein of another horse, or for similar uses. But the best use is to form of the buckhorn a grip for tightening the saddle-girths.

A Girth-Tightening Whip Crock.

It is simply done: a flat is cut on one side of the horn and roughened with cross-cuts as of a file; a hole is bored in the end near the socket that takes the whip handle or "crop," and a small mortise an inch from the end at the edge of the roughened horn is made. A nickel vice-jaw, an inch long and ⅜in. wide, is the movable jaw, which turns only about ⅛ of an inch in the mortise, the turning being on a long screw through the projecting angles of the jaw, and lengthways of the buckhorn crock. The jaw is always a quarter of an inch open till closed with the thumb pressure, which causes it to grip the leather of the saddle called the "point," which takes the girth-buckle.

The illustration shows the whip being used by the huntsman's hand pressing up the saddle-point strap, and drawing it through



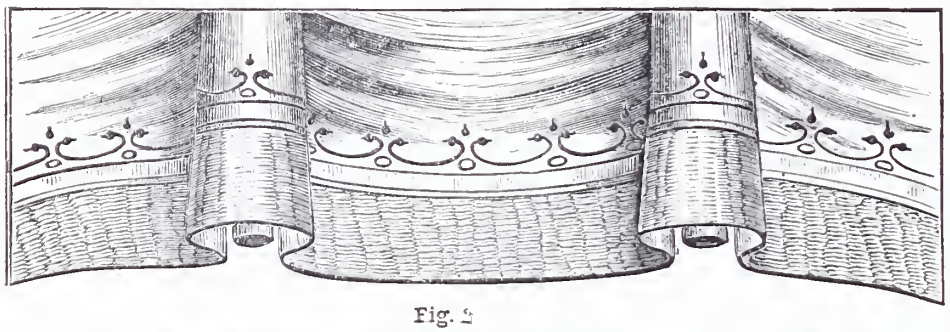



Fig. 2

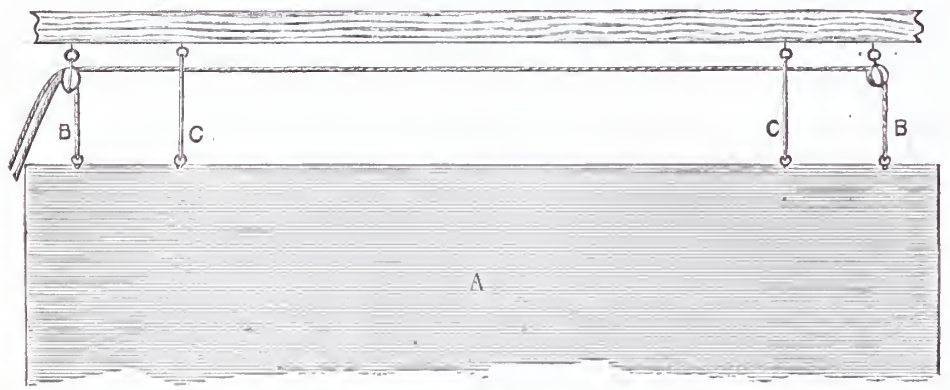
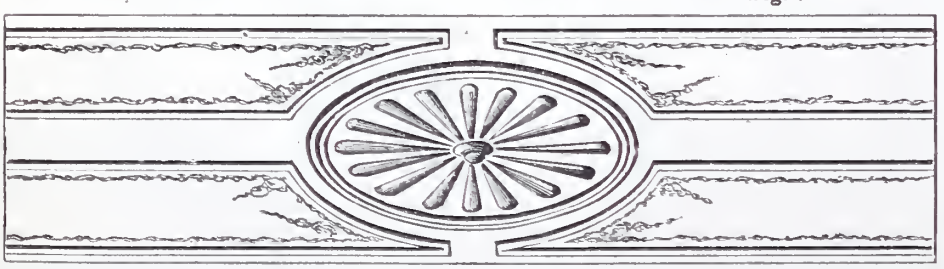



Fig. 5

Fig. 6

Fig. 7



BORDERS. Fig. 1.—Cut Border: Foliage. Fig. 2.—Cut Border: Drapery. Fig. 3.—Small Wood Block for raising Border. Fig. 4.—Arrangement for raising Border. Fig. 5.—Border (A) with Pulley Blocks (B) and Dead Lines (C). Figs. 6, 7.—Borders representing Ceilings of different kinds.

the girth-buckle. With this grip the fingers are not strained, as the power of the hand lightly used is sufficient to draw a girth tight. Grooms often catch hold of the girth-point with their teeth, to their injury. The metal jaw is not in the way, and weighs about half or three-quarters of an ounce The equestrian readers of WORK are welcome to the use of the invention.

## STAGE CARPENTRY.

BY WILLIAM CORBOULD.

### BORDERS, GROUND ROWS, ETC.

BORDERS are classed under several heads: such as sky borders, tree, interior, and drapery borders. The making of them is the same, as far as battens and canvas go, but the painting is quite another thing; of that, further on.

In making a border, the most particular thing is to have a good batten of sufficient strength to keep the canvas straight and flat, especially sky borders. There should be no creases; the reason is obvious. Suppose we have a border, say, 15, 20, or 30 ft. long, and 3 ft. or more deep, you must stretch your canvas on a frame or some flat surface. After you have done this, make some good priming. What I mean is, let your size be strong, but not too much whiting, as borders, as a rule, get a deal of knocking about; if you had too much whiting they would crack and show bad places. When your priming is dry, it will be ready for painting, if a sky border; or for an interior ceiling or drapery, it would be ready for drawing in your subject. Should there be cutting-out to do, such as hanging branches and leaves of trees, or drapery (see Figs. 1 and 2), you would, after painting, take the border off the frame, lay it flat upon the stage or floor, and tack it to your batten; you may then hang it up, say, shoulder high, when you can cut, foil, or do anything you wish. After it is all complete, you may hoist it into its place, hanging it with two or more "dead lines" to beams, rafters, or any place of safety with "screw eyes" having a firm hold. Should the borders be required to rise and fall, small blocks would have to be used.

With regard to blocks, I would advise the amateur to use small wood blocks (see Fig. 3). They are far better than the iron (Fig. 4), as the wood blocks will work about with the pulling of the ropes; on the other hand, the iron ones, being fixtures, soon cut the ropes. If you have movable borders, always have good dead lines attached, to prevent accidents (see Fig. 5; A, border, B, B, pulley blocks, C, C, dead lines), for should the block lines give way, the dead lines would prevent the border from falling.

When representing interiors, be careful with the perspective; although a border may be hanging down, it may be made to appear flat by attending to your perspective (see Fig. 6, representing an old ceiling with oaken beams, and, may be, plaster between them). Fig. 7 might be that of an old baronial hall. Fig. 2 is a border drapery, such as a proscenium front; this may be of different colours, such as crimson, blue, green, or amber, with gold or silver bullion fringe and ornaments. I shall give a description of their painting and manipulation when I treat of drapery painting.

We now come to ground rows or borders, rises and sinks, etc. A ground row may

consist of rocks, banks, foliage, water, etc.; they are usually fixed by small dogs (see Fig. 8; A, B, C). Supposing you wished to represent, say, Loch Lomond, with its numerous islands—I have done this with six border rows; the first—that is, the one nearest the footlights—would be painted, the water rather rough, such as a stiff breeze would cause; the next border would be less rough, the third still less than the second, and so on with each one, the last being quite flat and pale in colour, the colour in each growing less in strength; you thus get a broad flat surface in proper perspective. Where you wish to represent an "island" you raise it with profile, as in Fig. 9. Boats may pass between the borders. Some years ago I painted the scenery for the gathering of the "Scottish Clans" at the Theatre Royal, Stockton-on-Tees. The chiefs were represented by children in a boat drawn by two swans; the water being frosted, the moon shining full down on the lake, the beacon fires on the hills, and signal lights of different colours, combined to make a splendid scene.

The *Colleen Bawn* is another play where, in the cave scene, water rows are used with a boat. Sometimes water rows are made with gauze, either pale blue or green; or the water painted—that is, the waves or riplets painted on the gauze, this being held in its place by two iron pins from the wings. A cord through the top of this gauze could be also fastened to the wings.

*Rises and Sinks.*—These are borders which rise through a slide or trap in the stage (see Fig. 10) managed by counter weights; used principally in transformation scenery. To give a description here would be impossible. This all depends on the fancy of the author or artist, which might be weird, grotesque, or any beautiful subject, such as the "Coral Caves of Neptune" or "A Cavern of Sparkling Gems."

In Fig. 10, C C is slide open; A, ground row rising; D, D, counter weights, manipulated from under the stage; at B, on the dotted line, the cord is fastened to the bottom of the border, the cord passing round the grooved wheel, the weight being gently pulled down by the hand.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Boring Holes.

There are a great variety of tools used to make holes in wood, and apart from the question of size, which is of importance, there is also a question of suitability. We will look at a few of these tools. Bradawls are well-known and useful tools for soft wood. Having a cylindrical stem, and being ground to a chisel edge, shows the observant amateur that the chisel having cut the fibres, the wedge-like form of the tool pushes them aside; used in end grain it scrapes and pushes its way in, and though roughly, yet effectually makes room for a nail or a screw. I am far from denying that the bradawl can be used for hard wood, but its special use is for soft wood, and its province is limited to comparatively small holes. In hard wood it is to be turned back and forth more freely than is necessary in soft wood, the edge acting more like a scraper in the harder material. The great fault of the bradawl is that no provision is made for the waste material, which is the reason why it is limited to small holes.

Gimlets are equally well known. They may be regarded as useful tools for the tool-basket, having the merit of portability, boring large pieces of hard wood fairly well, and being just as suitable to bore end grain as across the fibres. Let no one, however, trust a gimlet to bore a hole near the end of a narrow strip of wood; the pointed screw, drawing the tool rapidly into the compact wood, is like a wedge, in that it splits the wood quickly.

For small holes in hard wood a small spoon or pin-bit is very suitable, and if the pin-bit is sharpened from the inside as well as the outside, it will cut better. A good all-round bit is that called "diamond twist;" it is in effect a twisted spoon-bit, and good

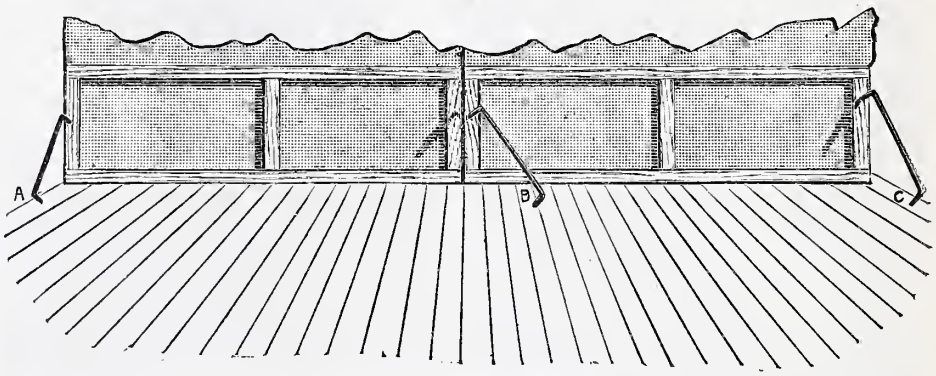



Fig. 8.

Fig 9.

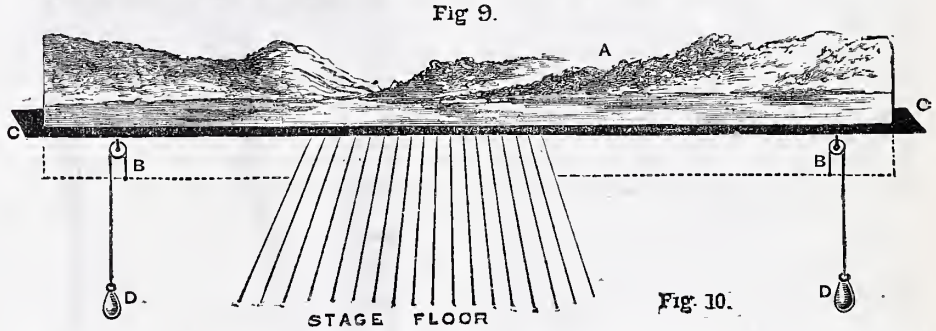



Fig. 10.

**GROUND ROWS, OR BORDER RISES, AND SINKS. Fig. 8.—Ground Row—A, B, C, Small Dogs. Fig. 9.—Ground Row. Fig. 10.—Ground Rise and Sink, showing the Scenic Portion comprised therein (A), with Pulleys (B).**

piece of wood; it has an almost continuous circular cutting edge, and two cutters to remove the inside wood. I have not tried it, but it seems to have all the requisites of a good tool.

Clark's expanding bits are excellent for organ-builders and others who require great variety of sizes; they work well, and would cost less than the number of centre-bits, whose work they are capable of doing. There is also a new expanding centre-bit recently introduced, but it does not work to perfection; the movable cutter in the one I have is too much like a scraper rather than a chisel. That is a slight fault which doubtless will soon be remedied by the makers.

work can be done by it. Centre-bits begin at about $\frac{3}{16}$ in., but, unless very nicely made, the small sizes are not much good; for holes from $\frac{1}{4}$ in. upwards they are applicable, suitable, and cheap; they do not do well for end grain, and should be kept sharp. The bits that are best for all purposes are Jennings' twist-bits; they combine in one article the advantages of gimlet, centre-bit, and the old-fashioned auger, inasmuch as they have a screwed centre-point, two sharp edges to cut the circle, and two chisel-like cutters like a centre-bit to remove the chips; it has also a polished surface to the spiral flutes, along which the waste easily travels.

Gedge's bit, which has two gouge-like cutters, is nearly as good, and in one respect better, for by its aid you can enlarge an existing hole. There is also a new bit which will cut a semi-circle from the edge of a

### Panels and Frames.

I have treated upon planing, sawing, setting out, and, to some extent, mortising and dovetailing; it will, therefore, involve a combination of several operations which we have learnt to make a frame and panel. A panel, in woodwork, is defined as a piece of board whose edges are inserted in a frame; the panel is usually thinner than the frame, but it may flush—that is, even on one side with the surface of the frame. It may be equal in thickness to the frame, then it is flush both sides, or two thin panels may be inserted in one frame, each panel being flush to a surface of the work. Flush panels are often used for doors intended to be covered with baize or cloth. Sometimes the panel is inserted in a groove, in which case, of course, it must be made, finished, and inserted before the frame is glued up. A

popular novelist once described a joiner, whose thoughts were otherwise employed, as forgetting the panel, and putting the door together without; a clever but an almost incredible illustration of absent-mindedness.

Amateurs must bear in mind that the panels must be inserted, if in a groove and set back from the front, in a perfectly finished condition. For this reason, and because panels are often veneered, carved, French polished, or otherwise ornamented, the frames are often rebated, instead of grooved, for the reception of the panels. In such a case the panels may be fitted after the frame is constructed, and can be removed at pleasure; such a method, which is very common among cabinet makers, is suitable for amateurs. I suppose I need not explain what is meant by a groove; a "rebate," however, is a more technical term. If a piece of the frame is removed, having its edges at right angles to the surfaces of the frame as shown in the annexed diagram at A, it is called a rebate; illustrations of its use can be seen on any picture frame or moulding intended for picture frames. There are many ways of fixing panels in rebated frames, but the method used largely depends on whether the back of the frame and panel are visible; if so, the panel is generally fixed with a bead or moulding nailed or pinned to the frame and not to the panel. The amateur may be well content to fix his panels in this simple way.

Rebate.

Frames and panels should be "square"—that is, unless otherwise intended, they should have the four angles equal, and all right angles. This *cannot* be the case unless the opposite sides are equal; it is for this reason that learners are taught to set out the stiles and rails in *pairs*. If the stiles and rails *are* so prepared, the opposite sides of the four-sided figure are *parallel*, and all we have to do is to see that the diagonals are equal, and we can then be sure that the angles are equal, and are each a right angle. I dwell on this because in large work, such as large window frames, there is no more accurate way of "squaring" the frame than this method of making the diagonals alike, provided always that the sides and ends are equal, or, as the geometricians say, "each to each," and are straight. As I am writing for amateurs, I should like to remind them that the same method of diagonal measurement to determine the angle is applicable alike from land measurement for buildings down to carpet planning or cutting floor-cloth; or, in short, any surface which can be divided into triangles can be plotted and copied, either full-size or to scale, by this plan with ease and accuracy.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 105.—Patent Amateur Parallel Vice.

This neat and handy American tool or workshop appliance may be regarded, and tersely described, as just the "something useful to, and needed by, everyone" who possesses a workshop or workroom, and turns his attention, and devotes his spare time, to doing odd jobs at home. It is true that it is by no means a new tool, and has been, indeed, on the market for years, but it has been improved from time to time as experience has shown to be useful or necessary, and it may now be looked upon as the strongest, most complete, and most serviceable tool of its kind in the market. Nothing but the best car-wheel iron is used in its manufacture, so that the face and jaws are always chilled, hard, and smooth. The

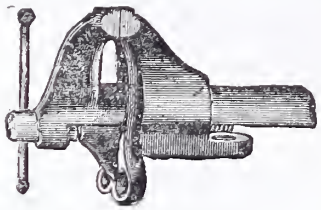


Fig. 1.—Patent Amateur Parallel Vice.

screws are of wrought iron, and the finish of the whole appliance places it at once in the front rank of tools of this description now on sale. Of course, as it happens to be an American tool, there is no necessity to give the name of the American maker, but, for the information of those who may be desirous of obtaining one for his own use, it may be said that this speciality is put on the English market by Mr. H. A. Hobday, Tool and Cutlery Works, Chatham, who frequently advertises his specialities in the pages of WORK. It is made and supplied in the following sizes—

| *No.* | *Width of Jaws.* | *Opening of Jaws.* | *Weight.* | *Price.* |
|---|---|---|---|---|
| 1 | 1 in. | 1¼ in. | 4 oz. | 1s. 0d. |
| 2 | 1½ in. | 1¾ in. | 1¼ lbs. | 1s. 9d. |
| 3 | 2 in. | 2¼ in. | 7 lbs. | 3s. 6d. |
| 4 | 2½ in. | 2¾ in. | 9 lbs. | 7s. 6d. |

The two larger sizes are furnished, it may be said, with an anvil attachment.

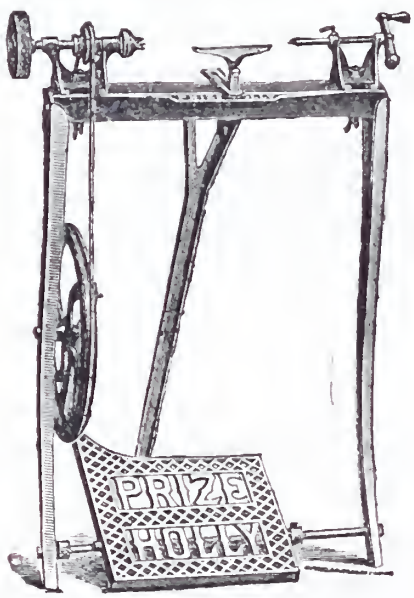


Fig. 2.—Prize Holly Turning Lathe.

### 106.—Prize Holly Amateur Lathe.

This nice little machine, as will be easily understood by readers of WORK, is specially suited for young beginners, and is in no way intended for those who are capable of using and, indeed, require heavier appliances or machines of this class. It is a lathe of American origin, and may be described as first cousin to the Prize Holly Fret Machine, which is well known here, and is to be found among the stock of every dealer in tools, appliances, and wood for fret sawing. Its price is low, costing no more than 21s., and is sent to any applicant, carriage free, at this price by Mr. H. A. Hobday, of Chatham, who, as I have already said when speaking of the Patent Amateur Parallel Vice, is an advertiser in the pages of WORK. Although cheap, it will answer the purpose just as well, and enable its owner to turn out as fine work and as easily as he can with any other small machine now made—the chief difference between it and them consisting in the plainness of construction and in being somewhat smaller in capacity. Its dimensions and capacity for work are as follows: Height of machine, 30 in.; full width, 18 in.; diameter of balance or fly-wheel, 12 in. A piece of wood, 10 in. long and 4 in. in diameter, may be turned on it, so that a pillar, or pilaster or half-pillar, of this length may be managed. The lathe-bed ways are ground and polished, which affords a smooth and level surface for the head and tail block to travel on. It is also fitted with an emery wheel and drilling attachment, and is sent out at the rate specified above with these attachments and three turning tools. Its strength, durability, and rate of operating is said to be greater in comparison than in any other small machine of its size and character; and it is also claimed that, so far as simplicity of construction goes, its equal cannot be found. As Christmas is behind us, and we are already a month and more on our way towards another, it cannot be said that it will make a good Christmas present for an ingenious lad with a mechanical turn of mind just now, but I may as well remind my readers that there are such days as birthdays, and such times as holidays and home-comings from school, when such a gift will be just as acceptable as at Christmastide.

### 107.—"A First Book of Electricity and Magnetism."

Electricity is very fairly—I might say exhaustively—represented in "The Library of Art, Science, Manufactures, and Industries," published by Messrs. Whitaker & Co., seeing that eight of the thirteen volumes that have appeared or are about to be published shortly are devoted to one branch or another of this wide subject. The book now before me, entitled "A First Book of Electricity and Magnetism," has been written for the use of elementary science and art and engineering students, and for general readers by Mr. W. Perren Maycock, M.Inst.E.E., who is Certified Teacher of the Government Department of Science and Art in Magnetism and Electricity, and of the City and Guilds of London Institute in Electric Lighting, and Lecturer on Electricity and Electrical Engineering at the Croydon Polytechnic and at the Whitgift Grammar School, Croydon—offices which, in themselves, are sufficient testimony to Mr. Maycock's thorough capability for dealing with the subject in a lucid and comprehensive manner, so as to render it clear and intelligible even to those who are reputed to be dull and slow to understand. The volume itself, which is abundantly illustrated with engravings of drawings by Mr. Maycock himself and two of his students—Messrs. Checker and Cullingford—is divided into three parts: namely (1) Magnetism; (2) Electro-kinetics, or electricity in motion; and (3) Electro-statics, or electricity at rest. Each part is followed by a series of some fifty questions or more on the subject. At the close of the book a list of apparatus is given, that will be found useful for experiments that should be carried out in illustration, and when treating of each branch of the subject as defined above. Mr. Maycock has been influenced in undertaking the task of providing what he aptly terms "A *First* Book of Electricity and Magnetism" through having found that the various elementary text-books in use, though excellent in themselves, are not elementary in the strict sense of the word, but are somewhat difficult for the beginner—especially the young or ill-educated beginner. The book is written in the simplest possible language, so as to lead nonchalant, dull, and backward students to take more interest in their work than they would if an ordinary text-book were placed in their hands. All teachers under the Science and Art Department will be pleased to know that the book covers the syllabus of the elementary stage.

THE EDITOR.

# SHOP:

## A Corner for Those who Want to Talk It.

*** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Carpentry.**—Markwell writes:—"To such readers of Work as, like myself, have neither workshop nor bench, or even an entirely spare room, it may be of service to know that a very fair amount of pleasure and profit may be enjoyed without them. To make one's dwelling a model of comfort and decoration should be the ambition of every man—and woman too—and where every possible help towards that end is so generously given for the asking to those of a mechanical turn, it does seem a pity that any latent ability should not be cultivated—especially by young people. In my own case the corner of a small room in the back wing is better than nowhere. There is a small fireplace—not much used, for fear of shrinking the wood too much. This is a lesson from experience. Having no place for a bench, I do without it. My makeshift is a fairly strong deal table—15 in. by 27 in.—which cost 7s. 6d. second hand. This was strengthened with well-fitted angular blocks all round glued underneath. In the drawer is a shallow tray—first joh—with divisions for loose screws, nails, and sundries. It stands close to a wainscot partition, and 15 in. from chimney angle, between which and the partition is a recess 10 in. deep. Part of an old table leg is clamped underneath the top at the corner and abuts against the chimney, thus preventing the concern from being shaken to pieces. A lot of small work has been done on this; but for larger and more solid work I bought 6 ft. by 9 in. by 2½ in. of dry pine. This lies level with front edge of table and abuts against chimney, is planed perfectly level and true, and has a stop screwed on near the end. It answers admirably for planing on, and on it edges are planed straight and square by laying the plane on its side and using the left hand to hold the work flat on an additional piece, which raises the edge to about the middle of the plane. In this respect it thus becomes a substitute for a bench screw or wood vice. But one can't do very well without a vice, therefore I have a 'handy' iron one. It is correctly named. The jaws open 3½ in., and are 2¾ in. wide. The screw is square-threaded, is ⅝ in. diameter, and works out of sight in a well-fitting square box; the cost of this was 8s. 6d. This is screwed on the end of a piece of 2½ in. stuff, 30 in. long by 9 in. wide, with two fairly strong 1½ in. screws, because it is often dismounted when this block—the face of which is kept perfectly true—is wanted for other purposes. When the vice is used to hold rather thick stuff for sawing, the block lays across the table, and is, besides being stopped in the ordinary way, held fast by weighting it with my two assistants. My brother 'chips' may like to hear about these. Two 14 lb. lead dumb-bells—made for me many years ago—are mounted on two pieces of wood, 12 in. by 3½ in. by 1 in. The ends are partly let in, of course, and a strap of zinc passes tightly over each end, and is tacked to the edge of the wood. The assistance they afford is so great that I would recommend something of the sort to all tyros."

**Knotting, Splicing, and Working Cordage.**—E. P. B. (*Penge, S.E.*) writes:—"I may say that Mr. Haslope's alternative way of forming 'Tom Fool's' knot by two half hitches is not quite correct, the 'Tom Fool' proper being correctly described by him in the after part of paragraph, and the two knots being slightly dissimilar when finished, as anyone may easily prove. He also passes over the pitcher or jar sling, most generally used afloat. It is made as pattern enclosed, forms a sennit round jar, and is, I think, the most secure of its forms."—[I am obliged to E. P. B. for his criticism. My object being to make these articles a complete manual of knotting and working cordage, I am always glad of any hints or suggestions. I am quite aware that there is a *very* slight difference in the appearance of the knot he refers to when it is made different ways, though for all practical purposes it is identical. I did not therefore consider it necessary to give another illustration merely to show that the strands do not cross one another quite in the same way when the knot is made by the two methods. I do not recollect the pitcher or jar sling he refers to. Perhaps he would kindly give me particulars of it. He speaks of an enclosure in his letter. There was nothing in it when it reached me.—L. L. H.]

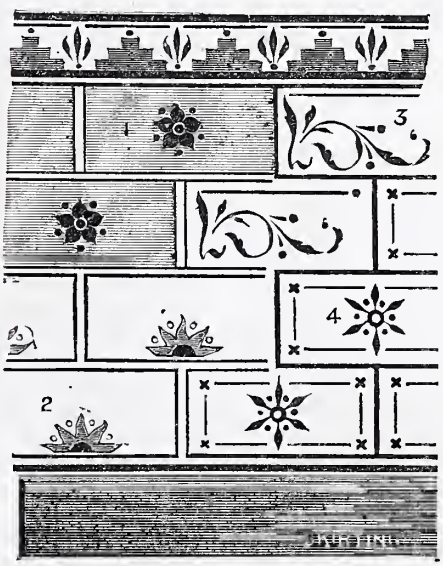
**Hot-Air Engines.**—Messrs. Norris & Henty write:—"In your issue, No. 141, Vol. III., you publish an article on 'Hot-Air Engines,' by Francis Campin, C.E. There are, however, two slight errors. The first is that Messrs. Potter & Co. are not, and never were, the makers of the Robinson Patent Air Engine. This error, however, probably arose from the fact that Messrs. Potter & Co. have placed several orders for these engines for working their ventilating fans, and no doubt have thus become identified with the engine. The other error is in the list of prices, etc. No. 6 is described as ¼-h.p., whereas it gives from 3-man to ½-h.p."

### II.—Questions Answered by Editor and Staff.

**Violin Varnish.**—Constant Reader.—I am not aware of any of the particular varnish you name being in the market; but if you communicate with Mr. James Whitelaw, St. James's Road, Glasgow, he will supply you with some that will answer your purpose admirably.—B.

**Rooms Infested with Bugs.**—Woodpecker.—My advice would be to tear down all papers and lime-wash the walls, to thoroughly scrub the floors and all woodwork with carbolic soap, and to repeat the scrubbing after a few days. Into all suspicious cracks and crevices mercury mixed to a paste with white of egg should be put, or the mercury can be dissolved in milk and put into the lurking places with a brush.—M. M.

**Papering and Painting.**—E. H. S. (*Plymouth*).—Probably you have derived some assistance from papers which have appeared since you wrote. Your painstaking and explicit letter shall, however, be fully answered, and I hope the information will be in time for your purpose. I take it, the porch you allude to is between an outer and an inner door. For this, paint is certainly preferable. Paint it three or four coats, if it is thoroughly dry, according to instructions given in "Painting Billiard-Room Walls." You can make, doubtless, a fair imitation of either grey or pink granites by coating the wall with a ground colour of pink (made with white lead and venetian red), and then, with a piece of honeycomb sponge, marking it when dry with first white and then black paint. Black and white spotted upon a medium grey or lead-colour ground will give an easy imitation of grey granite. A coat of varnish for finishing is advisable. Granite is scarcely what I would use myself; it is rather heavy and a little inelegant. If the work were painted a plain Bath stone colour, the intersecting lines being run in with dark red, you would get a more tasteful effect. If you can draw a little, and cut a simple stencil, better still. You can then carry out the idea the rough sketch above will convey. Use dark red or brown for lines and ornament also. You would only use *one* design, and could easily manage a simple pattern by the aid of a compass. Keep them smaller in proportion, rather, on your wall, than I show. The lines can be made with a straight-edge and lining fitch (see "Painters' Brushes"). I wouldn't advise an attempt to imitate any *marble;* it would, probably, result in a "dauh." Walls should be coated with glue size before being papered. Paste is best made with a small knob of alum in the boiling water used for mixing. Certainly, if you can afford it, varnish hall and kitchen papers. You will not get a paper fit for or worth varnishing for much under 1s. per piece. Don't use good varnish on a common paper; if varnishing at all, have a decent article. "Sanitary" papers, from 1s. per piece upwards, are good value, and can be sponged, but not washed. Paper must be twice coated with patent size previous to varnishing. The size must be applied in liquid form; hence the print of the paper must be made for that purpose, so that it will not ruh up.—Decorator.




**Four Simple Treatments for Ashlar-work Dado, with Border.**

**Electrical Machine.**—W. T. T. (*Houghton-le-Spring*).—The Winter electrical machine described and illustrated in No. 134, Vol. III., cannot be made to produce the electric light. Such machines produce thin currents of extremely high tension. The converse is required for electric lights.—G. E. B.

**Electric Lighting.**—J. A. (*Gristhorpe*).—In No. 99, Vol. II. of Work, at p. 758, under the heading of "Working Dynamo-Electric Machines," you will find my remarks on the use of windmills for electric lighting purposes. My advice to you is, give up the idea altogether. It is not altogether impossible, but is most impracticable for an amateur.—G. E. B.

**Iron Bridge Building.**—J. S. W. (*West Bromwich*).—For particulars as to this, see article on "Wrought Iron and Steel Girder Work," in No. 24 of Work, p. 375.

**Photographic Schools.**—J. D. (*Bethnal Green*).—The only schools with which we are acquainted in which photography is successfully taught are the Guildhall Technical Institute, in the City, and the Polytechnic, in Regent Street, in which classes are held and instruction given by thoroughly competent men. In reply to your other question, the data given are insufficient to permit any definite conclusion being drawn. There are two reasons, one of which is probably the right: First, that you omitted to draw up the shutter of the dark slide; and secondly, the time of development was much too short. Very few plates will develop properly in less than two or three *minutes;* certainly *none* in the time you mention. Interiors of all kinds, well lighted or otherwise, require a longer time to develop than exterior views; from five to ten minutes is not considered long for such subjects, and may sometimes, in certain cases, require an hour or more. You had better procure a shilling elementary hand-book on photography, from which you may derive much useful information.—D.

**Photographic Varnish and Enamelling.**—W. S. (*Harrow Road*).—The varnish you require is made by dissolving 1 oz. of Canada balsam in 4 oz. of pure turpentine; or, take 1 oz. of mastic gum in half a pint of spirit of turpentine or wine, and a couple of drachms of nut oil. I give the preference to the Canada balsam varnish. Before the application of either, the picture must he properly sized by coating it evenly on both sides with a warm solution of gelatine, ten grains to the ounce of water, in which one grain of chrome alum has been dissolved, and permitted to get thoroughly dry. With small pictures, immersion for a few minutes in the gelatine is best, but with large surfaces this is impracticable. If the paper is not properly sized, the absorption of the varnish will cause dark marks, and give a patchy, unsightly effect. If the picture is to be mounted, it should be done before sizing. In reply to question No. 2, provide the following: Supposing there are half a gross of cabinets to he enamelled—two dishes (one considerably larger than the other), a squeegee, a pound jam pot, white wax, 1 oz. Nelson gelatine, a bottle of enamel collodion, and a sufficiency of pieces of glass free from scratches, rather larger than the prints to be enamelled. Set to work by putting the gelatine into the jar, and filling up to within half an inch of the top with clean cold water; leave this to soak for an hour or so. In the meantime polish the glasses on one side, and scribble over them with the white wax: the word "waxed," written large, on them will do. Hold them before the fire to get well warm and the wax melted; then rub them all over with a pad of calico free from size or fluff, and as they get done set them up edgeways one behind the other. Now place the jar containing the gelatine and water in a saucepan of water on the fire till the gelatine is melted and well heated. Into the larger dish pour some boiling water; set the other dish in it, and into this pour the dissolved gelatine. One by one place the prints in this gelatine solution, and leave them there. Now take a waxed plate, and on the waxed side coat it with enamel collodion, rocking the plate to get an even layer. As soon as the collodion has well set, and feels firm to the touch, wash under a tap or in a dish till the greasiness disappears. Now approach the glass near to the prints in the gelatine, and lift one out, laying on the glass face down (collodion side), and with the squeegee passed two or three times over it, to remove the superfluous gelatine and air hubbles; sponge off the face of the glass, and set in a warm dry place to dry. When *quite* dry, the prints will often peel off themselves; if not, a penknife passed under one corner will permit them to he easily stripped off. Note.—All spotting must be done before enamelling, and the colour mixed with albumen, and afterwards dipped in methylated spirit to render it insoluble; also trim the prints beforehand, and they must be mounted before they are removed from the glass support, or they lose gloss. Care must be taken to avoid hubbles between the glass and the picture; they will be observed as silvery-looking spangles, and must be pressed out with the squeegee; but if the prints are carefully laid down in the first place, there will be very little trouble. If the prints stick to the glass or tear, the waxing is not sufficient, or not all over the glass; let the prints get *thoroughly dry* before attempting to remove them, or they will be certainly spoilt. Be careful not to troth up the gelatine solution in pouring from one vessel to another, or by moving the prints about in it unnecessarily. Let everything but the collodion be kept warm during the continuance of the process. When large quantities are enamelled, a number are squeezed on to a large sheet of glass.—D.

**Magic Lantern.**—M. A. P. (*South Shields*).—An article on "How to Make a Magic Lantern," written by a practical hand, is with the printers, and will appear early in the new volume of Work.

**Damp-Proof Developing Shed.**—P. B. (*Clapham*).—Yes, it is quite practicable. An excellent small dark room, called the "Eveready," made by Davenport & Co., Parkhouse Street, Camberwell, for two guineas, would supply your requirements; the size is 6 ft. 6 in. by 3 ft. 6 in. by 3 ft. This is not covered with any waterproof material, but might be made thoroughly watertight by covering it with "Willesden" canvas or paper, and raising it from the ground by a few bricks or battens of wood. An article appeared in WORK a few months ago on "Dark Rooms" which might probably afford you some information.—D.

**Glaze and Red Stains.**—G. G. (*Clapham*).—Glaze is made by dissolving 6 oz. or 8 oz. of good gum benzoin in 1 pint of methylated spirits; carefully strain before using. The benzoin, to be good, should cost not less than 2s. 6d. per lb., and glaze once made improves by keeping. Patent glaze, as sold by most druggists and shellac merchants at about 8s. per gallon, is considered by some polishers to be very good; but for good work, though costing nearly double the price, the home-made article is much to be preferred. If, as you say, you have taken in WORK from the commencement, you must surely have missed the article on "Glazing," by David Denning, p. 338, No. 126, which you will do well to carefully read. Red stains, as made from madder-fustic, brazil chips, logwood, dragon's blood, or red sanders, are now looked upon by most practical French polishers of to-day as old-time methods, and for small jobs is rarely used by them, Bismarck brown having superseded them by reason of its being readily dissolved in water, glue, size, or spirits. It is usually sold at the same place as shellac, etc., at about 6d. per oz., and though this sounds dear, I can assure you that it is not so, owing to its powerful nature. If you have a large job on hand, and prefer the stains as made by chips, etc., I append a few recipes: A light brown mahogany colour may be given by means of a decoction of madder and fustic wood ground in water, ½ lb. madder, ¼ lb. fustic, 1 gallon of water; for a darker mahogany, omit the fustic; add instead 2 oz. logwood chips, which, when dry, should be wiped over with pearlash, 1 oz. dissolved in 1 quart of water; for a bright red, make a strong infusion of brazil chips in water, to which has been added pearlash, 1 oz. to 1 gallon; while the work is still wet with this stain, brush it over with alum water, 2 oz. of alum to 1 quart of water; or, for the same colour, dissolve 1 oz. of dragon's blood in 1 pint of spirits.—LIFEBOAT.

**Newspaper Illustrations.**—T. M. (*Shields*).—The artistic and mechanical stages are generally quite distinct. The drawing is prepared by the artist in black ink upon a smooth card; it is then handed to the photo-etcher, who produces a relief block from it by a photographic and etching process. This is a distinct business in itself, and cannot be practised by a novice. There is one way of combining the drawing and engraving processes—namely, by drawing direct upon a metal plate with a prepared surface by means of a graver. The picture is at once ready for the stereotyper. Apply to the Hoko Engraving Plate Company, 37, Walbrook, London, for particulars.—W.

**Polishing Tinware.**—MAKER BY THE GROSS.—To properly polish tin goods, they should first of all be thoroughly cleaned from spirits of salts, then well rubbed with oil and whiting, then again well rubbed with a dry cloth, and finally polished with a soft duster and dry whiting. I have never found any difficulty in getting a good polish by these means. Of course, in large shops they use a polishing wheel with buffs of various shapes and sizes to buff up the goods, and if you want the same high degree of finish, you must do the same. I am unable to tell you how the bends of hurricane lanterns are made, but most probably with a die-press.—R. A.

**Plumbing.**—NED.—The following are good works on plumbing: "The Plumber and Sanitary Houses," by S. Hellyer, price 8s. 6d., published by B. T. Batsford, 52, High Holborn; "Plumbing," by W. P. Buchan, price 4s., Crosby Lockwood and Son, Stationers' Hall Court, Ludgate Hill; "House Drainage and Sanitary Plumbing," by W. P. Gerhard, price 2s., Spon, 125, Strand, London.—M.

**Robinson Hot-Air Engine.**—E. W. S. (*Egham*).—We cannot give insertion in the body of WORK to the name and address of the makers of this engine.

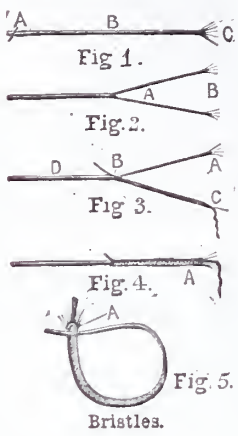
**Scene Painting.**—A. W. B. (*Glasgow*).—The articles on "Scene Painting" appeared in Nos. 92, 95, 97, 101, and 103 of WORK.

**Wardrobe Mirror.**—READER.—Surely in your town, or near it, must be a furniture warehouse; if so, apply to them, stating size and whether bevelled. The carriage from a London firm would, on a single plate, far exceed the price charged extra for the same reason by the provincial firm, who would probably have received their glass in great quantities. The addresses of some London firms have already appeared in "Shop," which you might easily ferret out. Inquire again if still unsatisfied, but meanwhile try the indexes to Vols. I. and II. of WORK.—J. S.

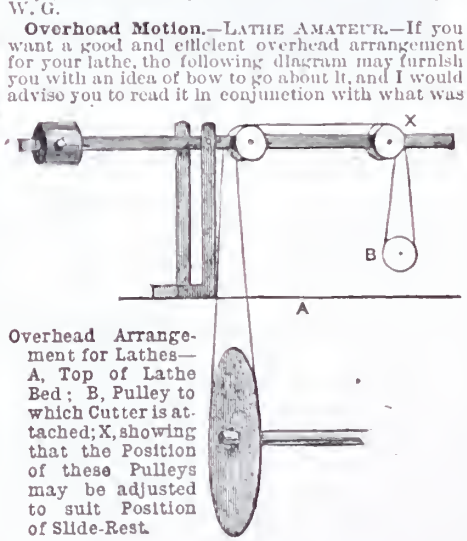
**Tinman's Tools.**—R. L. T. (*Plumstead*).—You will find the illustrations of tinmen's tools and machines in Nos. 67 (p. 209) and 78 (p. 413) of WORK, and you can obtain them by ordering through your newsagent or direct from the publishers.—R. A.

**Lead-Burning Machine.**—A BURNER.—The proportions of zinc and acid vary somewhat in different machines, but you can try the following: 7 lb. of zinc clippings in the lower reservoir, 3 quarts of water and a pint and a half of sulphuric acid in the upper reservoir, and add about a pint of acid for each two hours of working. The zinc will last about a week. The saturated acid should be drawn off after each usage.—R. A.

**Fastening on Bristles.**—A. H. (*Nottingham*).—First pick a pair of good bristles, that is, of equal substance, and as transparent as possible; from A to B (Fig. 1), on the end of each bristle, there is a dry, glutinous substance; this is the part that is in the hide when on the animal, and is of no use to us for our purpose; it is, therefore, cut off in a slanted direction, as shown by the line across it at A. Hold the two points together, and stroke them up and down, on a piece of sand-paper, somewhat in the same way as you would use a whitewash brush, holding them between the thumb and finger, and at the same time twisting them round—this will make a nice round point to them; then, about halfway, just bend them against the thumb nail, so as to centre them both in the same place. You now have one end sharp and the other end, C (Fig. 1), bushy, of which you take equal portions between the thumb and finger of each hand, and split it down to B, as shown by A B (Fig. 2). The end of the thread is waxed, and the fine tapered extremity is placed in the crutch, as B (Fig. 3), both of which are held firmly between the thumb and finger of the left hand, the palm of the hand being towards you; then between the thumb and finger of the right hand the split part of the bristle, C, and the thread with it, is twisted towards you; and each time you want to take another sweep, hold the part C, *pro tem.*, between the little and third fingers, and when twisted just tight, twist A in the same direction, being careful not to break it. Then put A and C together, hold them between the thumb and finger of the right hand, and leave go with the left at B, and with it take hold of D, and twist that in the same way. This should give a result as shown in Fig. 4. Then at A, with a fine stabbing awl, a hole, or eye, is made in the thread, and the point of the bristle put through it, as shown at A (Fig. 5). This is drawn right through, and then smoothed from the point downwards, between the thumb and finger. This, it will be seen, is to secure the ends of the bristles, and prevent them from unplaiting. This method is called plaiting. There are other ways, but this is by far the best, for stitching.—W. G.




**Overhead Motion.**—LATHE AMATEUR.—If you want a good and efficient overhead arrangement for your lathe, the following diagram may furnish you with an idea of how to go about it, and I would advise you to read it in conjunction with what was said to J. E. J. (*Portsmouth*) upon this same subject in WORK, No. 12, p. 190. A is the top of lathe bed; B, pulley to which cutter is attached; X shows that the position of these pulleys may be adjusted to suit position of slide-rest.—ED.




Overhead Arrangement for Lathes—A, Top of Lathe Bed; B, Pulley to which Cutter is attached; X, showing that the Position of these Pulleys may be adjusted to suit Position of Slide-Rest.

**Foot-Blower.**—R. H. E. (*Blackburn*).—The bellows with a reservoir is preferable to a fan-blower when worked by foot, because temporary suspension of the action of the foot does not stop the blast, and a bellows treadle is easier to work than a crank treadle. You will require special leather and wood to make the blower, and will find it a troublesome job—at least, that has been my experience in making a similar arrangement for experiments on sound. It would probably be cheaper to buy one. Messrs. Alldays and Onions, of Birmingham, supply all kinds of blowers and bellows. You might have a fan-blower fitted with a reservoir, but there is this disadvantage: a fan is not a positive blower; when the reservoir pressure exceeds that in the fan, you are wasting power in grinding wind.—F. C.

**Emery Wheels.**—NO NAME (*St. Leonards*).—Emery wheels are made of emery of various degrees of fineness consolidated under pressure with a suitable cementing material. For the actual composition I must refer you to the makers, though I am not sure they would make public their methods. In use emery wheels are run at a surface speed of from 4,000 to 4,500 feet per minute. When used for sharpening small tools, they should be used with water.—F. C.

**Steel Tubing.**—A. N. H. (*No Address*).—I do not know of any works where solid drawn steel tubing of the size you require is made. The thickness to stand a working pressure of 60 lbs. is theoretically $\frac{1}{50}$ in., but of course you cannot practically use the metal so thin. Your best plan would be to make the boiler of sheet copper about $\frac{1}{8}$ in. thick, riveted and well brazed together; then, as your firebox is of copper, the expansion and contraction under variations of temperature would be equal, and there would be less liability to leak. You might get an electro-deposited copper tube of the diameter you require.—F. C.

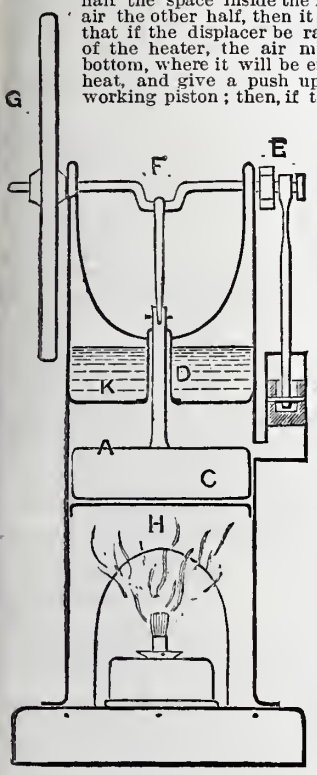
**Four-Jawed Chuck.**—G. H. A. (*Clapham*).—I do not know of any substitute for the four-jawed chuck, but if you call at Messrs. Grimshaw and Baxter's Stores, Goswell Road, E.C., you will most likely find something to suit you. If you are likely to be disheartened in so small a matter as making a model engine, I should advise you not to commence it. You can buy one for a trifle.—F. C.

**Beam Engine.**—AXLE.—The bars B and C in your sketch form a parallel motion for the head of the piston-rod, or would if they are of equal lengths, assuming that the end of bar B nearest the piston-rod is gudgeoned to the framing. Usually the rod A has a connection for air-pump or feed-pump rods, but you do not show any such attachment. This form of parallel motion is not absolutely true, but when the rods are properly proportioned, restricts the head of the piston-rod to a motion very closely approximating a straight line. I suppose the bars are brass-bushed, and the wear of the bushes causes the rocking of the piston-rod. The dead-centres upon which the rods vibrate may also have worn out of centre. If the engine worked satisfactorily when first started, your remedy is simple: put in new dead-centres in the framing, new bushes in the bars, A, B, C, and new bearings in the piston-rod head and the strap connecting it with the beam. If the rocking of the piston-rod has long continued, the gland is most likely worn oval, in which case a new one should be fitted and the stuffing-box, if necessary, bushed. In regard to the piston-rings, you do not say of what class they are, but for the size you give I should recommend a split cast-iron ring, ¼ in. thick on the thick side and ⅛ in. on the thin side, turned to an outside diameter of 8¼ in., cut on the thin side and put in in the usual way. It might be better to put in a new piston with Ramsbottom wrought-iron rings, but whatever rings you use, round off the outer edges so that the cylinder may not be scored by them. If you had given fuller particulars as to the use of the engine, I could have given further advice.—F. C.

**Hydraulic Cylinder for Lift.**—R. S. (*Manchester*).—Some dimension must first be given or assumed. Your lift is 40 feet; if, therefore, you make your ram with a 5 ft. stroke—that is, one-eighth of the height to which 3 cwt. is to be raised—the load on the ram will be 3 × 8 = 24 cwt. The speed of the cage to lift it 40 ft. while the ram only travels 5 ft. is obtained by chains passing over top and bottom pulleys in the usual way so that there are eight lines of chain side by side. One set of pulleys may be fixed to the bottom of the cylinder, and the other set to the head of the ram; from these the chain is led away over the head pulley of the hoist and attached to the cage. In addition to the 24 cwt., an allowance must be made for friction, say, 5 per cent.; 24 cwt. equals 2,688 lbs.; 5 per cent. on this is 135¼ lbs.; total load on ram, 2,823 lbs. Now the pressure of water per square inch multiplied by the area of the ram in square inches must equal this total. If there is a high pressure service of, say, 100 lbs. per square inch, the area of ram required will be $\frac{2,823}{100} = 28{\cdot}23$ square inches, which we find, from a Table of Areas of Circles, corresponds to a diameter of 6 in. The cylinder would be made about 6¼ in. inside diameter. The supply pipe should be about 1¼ in. in diameter. Whatever conditions you have you can get at your results by the above method. If, for example, the diameter of ram is fixed at 5 in., this corresponds to 19·63 square inches area, and the pressure required per square inch will be $\frac{2,823}{19{\cdot}63} = 144$ lbs. per square inch. If the pressure is to be taken from a tank, the height of the tank in feet above the ram must be equal to the pressure per square inch in pounds multiplied by 2·31. You will see that we have found the following rule for the total load on the ram: Multiply the actual load by the height of lift, divide the product by the stroke of the ram, and add 5 per cent. to the quotient.—F. C.

**Quarter Horse-Power Steam Engine.**—A. P. S. (*Hyde*).—It is not possible to comply with your suggestion.

**Hot-Air Engines.**—W. H. B. (*Leicester*).—In these small hot air-engines there is a cylindrical box, called the heater, containing air, a fixed quantity of which remains in the box, for there is no exhaust; and this air, being alternately heated and cooled, expands and contracts, the pressure varying about 12 lbs. A working cylinder is connected with the heater; in this a piston moves, being forced up when the air is heated, and drawn down when it is cooled; the top of the piston is open to the air, and a connecting-rod fastened to a pin in the piston works the crank at the upper end. Now, we cannot very well remove the fire from the heater at every stroke of the engine, so the plan adopted is to have the fire play upon the bottom of the heater, whilst the upper part is cooled by a water jacket; inside the heater there is a loose-fitting deep piston, called a displacer, whose office it is to move the air up and down, so that it may be heated by the bottom plate of the heater, and then cooled by the water jacket at the top. If we suppose the displacer to occupy half the space inside the heater, and the air the other half, then it will be evident that if the displacer be raised to the top of the heater, the air must go to the bottom, where it will be expanded by the heat, and give a push upwards to the working piston; then, if the displacer be moved down to the bottom of the heater, the air must go to the top, where it will be cooled by the surrounding water, contract in volume, and suck down the working piston. The diagram is a sectional sketch of Seal's model hot-air engine, which, being very simple, will serve to explain the principle on which these engines work. A is the heater, communicating with the working cylinder, B, by a passage always open. C is the displacer, occupying about half of the heater; it is moved up and down by a crank and connecting-rod attached to a piston, which passes through a tube, D, which acts as a guide. E is the crank moved by the working piston; F is another, which moves the displacer, and is set at right angles (about) with the first. G is the fly-wheel. The flame of the lamp plays upon the bottom plate, H, of the heater, and some water is poured upon the top plate, K. The model will start at once on lighting the lamp, and runs at 250 revolutions per minute; it has no power, the working cylinder being so small—only ¾ in. diameter. The model costs 10s. 6d. I have one, and it runs well; perhaps if Mr. Seal sees this he will advertise his present address. The action of these engines will now be easily understood. The heater crank precedes the working crank just as the eccentric precedes the crank of a steam engine: the engine being in the position shown in sketch, the air is being cooled, and the piston of B is being sucked down. In one quarter of a revolution it will have reached the bottom, and displacer, C, will be in the middle of the heater; a little further, and there will be more air beneath the displacer, pressure will increase, and the working piston will be forced upwards, etc. It is curious to find that the air can be heated and cooled 300 times in one minute. The proportion between the space swept by the piston and displacer is important, and I obtained a greater speed by reducing the stroke of the working piston; the working crank might be made with several holes for the crank-pin, and the engine tried with different strokes till the best position has been found. It will now be seen that in Robinson's engine, instead of two cranks placed at right angles, the piston and displacer are themselves fixed at right angles and worked off the same crank, which produces exactly the same effect. The power of hot-air engines is generally rated too high. I tested one with a 9½ in. cylinder, and found that, though the indicator showed 23,716 foot lbs., say, 5-men power, the brake power was only 10,028 foot lbs., say, 2-men power. For 2-men power I should require a 9 in. cylinder, and the engine would be very bulky and heavy.—F. A. M.



Hot-Air Engine.

**Damp in Piano.**—INQUIRER.—The damp which creates the rust in the bottom part of piano rises from the floor, sometimes through damping the carpet before it is swept. I should advise you to turn the piano up, so that you may tack a piece of oilcloth or waterproof over the bottom, as sometimes there are holes where damp may enter. To clean the rust off, use a piece of leather with a few drops of paraffin oil on, and sprinkle with fine emery powder. Having done this, procure some lard free from salt, and crush some camphor, and mix them together. Rub this over the strings; this will prevent rust.—T. E.

**Japanning.**—W. P. W. (*No Address*).—You appear to have been very painstaking in your work, and certainly deserve to succeed. I regret that I cannot add anything to the information already given, unless it is to express an opinion that it is scarcely necessary to go to so much trouble over repairing jobs. I should suggest that you simply give the beams, etc., a coat of finest air-drying black japan, and lay on with a camel-hair brush where required some of Pavitt's Gold Ardenbrite, and when dry a coat of clear varnish if wished, but it is hardly necessary, as Ardenbrite will keep up colour for a long time.—R. A.

**Patents.**—S. G. T. (*Penarth*).—The writer states that, on searching the lists of applications for patents (see "Shop," p. 587, No. 141), he "found that there were about two a day for the last three months for the same kind of thing." He then asks: "Can any of your correspondents tell how we are to know that some of these applicants may not have the very same thing as ourselves, and, being before us, of course have the preference?" We can assure S. G. T. that neither he, I, nor anyone else can ascertain this until the complete specification is filed and accepted, when it may be inspected on payment of the usual fee; or he must wait until the specification is printed, every application for the grant of a patent being inaccessible to the public until the complete specification is filed and accepted. Every person making application for the grant of a patent has to take his chance as to whether a prior applicant has covered his invention. There is no way of getting over this.—C. E.

**Plain Sketches.**—T. P. (*Frodsham Bridge*).—We do not know of any work specially devoted to this subject, but there are several works which touch on it. Some years ago the Council of Education published, or authorised the publication of, books on drawing, one of which gave instructions how to sketch from the object, but we do not remember the name of the author. Spon, publisher, Strand, W.C., would no doubt have it in his catalogue books, which would assist our correspondent. We know of no better course than copying from the object itself on paper, taking care that each part is *put in the right place*, and avoiding any "artistic" performance in the work, adhering to stern exactitude, so that the result obtained is the *actual machine* on the paper, and then the dimensions of each part can be taken and put on the drawing. We learnt to do this in the manner described above, and soon acquired aptitude in the work, there being no books to help us in those days. We believe there have been some books published on the subject by the Science and Art Department at Kensington. One was written by John Maxton, a clever draughtsman and engineer, who was teacher of engineering drawing to the department, and it would most likely be found in Spon's catalogue. We do not know of anyone who would teach by correspondence, but should fancy if there are any engineering establishments employing draughtsmen near our correspondent, he might be able to arrange with some of the latter to give him instruction for an hour or two of an evening, after his work is over, for a consideration to be agreed upon between them.—C. E.

**Repairing Piano.**—CLERK.—Your letter is very explicit, and I understand what you require. If your piano has not got an iron plate to which the strings are attached, the pins are driven into hard wood, and these pins in old pianos are usually made of brass instead of iron, and when you tune the piano they often bend, and sometimes break off (I am speaking of the lower pins). The wrest pins, as you say, are probably loose. Now examine very carefully and see that the plank is not split, and if it is not, take out one of the old pins and get a size or two larger; you can obtain them from W. Hughes, 37, Drury Lane, W.C., and they will cost you 1s. 6d. a set, and if the lower pins are bending, I should replace them with small hitch pins. Count the number you require, and obtain at same place; cost about 6d. You can also get what wire you want at 1s. 9d. per lb. Do not string it with beavier wire; a size thinner would be better if for concert pitch. You ought to manage it all right.—T. E.

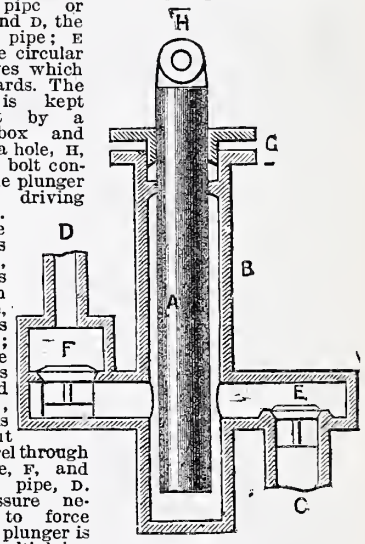
**Piano Work.**—J. M. F. (*Notting Hill*).—Your best plan would be to get an estimate from a pianoforte maker; he would be able to tell you exactly what it would cost. Try Rudd & Co., Dean Street, Soho Square.—T. E.

**Piano-Front Pattern.**—J. W. (*Wellington, Salop*).—Sorry you did not succeed in getting the patterns, but as the fret-cutters chiefly design their own, they are somewhat jealous of them. If you could get access to a piano that has a fret front, with a sheet of paper and a shoemaker's heel-ball you could rub a pattern off it by simply laying the sheet of paper on and rubbing the heel-ball over the surface. Or you could purchase a fret from the address I gave you if you send the length and width you require. Frets have given way to panels for piano fronts, although some are partially fret cut.—T. E.

**Piano Making.**—DOUBTFUL.—If DOUBTFUL will not doubt any longer, but will read my article on stringing, he will see that, instead of doubling the length of the wire, the difficulty is surmounted by increasing the thickness. The measurement, 21½ in., is correct for fourth C. I should think "Sound, Light, and Heat," by Thomas Dunmans, price 1s., would suit you; or, as you are near the People's Palace Library, you could see one there.—T. E.

**Materials for Piano.**—ANXIOUS INQUIRER.—As probably you are aware, you cannot purchase materials for piano making at one firm, as the firms who supply the trade are noted for their special line. For ironmongery, try Hughes, 37, Drury Lane, W.C; for veneers or wood, Witt and Palmer, Drummond Street, Hampstead Road, N.W.; for action, Hallpike, 213A, Mare Street, Hackney, N.E.; for keys, F. Edwards, 53, Southampton Street, Pentonville, London, N. The articles on "Piano Making" appear in WORK, Nos. 29, 32, 36, 41, 43, 46, 50, 51, which you may obtain through a bookseller.—T. E.

**Force-Pump.**—J. W. (*London*). — The accompanying diagram is a vertical section of an ordinary plunger force-pump; A is the plunger, B the barrel, C, inlet pipe or suction; and D, the discharge pipe; E and F are circular stalk valves which open upwards. The plunger is kept watertight by a stuffing-box and gland, G; a hole, H, receives a bolt connecting the plunger with the driving power. When the plunger is drawn up, water rises through the valve, E, and fills the barrel; when the plunger is pressed down, water is forced out of the barrel through the valve, F, and discharge pipe, D. The pressure necessary to force down the plunger is found by multiplying the area in square inches of the end of the plunger by the height in feet to which the water is raised, and by 0·434 lbs.—F. C.



Force-Pump.

**Piano.**—GLASGOW.—As I am not aequainted with Glasgow, I cannot refer you to any place to buy your wood, but I presume you would be able to get ordinary spruce deal, such as carpenters use, at any timber-yard or cabinet-maker's shop.—T. E.

**Piano Question.**—JOINER.—The bottom iron plate runs from the bass end, and lays on the bent side. Of course, there is no necessity for it to run further than the bent side, as there are hitch pins in the bent side. When you receive the plate from the makers, the pins, which are riveted in, will be all in their place.—T. E.

**Books on Electric Bells.**—READER OF WORK.—Mr. F. C. Allsop's book on "Practical Electric Bell Fitting" is a good work, written by a practical man who has had considerable experience in the work of bell-fitting. It is, therefore, a good book for learners. Another good book on the same subject is Mr. Bottone's "Electric Bells and All About Them."—G. E. B.

**WORK Subscription.** — JACOB. — The fourth volume of WORK will begin with No. 157, and will be, as you say, "a very good time to begin to take it in." As you are so anxious to help the publication, however, why not begin subscribing to it at once, and induce those "many fellow-workmen" of yours to do the same? Some of our subscribers even adopt the sensible plan of buying an extra copy weekly to send abroad or into the country.—ED.

**Bicycle Patent.**—C. M. (*Liverpool*).—Referring to reply to F. S. (*Kidderminster*) on page 394 of WORK, the drawing shown does not in many points agree with the description, and the information given would fail to make anyone understand what is meant or what is to be gained by the arrangement. The inventor seems to aim at gearing up an ordinary front-driving bicycle by means of a gear similar to the Rob Roy tricycle, made long since by the Zephyr Cycle Company. With them the gear is simplicity itself; in the reply referred to it is anything but simple or clear, and Fig. 2 of the diagrams is not correctly drawn. I am unacquainted with either the address of the inventor or the number of the patent.—A. S. P.

**Work Volume.**—F. R. W. (*Mildmay Grove, N.*).—The third volume of WORK commenced with No. 105.

**Watch Jobbing.**—CONSTANT READER.—As far as I am aware, there is nothing to prevent you from calling yourself a watch jobber because you have not served your term of apprenticeship; but as to going in for examination for a certificate, I am afraid that it would be useless unless you are very well up in theory and practice, which I am afraid you are not if I may judge from your letter, and therefore I think it would be a guinea spent needlessly, although, could you pass, I believe it would be a good thing; and I should like to see every jobber, watch and clock, go in for the examination: it would be better for themselves, for their employers, and for the owners of watches and clocks, as ninety-nine out of every hundred watches and clocks are, in my opinion, "butchered" up instead of wearing out. Now, as to the verge watch. When the nose of the potance has been filed away to let the wheel up as close to the verge as it will go, and the follower pushed up to keep it, and still it trips, without giving sufficient impulse to the verge, the only thing that is to be done is to put a new balance wheel ('scape wheel), broader in the band, so as to reach the verge pallets; when this is done it usually wants a new dovetail put to the potance, and often a new follower as well, but these you could easily fit up yourself. For a new wheel you must send to the tool shops, say, Grimshaw & Co., Goswell Road, Clerkenwell, London, who will put a new one for about 9d. or 1s. outside.—A. B. C.

**Fairy Bells.**—W. L. (*Hull*).—See reply to CORKONIAN on page 572, No. 140, which will give you full particulars concerning fairy bells and their construction. Following out the suggestion of the Editor, I give the cost of material, quoting from the list of Chilvers & Co., Norwich. Wrest pins, 6d. per dozen; music wire, 4d. per oz. ring any size. As, however, at least six different sizes are required for bells of twelve strings, Chilvers & Co., supply the strings with eyes already turned at 1s. per dozen, and a whole set of materials—wood for baseboard, sides, blocks, cover, together with screws, wrest pins, and wire—may be had for 4s. 6d. —R. F.

**Photographing and Mounting.**—J. McB. (*Tain*).—The photographs you require are taken by almost any good photographic firm, and will be mounted as desired. There is nothing outside ordinary portrait work indicated. If you already have the photo *unmounted*, all the photographic dealers supply the cards with sentences suitable for Christmas printed thereon. Marion, Soho Square, W., Fallowfield, Charing Cross Road, and Adams, Charing Cross Road, W.C., all keep them. Percy Lund & Co., Bradford, is also a good firm for them. See also our advertisement pages.—D.

**Re-cementing Achromatic Lenses of Opera Glass.**—MELITA.—The lenses forming the achromatic combination of your opera glass require to be separated and re-cemented together again with Canada balsam. This can be done with every chance of success if you carefully follow the instructions contained in the reply to A LOVER OF WORK (see No. 58, page 98, of WORK). You will not be able to doctor up the silvering on your looking-glass; it will require to be re-silvered after the old silver has been carefully cleaned off. The process would occupy too much space to be located in "Shop." Your work on "The Antiquities of Athens" is, without doubt, of value, but to ascertain the exact worth you should address your inquiry to a paper such as the *Athenæum*.—C. A. P.

**Cold Lacquor.**—J. H. M. (*Liverpool*).—It is not much use an amateur trying to make small quantities of lacquer. Leaving out the probability that you would spoil it in the making, it would be more expensive than buying it. If you want a good colour lacquer, I can strongly recommend the lacquers sold by the Frederick Crane Chemical Co., Birmingham. They will send you a sample 1 oz. bottle for 1s., either colourless, gold, or antique brass. See also WORK'S advertising columns.—R. A.

### III.—QUESTIONS SUBMITTED TO READERS.

**** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Oil Stone.**—A. E. M. (*Cheshire*) writes:—"I shall be glad if anyone will tell me through 'Shop' whether there is any way of softening an oil stone. I have one which to all appearances looks a good stone, but on attempting to sharpen a tool on it, it scratches instead of having a nice working surface. If anyone can tell me what to do to alter it, I shall be greatly obliged, as it is nicely mounted in case, and will save expense of buying another, as I am told they are expensive."

**Inlaying.**—J. T. S. (*Sheffield*) writes:—"Can any of 'ours' help me with information *re* inlaying wood by aid of frot machine? How are the necessary threading holes hidden? Any hints or reference to any work or article on the subject will be gratefully received."

**Staining and Varnishing.**—J. T. S. (*Sheffield*) writes:—"What is the best work on these as applicable to amateur requirements?"

**Overshot Water Wheel.**—F. T. C. (*East Finchley*) writes:—"Will some practical correspondent give the dimensions for an overshot water wheel which will lift to a height of 10 ft. by means of an endless strap and buckets enough water to supply a ¾ in. or ½ in. pipe? The supply pipe is 1 in. bore, and there is 2 ft. pressure of water."

**Carpentry Kit.**—C. H. J. (*West Bowling*) writes:—"I should be glad if in some future number of WORK some generously minded reader would kindly give a list of the tools, etc., which an amateur should possess before attempting the manufacture of household furniture, or, generally speaking, 'cabinet making.' I have no doubt that there are many others besides myself who have just recently commenced taking in WORK, and are wishful to put to a practical use some of the valuable hints which are given us in WORK. A list such as I have asked for above, with probable cost of same, would, I believe, be read with a great deal of interest by many of us novices."—[Some brother "chip" will doubtless give you the assistance you ask for.—ED.]

**Benares Brass Work.**—SLIEV DONARD writes:—"I shall feel obliged for information as to cleaning above. The brass is covered with punched patterns, and red, green, and black enamel. I have tried lemon and hot water, but the brass does not keep bright long. Has sea air any effect?"

### IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**White Metal.**—EDDIFRA writes, in answer to L. S. L. (*Kirkcaldy*) (see p. 622, No. 143):—"You do not state what kind of white metal. There are numerous alloys. If you refer to Knight's 'Dictionary of Mechanics,' p. 63, Vol. I., you will find thirty-two different alloys, all of which are under the heading of white metal, such as pewter, Britannia metal, Parisian white metal, German silver, etc. I have sent a few receipes:—Pewter, 6 parts copper, 112 tin, 2 zinc, 16 lead. Hard Pewter: 4 parts copper, 192 tin, 16 antimony. Britannia metal: 1 part copper, 1 tin, 2 antimony. Another Britannia metal: 4 parts tin, 4 antimony, 4 bismuth, 4 brass. Parisian white metal: 69·8 parts tin, 5·5 zinc, 19·8 nickel, 4·7 cadmium. German silver: 20 parts copper, 16 zinc, 3·4 nickel. Best German silver: 20 parts copper, 8·10 zinc, 5·6 nickel. If I knew what you wanted them for, I perhaps could send you better receipes."

**Polishing Vulcanite Pipe Mouth-pieces.**—W. L. F. (*Dublin*) writes, in reply to C. H. C. (*Manningham*) (see p. 622, No. 143):—"First take all file marks, scratches, etc., out with very fine emery paper; then polish with a lathe, using a circular buff, with rottenstone and oil; finish off with a soft cloth, using rouge and oil. Take care not to spoil the vulcanite by making it too hot. If C. H. C. has not a lathe, he may glue a piece of soft leather or felt on a flat piece of wood, and rub the work with it, putting the rottenstone and oil on the felt."

**Measurement Reckoner.**—J. M. S. (*Hull*) writes, in reply to J. G. (*Bradford*) (see p. 574, No. 140):—"You should get the 'Tradesman's Ready Calculator,' published, I think, for about 6d. by Messrs. Routledge & Sons, the Broadway, Ludgate Hill, London. It is a splendid little book, and will suit all purposes."

**Ivory Tablets.**—W. F. H. (*Dagmar Terrace, Islington*) writes, in reply to SEA GULL (see p. 574, No. 140):—"I am a wholesale maker, and supply nearly all the camera makers in London."

**Lapidary Work.**—H. S. G. (*Fulham, S.W.*) writes, in reply to SPES MEA (see p. 542, No. 138):—"This is dealt with on p. 173, No. 81 of WORK."

**Ready Reckoner for Timber and Glass Trade.**—M. (*Bishop Auckland*) writes, in reply to J. G. (*Bradford*) (see p. 574, No. 140):—"The 'Complete Measurer,' by R. Horton, published by Crosby Lockwood & Co., treats of the measurement of timber and glass. 'Haworth's Practical Timber Measurer,' price 1s., post free, from 19, South John Street, Liverpool, is also a good book."

**Wooden House.**—M. (*Bishop Auckland*) writes, in reply to OLD CHIP (see p. 590, No. 141):—"Try W. Whiteley, Westbourne Grove, Bayswater, London."

**Open Sailing Boat.**—T. M. (*Liverpool*) writes, in reply to G. A. (*Hornsey, N.*) (see p. 606, No. 142):—"The best dimensions he could have for a sailing boat 19 ft. long are: 5 ft. 3 in. beam amidships, 2 ft. 2 in. deep amidships, and 6 in. deeper at stem and sternpost, which will be 2 ft. 8 in. This gives a sheer of 6 in. If he is going to build a square-stern boat, the width of stern will be half the beam—2 ft. 7½ in.—and the tuck in sternpost to allow stern to fit on will be 1 ft. 6 in. deep. All depths to be taken from top edge of keel. The stem should be made of English oak or elm, as with these he can get the grain right in the round at the foot of stem. The keel, gunwale, sternpost transom, and timbers could be made of American oak. The planking should be either larch or yellow pine."

### V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—T. C. (*Liverpool*); H. D. S. (*Uxbridge*); A. J. C. (*Carlisle*); J. W. (*Upper Norwood*); C. D. (*Bury St. Edmunds*); E. C. S. (*Bristol*); J. S. H. (*Cheetham*); ELECTRA; G. H. (*Oldham*); R. M. T. (*Cornwall*); J. M. M. (*Bristol*); A. R. (*Ottawa, Canada*); F. H. F. (*Homeland, U.S.A.*); H. R. (*Kidderminster*); T. J. (*Preston*); W. S. (*Carbrook*); J. W. B. (*Huddersfield*); E. J. (*Borough, S.E.*); ADMIRER OF "WORK"; G. S. W. (*Dewsbury*); J. W. (*Loughborough*); TREGER; LOVER OF "WORK"; ZINCO; TELEGRAPH; L. H. (*Brighton*); V. L. (*Bayswater*); G. P. D. (*Aberdeen*); A. H. B. (*Petworth*); H. C. F. (*Great Bedwyn*); J. A. J. (*Morriston*); A. H. Manningham; S. M. A. D. A. (*Tunbridge Wells*); G. C. (*Penälleon*); W. S. (*Appleby*); W. W. (*Forest Gate*); J. W. (*Glasgow*); A. H. P. (*Lewisham*); C. E. L. (*Andover*); JELLY; G. E. S. T. (*Birmingham*); J. J. (*Tredaule*); C. S. C. (*Gravesend*); KILN; C. T. (*Leytonstone*); T. P. B. (*Bradford*); E. A. P. (*Tullow*); A NEW ONE.


## MANUALS OF TECHNOLOGY.

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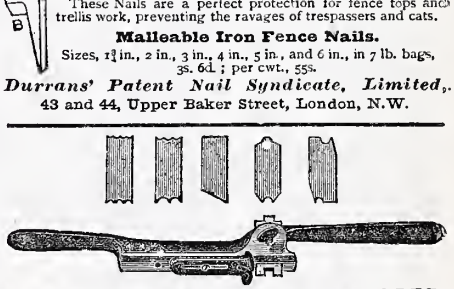

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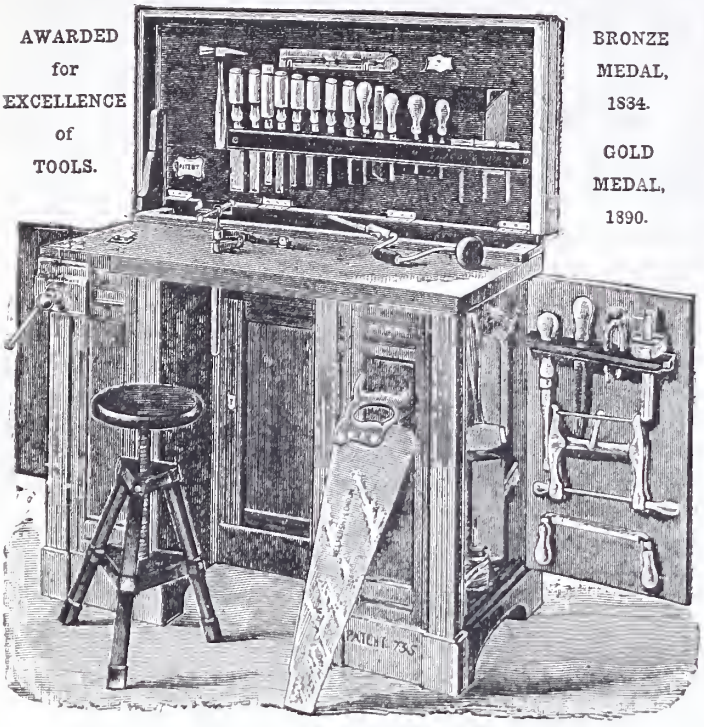

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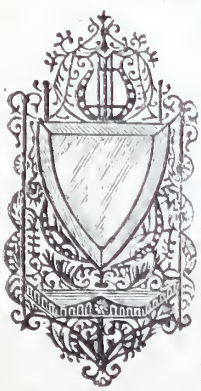

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# WORK

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VOL. III.—No. 150.] SATURDAY, JANUARY 30, 1892. [PRICE ONE PENNY.

Fig. 3.—Grotesque Animal Interlacement: "Book of Kells."

Fig. 2.—Border from St. Dympna's Crosier.

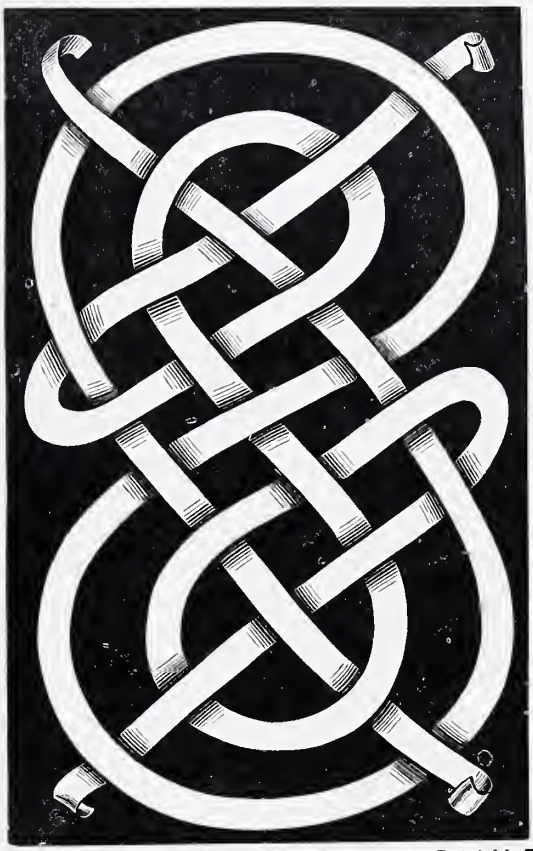

Fig. 1.—Interlaced Ribbon Work from Shrine of St. Patrick's Bell.

Fig. 5.—Interlaced Ribbon: Ardagh Chalice.

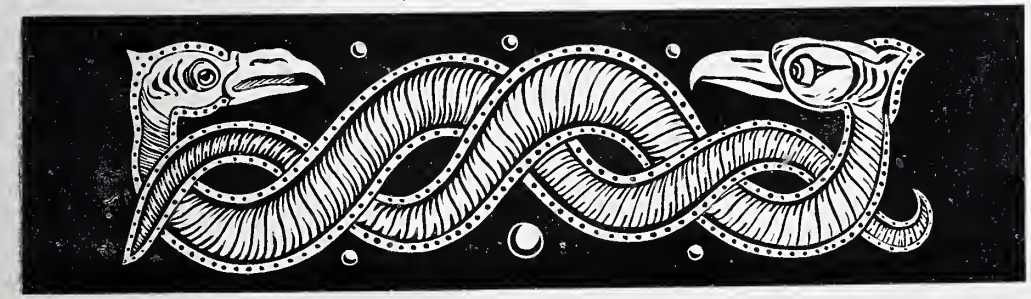

Fig. 4.—Tara Brooch.

SIMPLE EXAMPLES OF KELTIC ORNAMENT.

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## SIMPLE EXAMPLES OF KELTIC ORNAMENTS.

BY OPIFEX.

In mediæval times Irishmen were wonderfully skilled in the art of decoration, especially in the illuminating of manuscripts. They were also very "cunning workmen" in bronze, silver, and gold, and must have been far superior to their posterity of to-day in powers of eyesight and, I think, also in patience.

In intricacy of design, accuracy in detail, and faithfulness in workmanship, the specimens of Keltic or Irish art which survive surpass anything produced by others in any country or period, ancient or modern.

To one who has never before seen any of these original works, a first inspection is simply amazing—assuming, of course, that they possess an appreciative sense. A page of the "Book of Kells" (seventh century), for instance, affords an opportunity for days of patient scrutiny, if one desires to follow the labyrinthine workings of the scrolls, knots, etc., executed by hands which have been at rest for a thousand years.

The chief characteristic of the Keltic style is interlacement, whether of simple "ribbons" (Figs. 1 and 5), grotesque animals (Fig. 3), or plant forms—the last being rare—or combinations of these.

One example will serve to give the reader some idea of the intricate nature of the designs. On a page of the "Book of Armagh" (A.D. 805, cir.) may be seen spaces of less than three-quarters of an inch long, by about half an inch wide, upon which designs are drawn containing 160 interlacements, of a fine ribbon pattern, and the most patient and searching examination with the aid of a powerful magnifying glass will fail to detect a single mistake or irregularity in the interlacing.

It has often struck me that, by means of enlargement and slight modification, some of these patterns might be turned to good account for various purposes of decoration, or be found most useful for fretwork, leather work, wood carving, repoussé work, or, in fact, any work of an artistic kind; and I have lately taken some note sketches from ancient specimens of pure Keltic work, and having found them most suitable and effective for some of the purposes just mentioned, I here give a few of the simpler examples, and hope, with the Editor's approval, to contribute some of a more elaborate nature at a future date.

The centre panel (Fig. 1) is a very simple example of ancient interlaced "ribbon," or strap-work, and is taken from the "shrine" of the bell of St. Patrick—a beautiful specimen of pure Keltic workmanship, made by an old Irish goldsmith, named "Cudulig O'Innainin, and his sons," about the year 1091, A.D. The body of the shrine is of brass, on which are riveted silver plates, gilt and ornamented with gold knot-work, and further enriched with gems and crystal.

The present example may prove suggestive for designs for various uses, but especially for fretwork, to which this class of pattern lends itself admirably. It is also an effective style of ornament for embossed leather work.

The border (Fig. 2) dates from the seventh century, and adorns the crosier, or rather, the pilgrim staff, of a certain pious princess and saint, named Dympna, who once lived in co. Monaghan, but having for some reason fled to Belgium, she founded a religious house and church, which still bears her name, at Ghent, where she has always been regarded as the patroness of the insane. This design, though rude in conception, is not without some weird grace, and might, if modified and improved, form a good border for repoussé work.

Fig. 3 is an example of a grotesque animal interlacement, and is enlarged and adapted from a minute design occurring in part of a large initial letter in the "Book of Kells," now in the library of Trinity College, Dublin. Reversed and duplicated, this design will be found suitable for various kinds of art work.

Fig. 4 is, I confess, not beautiful, nor is it exactly true to any original, but was suggested by a very minute design upon the "Tara brooch," with which many of my readers are doubtless familar, and which is an object of great interest to all antiquarians, as it is a gem of ancient metal work, and is certainly of great antiquity, although there is no distinct clue to the date of its manufacture. The design is suitable for repoussé, and when enlarged, forms an effective panel.

Fig. 5 is another specimen of interlaced ribbon work taken from one of the most precious and interesting examples of Keltic metal work, the Ardagh chalice, dating most probably from the close of the seventh century.

## HOW TO SECURE COPYRIGHT IN DESIGNS.

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In my former papers I have brought the reader up to that point when he gets his certificate of registration issued to him. There yet remain certain other points, which I will deal with in this concluding paper.

*Marking the Finished Articles.*—The Act directs that the finished goods to which a registered design has been applied, should, before delivery on sale, be marked in a certain way—those which belong to classes 1 to 12 should be marked "Rd.," and the number given by the Office upon registration as "Rd., 15423"; those in Classes 13 and 14 should bear simply the mark "Regd." If this is not done, the registration will be invalidated, unless the proprietor can show, to the satisfaction of the Court, that he took all proper steps to ensure the goods being so marked.

This regulation is to let the public see that the design is registered, so that no person could allege that he was not aware of the fact; for, by examining an article, any person can see whether it is registered or not. This marking is sometimes difficult to perform on some articles, from various reasons; but then labels or tickets should be used, either attached to or connected in some way with the article. In Class 13—*i.e.*, the textile piece goods class—the mark is usually put only upon the end of a long roll of the material, so that in these cases many pieces of even yards in length might be cut off, and circulated amongst the public, without bearing any indication that it is a registered design, which is not open to imitate or reproduce.

*Searches.*—If, in such cases, it is proposed to reproduce a design—perhaps an order has been received for execution—and there is reason to think it is a registered pattern, this can be decided by sending to the Office a Search Form, "N," costing 5s., and two representations of the design. The Comptroller will institute a search, and inform such a person whether the design is one in which a copyright is still existing. If it is, he will give him the name and address of the proprietor, and the date of registration, so that the time the copyright has to run may be easily calculated. If the article bears a registration number or other mark, similar particulars will be sent if a copy of the mark is furnished on the same form "N."

These searches are also useful to find out if a design has been anticipated before making an application; or if an action for infringement is threatened, a search may, perhaps, reveal other designs, which would bar the threatened action by revealing anticipation. In cases where the registration number appears upon the articles, the information as to the proprietor and the date of registration may be got by the applicant himself, without paying any fee, by referring to the official journal of the Patent Office, sets of which are kept in the public library at the Patent Office; and sets are also kept at most of the public libraries in the chief towns of the kingdom.

*Copyright limited to the United Kingdom.*—The copyright granted refers only to the United Kingdom. Foreign countries have their own laws and regulations, which must be complied with before a copyright can exist in those countries. But certain rights of priority are given to the registered proprietors of this country by the International Convention, the practice for designs following, in nearly every particular, that applying to patents.

*No Renewals.*—After the expiration of the period of copyright the design becomes public property: it is open to anyone to produce or sell it, and the Act gives no power of renewal of the copyright in any case. It is not again eligible for registration, because, at this later date, it would not fulfil the conditions precedent to secure a valid registration—*i.e.*, being new or original, and not having been previously published in the United Kingdom.

*What Constitutes an Infringement.*—The Act says that the unauthorised reproduction of the design, or any fraudulent or obvious imitation thereof, constitutes an infringement, and it is also an offence to sell or exhibit for sale any articles to which the design or the fraudulent or obvious imitation has been applied, after the person so selling or exhibiting for sale has been warned that the articles in question are infringements of a registered design.

A recent amendment of the Act renders the person who causes to be applied such infringement, liable for penalties. Under the law, as it formerly stood, the greater sinner got off scot-free, whilst the person who had produced the goods on the order of someone else—such as a manufacturer producing for a merchant's order—was alone liable for damages.

Most cases turn upon the meaning of the words, "any fraudulent or obvious imitation thereof," and the question whether it is an "obvious imitation" is determined by the eye of the judge who tries the case. After hearing evidence from each side, he, as it were, puts to himself this question—Could the imitation be passed off upon an ordinary

person as the original design, say in the case of a person ordering from a sample of the original design, and being supplied with the infringement in execution of the order? If the infringement is close enough to deceive such a person, in such an instance, it would be deemed an "obvious imitation" within the meaning of the Act. In one case, a person set his designer to work to produce certain designs, which should have the same general effect to the eye as some prior registered designs which he supplied the designer with. He directed him to vary all the details, so that they could not be said to be exact copies of the registered designs, but he was at the same time to preserve the same general effect. The Courts held that these were "obvious imitations" of the registered designs, saying that if the first designs had not been brought out, the imitating ones would have had no existence.

The question of "fraudulent imitation," turns mainly upon the evidence of fraud or fraudulent action of the persons producing the imitation which is put before the Court; in some cases, this term seems to have a wider sweep than the terms "obvious imitation." A common defence to an action is to set up a counter-plea that the registered design was not new or original at the date of registration, or was published before that date, and, therefore, not entitled to be registered; and if this plea succeeds, the original action falls through, and the Court makes an order for the design to be struck off the register.

*Penalties.*—The Act says that a penalty not exceeding £50 may be claimed for every offence by the registered proprietor of the design, who may recover such sum as a simple contract debt by action in any Court of competent jurisdiction.

The registered proprietor may, if he elects to so so, bring an action for the recovery of any damages arising from the infringement.

*Inspection of Expired Designs.*—On the expiration of the term of copyright all designs are open to inspection by the public. Any person may do so, any day between the hours of 10 till 4 p.m., at the Designs Branch of the Patent Office, and copies may be taken, but a fee of 1s. for every quarter of an hour is charged. This fee acts practically as a seal of secrecy on the expired designs, and if this regulation could be abolished and the designs publicly exhibited, a very valuable mine of information would be at the disposal of the public. The patent specifications, and the registered trade marks, are open for inspection free of charge, and there seems no valid reason why the expired designs should not be treated in a like manner: No doubt, interested parties may object to their designs being publicly exhibited, after their term of copyright had expired, but they could have little real ground for complaint, as the fundamental principle of the law is, that the grant of exclusive copyright for a limited time is to be repayed, by the public having the full benefit of the design or invention after that term has expired.

In the present day, when the questions of technical education, museums, and exhibitions are so much to the front, it seems strange that this large collection of expired designs have not been utilised. The value of such a technical museum or exhibition as might be formed from the expired designs, could not be overrated, especially if developed by some experienced person, who had sufficient knowledge of technical requirements, and true notions as to the good in industrial art, to be able to winnow away the chaff and select for exhibition the true grain, worthy of being imitated, and such as would tend to the education of the students frequenting the place, and to raise the standard of excellence in industrial art and design. The value of such a museum or exhibition would be enhanced by the fact, that these designs are the actual things which are finding a sale in present-day markets. The exhibition of a collection of unique and ancient articles, such as form the bulk of our museums for the advancement of industrial art and design, is, without doubt, valuable to the designers for present-day markets, and is, of course, highly interesting from an historical point of view; but it is open to the oft-urged objection that the articles are, in many cases, totally unfit to serve as models for imitation in the present day, when the wants to be met are so different, the conditions of sale so altered, and the methods of production so totally revolutionised.

There is another point which tells in favour of such an exhibition: here the designs are ready to be used, and will cost nothing, whilst the cost of acquiring a collection of rare and unique articles is naturally very considerable. The number of designs available is also always increasing, and there seems no reason why grants of these designs may not be made to localities, in the same way as the patent specifications are granted, to furnish the local technical museums; which are now, under the fostering influences of the "Technical Instruction Act," springing up all over the country. Of course, experience would be wanted in the selector, so as to ensure localities securing what would prove most valuable to their special industries, and what would tend to develop a correct taste in the students who would take advantage of them.

The institution of such an exhibition or museum, in conjunction with the Designs Office, would be highly valued by designers generally, and, if properly brought to their notice, would be largely used, and, at the same time, would do much to popularise the Office, and bring its proffered advantages more clearly home to the class whom the law is so well adapted to benefit—the ingenious artisan, worker, or designer.

Under present circumstances these advantages are much more largely acquired by manufacturers in a large way of business—who frequently register hundreds of designs in a year—than by the individual designer, who can thus create a property in his work, and in many cases enhance its value in the eyes of the manufacturer, to whom he offers his design for sale; for an exclusive right to manufacture means cutting off competition, and ensuring a sale at a price which will yield a fair profit to all concerned.

It is my fervent hope that these papers will do something towards bringing the knowledge of the advantages which are open to all, prominently before that very wide class of workers who weekly or monthly peruse these pages. The subject on which I have been writing is one that is of the utmost importance to many readers of WORK, and if I appear at times to have been somewhat prolix and precise, I must ask indulgence on the plea that I have been desirous of leaving unsaid nothing that might be said, or should be said. I have spoken of this in the concluding paper of this series, but I may as well say that there is another to come on "Copyright in Sculpture," which was promised in my first paper.

## SPECIFICATION OF WORKS FOR ERECTION OF A PAIR OF COTTAGES.

BY W. BENNETT.

### Designs for a Pair of Cottages.

The designs submitted are for a pair of cottages; they are designed for the purpose of meeting the requirements of the many readers of this valuable paper who write asking for a design for a pair of cheap and substantial cottages, and whose wants, I trust, will be satisfied with what I now bring under their notice. In the illustrations it will be found that the cottages are economically and comfortably arranged. They consist of a parlour, kitchen, scullery, pantry, etc., together with a small porch, which give the buildings an architectural effect.

It will also be seen, by referring to the chamber plan, that there are provided three bedrooms to each cottage. The mullion windows are to be provided with 1½ in. sashes, to open inwards. You will see by referring to my specification what materials I would advise in their erection. I estimate the cost of the cottages, with 9 in. interior walls and 14 in. exterior walls, to cost the sum of £300; if 4½ in. walls be used for the interior and 9 in. for the exterior walls, their cost will be greatly reduced—from £300 to £240.

### Excavator.

*Trenches.*—Make perfectly level the bed of all trenches for footings and consolidate the earth about the same, and against all drains, walls, etc.

*Concrete Foundations.*—To make an artificial foundation to the entire buildings, the same to be composed of one part of the best fresh quickstone lime to six parts of unscreened coarse stone ballast, mixed thoroughly with each other.

### Specification of Works—Brickwork.

*Brickwork.*—The whole of the exterior brickwork to be of the best red pressed bricks, first quality, laid on mortar, compounded of one-third well burnt stone lime and two-thirds of clean sharp sand, free from salt. The brieks are to be properly bonded together in old English bond, and no four courses to rise 1 in. beyond their collective height.

*Brickwork, Interior.*—The whole of the interior brickwork to be the best clamp bricks, hard, square, and free from shakes and cracks, and to be laid on mortar, as described above.

*Damp-proof Course.*—Lay throughout the length and thickness of walls and jambs a course of pitch and tar well boiled, or a layer of roofing felt well soaked in pitch and tar, the same to be ¼ in. in thickness, to prevent the damp from rising.

*Gauged Arches.*—All front and back windows to have the best gauged arches, abutting on proper skew-back, the soffit and reveals to be 4½ in., all outer openings to have plain axed and cambered arches closely set and pointed in cement.

*Brick Strings and Cutting.*—Properly form the string courses, fascias, breaks, recesses, etc., shown by drawings (cutting and rubbing such of the work as may be moulded), neatly splaying angles, plinths, etc.

*Fireplaces, Flues, and Stacks.*—Properly form all fire openings, with camber arches over the same, and trimmer arches where required for front hearths. Carefully gather in the chimney throats and carry up flues of not less than 14 in. by 10 in. in the clear, well pargeted. The stacks to be carried above roof to the height shown on elevations,

with salient courses, etc., and properly fix the chimney tops hereafter described.

*Chimney Bars.*—Put chimney bars of wrought iron, 2½ in. by ½ in., and 18 in. longer than the chimney opening, properly caulked at the ends.

*Bedding and Pointing.*—To bed in mortar all the bond timber, plates, lintels, woodbricks, templates, stone, and other work requiring to be set in the brickwork. To

vide and fix all proper junctions, syphons, bends, and traps, where requisite.

*Jobbing.* — Attend upon stone-masons, joiners, plumbers, etc., aiding and making good after them, and perform all jobbing necessary to perfect completion of works.

### STONEWORK.

*Doorsteps.*—To put to all exterior doorways two 12 in. by 6 in. plain solid tooled

be not less than 2 in. Properly cut double hips and eaves, and cut heading course.

### PLASTERER'S WORK.

*Plaster Walls.*—Cover all the brick walls with simply one coat of paint cement: this cement to be worked to a fine surface with a wood float and carefully applied.

*Ceilings.*—Lath, lay, and float all ceilings with best lime and hair plaster.

Fig. 1.—Front Elevation.

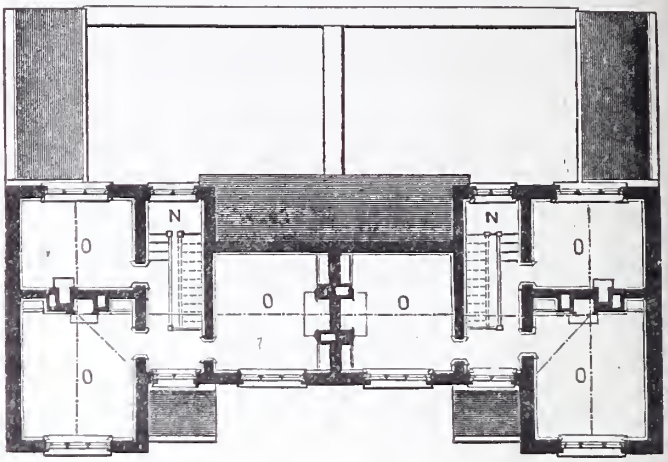



Fig. 4.—Chamber Plan.

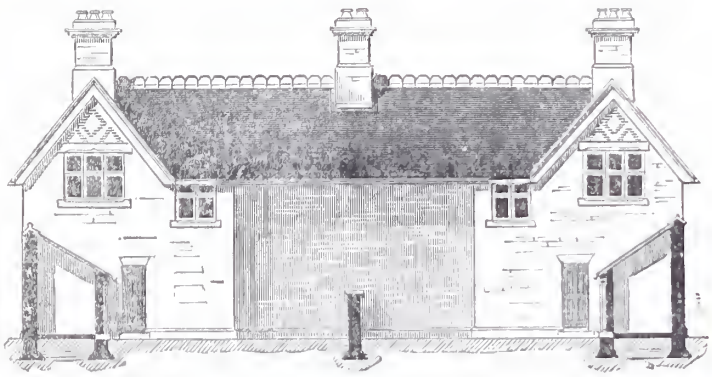


Fig. 2.—Back Elevation.

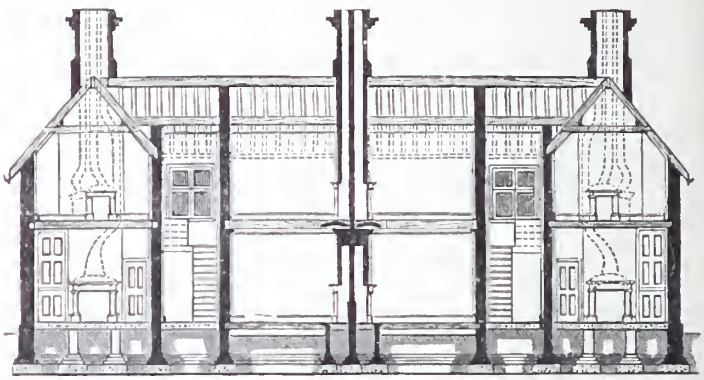


Fig. 5. — Longitudinal Section along Line C D in Fig. 3.

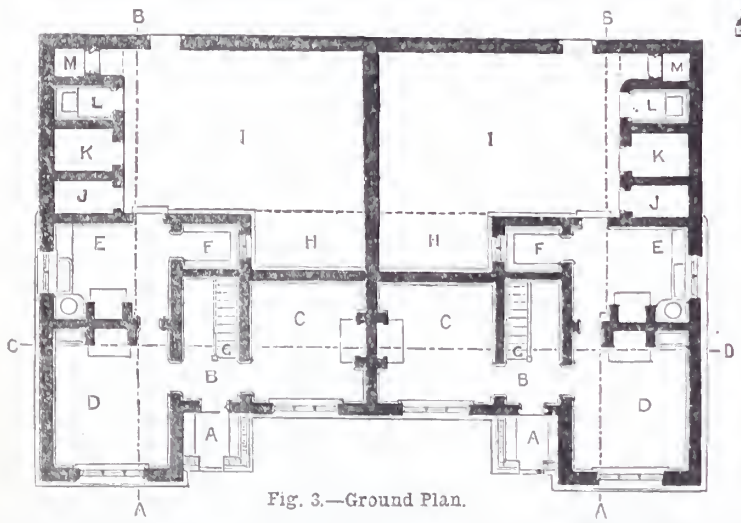



Fig. 3.—Ground Plan.

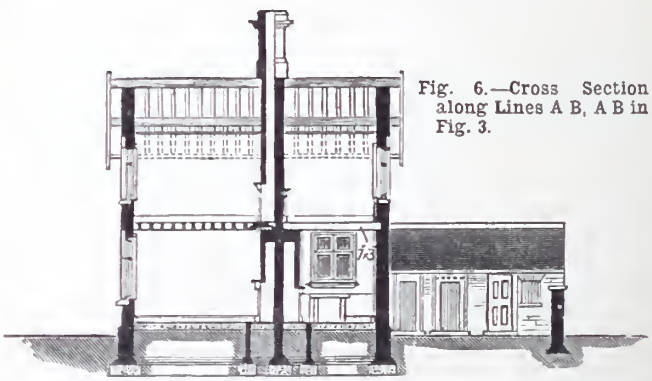


Fig. 6.—Cross Section along Lines A B, A B in Fig. 3.

bed in and point round with lime and hair mortar all door and window frames, and back up and fill in with solid brickwork.

*Encaustic Tiles.*—Pave the kitchen and passages with 6 in. Maw's encaustic tiles laid on a 4 in. bed of concrete, the tiles to be well grouted over with cement when laid.

*Glazed Earthenware Pipes.*—Provide and lay drains with glazed stone earthenware socketed pipes, free from cracks, the drain to be laid to a fall of 2 in. in 10 ft., and jointed with tarred gaskin or cement. Pro-

steps of Whitby stone, the same to be 6 in. longer than the opening.

*Chimney Stacks.*—The chimney stack to be capped with a 6 in. stone, splayed at the top.

### SLATING.

*Slating.*—Cover the roof with good scantle slates on sound heart of oak or fir, double laths and oak pins; no slate to be less than 20 in. by 10 in., and the whole to be well plastered against the pin with lime and hair mortar, the lap of upper slate over lower to

*Backing.*—To back all plinths and architraves with lime and hair plaster.

*Angles.*—To form all angles and corners with Keen's cement.

### CARPENTER'S AND JOINER'S WORK.

*Sundries.*—Provide and fix all required scaffoldage, centring, turning pieces, beads, stops, fillets, tilting fillets, backings, blocks, cradlings, firrings, bearers, and all such like required for erection of dwellings.

*Bond Lintels.*—Provide all necessary

wood bricks and templates of sound Memel or red pine, free from shakes, sap, or dead knots, also lintels of Memel or pine over all window heads. All lintels used must have a vertical depth of 1¼ in. for every foot of opening.

*Ground Joists.*—All ground joists to be of sound pitch-pine, 4½ in. by 3 in., and 12 in. apart, and to be secured to wall plates, 4½ in. by 3 in., and to sleeper walls.

*Ceiling Battens.*—The joists of upper floor to have ceiling battens 1½ in. by ¾ in., and put 12 in. apart.

*Roof.* — The roof over building to be supported by trusses, as shown by the section, these trusses to be no more than 8 ft. apart; all scantlings to be of red wood, properly bolted together where required. The roofing spars to be 1½ in. by 2 in., and 12 in. apart.

*Windows.*—Provide all windows with mullions and sashes to open on pivots or hinges, also window-boards and architraves, and fix same.

*Projecting Eaves.*—Provide and fix a necessary woodwork to form projecting eaves, the fascia to eaves to be 7 in. by 1½ in., with bead run along under part.

*Floors.*—Cover all floors, except where otherwise described, with red deal floor boards ½ in. thick.

*Doors, etc.* — Provide and fix all doors, plinths, joists, lintels, seats, and all bond timbers where required in erection of dwellings, and make good after other trades for completion.

### Plumber and Glazier.

*Windows.* — Glaze all windows with 24 oz. glass, properly secured to sashes by beads, the upper part of the sashes to be glazed in small squares with leads, as per drawing.

*Eaves Spout.*—Provide and fix 6 in. by 4 in. eaves spout securely fixed to fascia.

*Fall-Pipes.*—Provide and fix all fall-pipes where necessary, with proper bends and heads to same.

### Painter's Work.

The whole of the outside work to have four coats in oil and turps, plain colour; the inside to have three coats, exclusive of priming.

[The foregoing paper has been prepared in accordance with the wish of a correspondent, who asked for plan, etc., of a pair of cottages.—Ed.]

## KNOTTING, SPLICING, AND WORKING CORDAGE.

BY LANCELOT L. HASLOPE.

Pointing a Rope—Mainstay—Shear-Legs—Hammock Clews—Stern Ladder—Mat Making—Conclusion.

*Pointing a Rope* is done partly to prevent it from untwisting, and partly to make it go more readily through a block or hole. Fig. 135 gives one manner of doing this. The rope is first unlaid for the necessary length, and the strands reduced gradually. They are then laid up again. The ends are finally whipped with small twine. If the end is not strong enough without it, a piece of stick is inserted to stiffen it. Sometimes a "becket"—that is, a piece of small line with an eye at the end—is put into the end and whipped over to secure it, as in the engraving. Fig. 136 gives another more elaborate way of doing the same thing. The rope is first unlaid, and a stop put on it where the unlaid part commences. As many yarns as are required are taken out and made into nettles by twisting together the two halves of different yarns. The remainder of the yarns are scraped down taper with a knife. Half of the nettles are turned back on the standing part of the rope, and the other half allowed to lie on the scraped part. Two or three turns of twine are hitched round the division of the two sets of strands, and the nettles laid backwards and forwards, the weft being passed each time, as described in making the fender (Fig. 131). The end is usually whipped and a seizing put on the upper part, which is snaked, as shown in the figure, by passing twine diagonally under and over the outer turns of the seizing alternately—that is, if it comes out over the upper turn, it will go under the bottom one, under the top, and so on until it is finished.

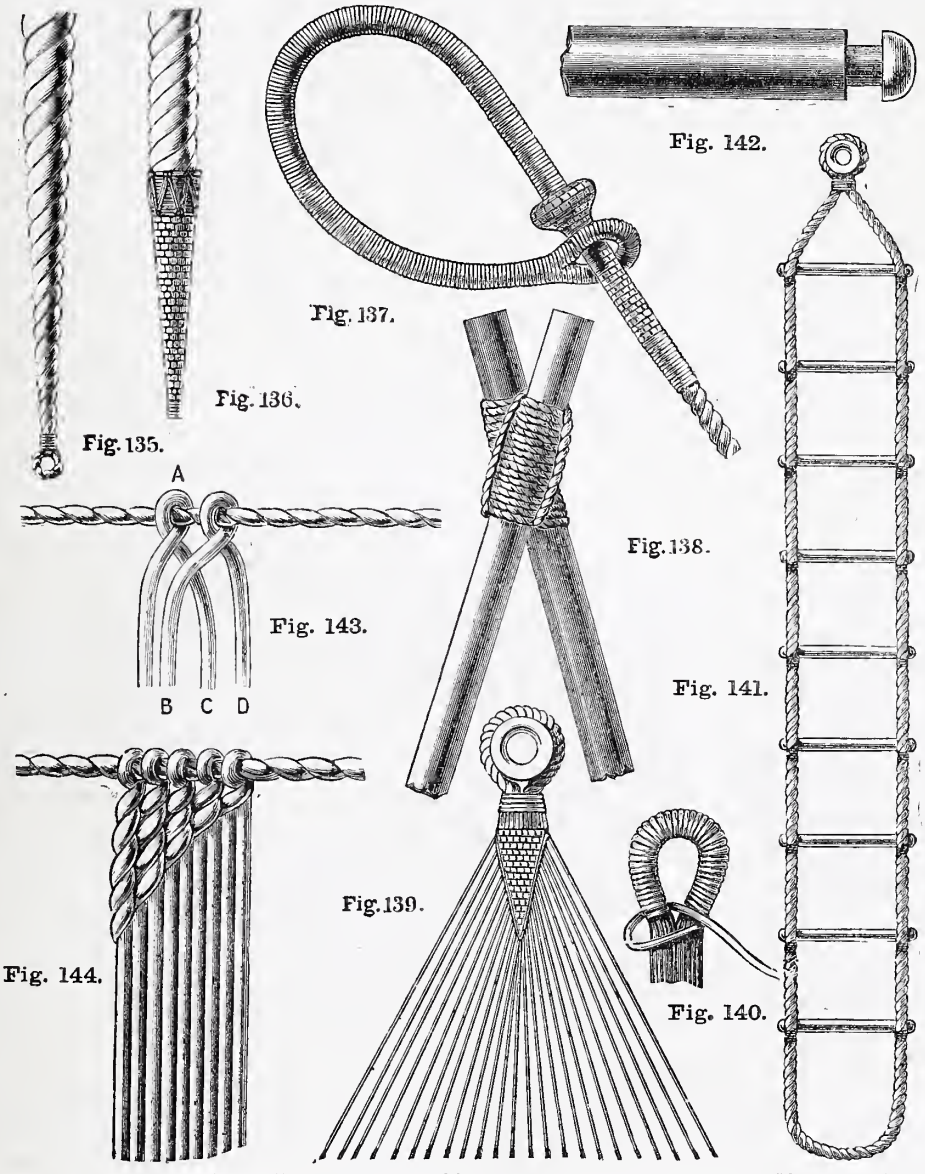



Fig. 135. Fig. 136. Fig. 137. Fig. 138. Fig. 139. Fig. 140. Fig. 141. Fig. 142. Fig. 143. Fig. 144.

**Figs. 135, 136.—Pointing a Rope. Fig. 137.—Mainstay. Fig. 138.—Shear-Legs. Fig. 139.—Hammock Clews. Fig. 140.—Alternative Loop for Hammock Clews. Fig. 141.—Stern Ladder. Fig. 142.—Round of Ladder. Figs. 143, 144.—Mat Making.**

Fig. 137 is part of a *Mainstay*. An eye is first made in the end, and a mouse the shape of a pear raised on the rope with spunyarn. Each turn of the yarn is hove well taut with a large serving mallet, and beaten close. The eye and the rope as far as the mouse are wormed, parcelled, and served over; the mouse and the part below it, which is called the tail, is parcelled with worn canvas, well tarred, and pointed over or grafted with small stuff. The mouse must be covered with nettles, and their number diminished as they are worked into the smaller parts. Below the pointing it is again served over.

Fig. 138 shows the way *Shear-legs* are fastened together. They are first laid side by side, and a lashing of rope put round them. The ends of the lashing are carried one up and the other down to form a cross-lashing, and are knotted in the middle. This is called a Portuguese knot. When the legs are separated, the knot becomes very secure.

The *Clews*, or small cords of a hammock by which it is slung, are usually about the size of fishing-line, but the dimensions of the cords vary according to the number of clews the hammock contains. As in other cases that I have mentioned, the pieces of cord, when cut to their proper length (about 3 ft.), are called nettles. Lay them all together with the ends even. Take hold of them and give them a twist or two in the middle, and put a thimble in the bight and a stop under the thimble. Now divide the nettles into two equal parts, holding the eye in the left hand upside down. Take one of the nettles from the outside on the right,

and lay it across the space between the nettles; do the same with a nettle from the outside on the left; haul upon these till they lie snug down in the divisions between the nettles. Now change the position of the nettles by taking one from the right and laying it over on the left, at the same time taking one from the left and placing it over to the right; repeat this alternately until all the nettles have changed places. Pull them well down, so as to make a clear division between them. Then take two nettles, one from either end of the work, and, crossing them, lay them down in the parting as before. Change the other nettles from side to side, as before, and continue working this way until all the nettles are used up. The last pair of nettles in the middle are knotted. Another pair of nettles being used up every time the nettles are crossed over, the worked part becomes taper, as shown in Fig. 139. The ends of the nettles should be whipped to prevent their unlaying.

A *Hammock*, as I daresay my readers know, is usually made of canvas, and is about 6 ft. long by 3 ft. wide. The ends are turned over and hemmed down, and a row of eyelets, in number equal to the number of the clews, are punched along it at equal distances. The nettles are rove through these, and secured with an overhand knot or two half hitches. When neither thimbles nor eyelets are at hand, an eye may be formed at the end of the clews by serving over the middle of the bundle of nettles with some of the nettle stuff, and then bending it into an eye. The easiest way to do this is to put two half hitches over a hook or anything that is convenient, and, standing at the full length of the serving stuff, gradually wind it on to the bundle of nettles by turning them round and round. The first end is secured by being stowed away among the nettles and served over. The last end of the serving stuff is brought round and through the eye, then round the front of the right part of the eye, round through the eye, and round the left side as at first. This must be repeated thrice, hauling well taut as you go. The end is then brought down, passed through the centre of the nettles, up through the eye, and round the lashing just made, where it is hitched; this must be repeated, and the eye will be secure. In the place of eyelets a hole may be made in the canvas with a pricker, and a small grommet inserted; this must be worked over in button-hole stitch with sailmakers' sewing twine. Of course, the first is the neater method, though the second is quite as strong. Two clews are required for a hammock, one at each end, and it is slung by two ropes spliced into the eyes of the clews.

Fig. 141 shows a *Stern Ladder*. This is made of four-strand rope; the rounds are turned out of oak in the form shown in Fig. 142. The groove at the ends is for the reception of the strands of the rope. The rounds are rather more than 1 in. in diameter, and are placed 11 in. apart. The strands are opened with a marlinespike and the rounds inserted between them, two on each side; a seizing is put on below each round; a round thimble is put into the upper bight, and an eye seizing is clapped on below it. The lower ends are generally spliced together, or a thimble may be spliced in, as at the upper end, if it is intended to make the lower end fast.

*Mats* are used on board ship to prevent chafing. In making wrought mats a piece of small cord is stretched tight horizontally at about the height of a man, and fastened at each end. Across this, hanging by their middles, nettles are placed. These are often made of "foxes"—that is, three or more rope-yarns twisted together by hand, and each rubbed down with tarred canvas or a handful of rope-yarn. Beginning with the nettle nearest the left hand, it is crossed as A (Fig. 143). Another nettle is then brought up close to the first, and crossed in the same way. The end B is then passed over the strand C, and pushed to the back; another nettle is then brought forward, crossed as before, and one part of it put over the part D, and pressed back. The work is continued this way, working diagonally until a sufficient width is obtained (Fig. 144); then, as no more nettles are added, and the outside nettle on the right is brought over from time to time, a selvage is formed as on the left side. Care must be taken to twist each of the nettles together at the bottom, so that they may retain their twist until the next in succession is brought down to interweave with them. There is a little difficulty at starting, but afterwards everything goes on easily. Each nettle from the right passes over the next one to it on the left, and is pushed back, the one that has been passed over being taken up first over the next and pushed back as before. Each twist should be pressed tight as it is made. When the mat is deep enough, a selvage is made by straining another piece of cord along the bottom, securing both ends. As each nettle comes down it is half hitched to this, and the next nettle is laid up at the back of it, and so on alternately. Mats are frequently thrummed, which is done by raising the nettles that lie on the top of the mat with a marlinespike or pricker after it is finished, and putting short pieces of the nettle stuff underneath. The thrums are then cut off to the same length, and opened out. Of course, wrought mats may be made of any material and used for a variety of purposes. They make most excellent door-mats, and are of everlasting wear. For this purpose they should not be made of tarred stuff. Very pretty mats may be constructed of twine for the foundation and various coloured pieces of worsted for the thrums.

There is another kind of mat used aboard ship called a sword mat. It is made in the same manner that weaving is done, only no loom is used. Two small cords, or, better still, two small rods, are secured horizontally and the nettle stuff wound round them, the coils being laid close together. A piece of wood called a "fiddle," as long as the width of the mat and about 2 in. wide and ⅜ in. thick, has half as many holes bored near the lower edge as these nettles in the mat. Every alternate nettle is secured to this by some twine laced through the holes. Another fiddle is fastened in like manner to the remaining nettles. The work is now ready to be commenced. The first fiddle is raised, and the first set of nettles consequently raised with it. What weavers call a "shed" is thus formed—that is, an opening between the two sets of nettles, along which the weft or filling is passed with the help of a netting-needle. The filling is driven well home with a flat piece of wood, tapered towards the edge, called a "sword." The first set of nettles are now allowed to drop, and the second set drawn up with the other fiddle. The filling is passed again and driven home as before. The work is thus continued until there is no longer room to use the sword, when the filling must be worked home with a pricker. When the mat is long enough, the filling is fastened off, and the mat is complete. These mats may be thrummed in the same manner as the wrought mats.

A softer kind of mat is made on a foundation of canvas or duck, which is very suitable for the stern-sheets of a boat or any other similar purpose. The material is cut to the right size and folded a short distance from the edge. A hole is made near the selvage with a pricker and a thrum inserted; another hole is then made a short distance from the first and another thrum put in, and so on until the row is completed. Row after row is thus worked until the mat is finished. Of course the holes, and consequently the thrums, go through both parts of the material. When the canvas is pulled straight after each row is finished, the thrums are held securely without any other fastening. When a pattern is to be worked on the mat, the design must first be drawn on the material in pencil and the canvas folded accordingly. It must be remembered that every fold produces two rows of thrums. White duck thrummed with pieces of cotton rope makes very nice, clean-looking mats for boat use, and as they wash beautifully, they can always be kept in good order. These mats, with a stout canvas or sacking foundation, thrummed with pieces of untarred hemp rope, serve very well for door-mats, though, of course, they will not last as long as wrought mats. Very ornamental mats are made somewhat after the same manner as those just described. Any suitable material, of any colour, can be used for the foundation, on which the pattern must be drawn. The mat is folded along the line intended to be worked, and a common pencil laid along the ridge of the fold. The worsted or other material used is threaded in a large needle, and worked over and over the pencil, thus forming, when the pencil is withdrawn, a series of loops on the foundation. Any pattern can thus be worked, provided always that it consists of straight lines. It might be possible, I think, to form curved lines by working the loops over the first finger of the left hand, moving the finger after each loop, but I have no experience of this. My lady readers will find mat making on this plan a very agreeable and useful employment, as really beautiful mats can be made by this method. I saw one a short time ago, made by a rigger's wife, which would not have been out of place in any drawing-room.

I have endeavoured with pen and pencil to give as clear an account as possible of the various knots and methods of working cordage in general use among seamen, and I hope my readers will soon master the subject. They will find it well worth their while to do so, as there are such a great variety of circumstances where a knowledge of knotting, splicing, and working cordage comes in usefully.

I have not touched on the subject of heraldic knots, partly because I considered it lay somewhat out of the line of my present purpose.

## HARD STOPPING OR BEAUMONTAGE: ITS USE IN FURNITURE WOODS.

BY LIFEBOAT.

INTRODUCTION — PROFESSIONAL *VERSUS* AMATEUR WOODWORKERS—ITS USE TO THE FRENCH POLISHER—ITS ADVANTAGE OVER PUTTY OR BEESWAX AND RESIN—HOW TO MAKE IT — HOW TO USE IT—TREATMENT OF CRACKS, BRUISES, BLISTERS—COLOURED BEESWAX — FINISHING.

*Introduction.*—"It's beaumontage sir," said the boy, when asked by one of his father's customers what he was using. "Yes, but I ordered it to be made of wood, not that

stuff," was the rejoinder. "But this is harder than wood, sir." "Harder than wood, is it? Then tell your father to make me one of all beaumontage."

So the story is told; but whether the boy had been too liberal with its use, using it where wood ought to have done duty, I will not say; but as putty is said to be the carpenter's best friend, we can say that to the French polisher and cabinet maker, especially those that do much in the way of repairs and repolishing—for the one often combines both callings—hard stopping, or beaumontage, *may* be his best friend, if he will use without abusing it, for if carefully selected as regards colour, it is difficult to distinguish it from the wood when polished over.

*Professional* versus *Amateur Woodworkers.*—The professional cabinet-maker, as a skilled workman, should make all his joints fit so closely, and arrange his nails and screws in such a position that their heads will be out of sight, and so leave no holes or defects to need filling up. But even he will find it difficult to select all his wood and ensure himself against any slip or accident so that his work shall present no flaw, shake, or hole that would be none the worse for a composition that shall fill up all defects and render them sightly. True, there are many old stagers who cling closely to beeswax and resin in about equal parts for such a purpose, and they will tell you it suits their purpose very well, though in many cases they only keep two colours in stock—red for mahogany and brown for walnut; at least, the writer so concludes, judging from work that daily passes through his hands.

It is not so much for the professional, who, as I have said, has little need for such a composition as beaumontage, that this article is penned, but for their less fortunate brothers who have to depend largely upon repairs and chance jobs for their livelihood, and for those of our readers, amateur or otherwise, who may have been, or may be, tempted to make some of the many useful or ornamental articles in wood, sketches and particulars of which are constantly appearing in the pages of WORK, and who, perchance, may not have employers willing or at all likely to supply them with perfectly sound material to work with; and there must be some who have found it suit their means best to supply themselves with packing case or other cheap class of wood. In their case they will find it extremely difficult to so select their wood and cut it that no nail or screw-hole, or maybe flaw, shall present itself.

*Its Use to French Polishers.*—The polisher may be called upon to repolish furniture from which little bits of veneer are chipped off, or some bruise, crack, or blister may present itself. The cabinet-maker, with his glue-pot, veneer, and cauls at hand, might let in little bits of wood, or open the blister and run in some hot glue, and apply his cauls, hand-screws, or weights as may be required. Not so the polisher, who may be out of reach of any such help, setting aside the fact that to call in such assistance would take away all his profit, besides hindering him hours, or maybe days, before he could finish his job. Something that will enable him to make level all defects in a short time and enable him to at once proceed with his polishing is found in hard stopping.

*Its Advantages over Putty or Beeswax and Resin.*—If we use putty, in drying it always shrinks, showing plainly in the case of cracks and screw-holes an indentation. If it is used on white wood before staining and polishing its oily nature prevents the stains striking into the wood so deeply as in the parts untouched by it, so causing the work to have a somewhat patchy appearance. If we use beeswax and resin, its chief fault is the want of variety, the colours of which, as I have said, are rather limited, owing to its being kept at hand in most cases in an iron ladle or large spoon, which, by the way, are not the most convenient things for a polisher to carry with him in his kit when going away from home to work.

As hard stopping can be made up in an indefinite number of colours, like so many sticks of sealing-wax—though it is not "harder than wood," yet can, with care, be selected to match any wood we may be working upon, and will not shrink, but retain a level surface, and will, moreover, take polish well—sufficient has, I think, been said to show its superiority over beeswax and resin or putty.

*How to make it.*—The greater the variety of colours the more its usefulness becomes apparent. It gives one a better chance of matching, and ofttimes saves staining such as would be necessary if little bits of veneer are let in.

It can be bought ready-made, at most places where veneers and fancy woods are sold, at about one penny per stick, and is quoted as "stopping-out wax." It is sold by Mr. Palmer, a London shellac and gum merchant, at 1s. 6d. per lb. in various colours; but it is easily made, and one better appreciates anything made by oneself, as knowing its composition lends additional interest.

Having previously planed up two pieces of wood about ⅝ in. thick, 15 or 18 in. long, and 9 in. wide, one of which should be screwed on the bench, take a cupful of any common shellac, put it in a tin or iron pot (half-pound mustard or coffee tin will do), add a teaspoonful powdered resin, and a piece of beeswax the size of half a walnut; then add a teaspoonful of powdered lemon chrome; put it in the oven or on the top of a stove till the whole is melted, stir up with a stick to properly amalgamate, pour a little of the melted composition on the fixed board, then gather it up by means of a scraper or knife, and roll out between the hands, and while still warm roll out into sticks between the two boards by passing the uppermost or loose board to and fro. If the loose board is kept warm by keeping it before the fire when not in use, it gives a better result. Care must be taken not to get the composition *too hot*, as it spoils by boiling. It will require a little practice and, perchance, a few scorched fingers before perfection in the shape of perfectly round sticks is gained.

Having poured out sufficient to make two sticks of this colour, add a little yellow ochre, and make two more; this will give two shades that will do nicely for oak. Then add a little brown umber, warm up again, and roll out two more; those will do for light walnut. Add a little more umber and you are right for dark walnut. Follow on by filling up the tin with shellac, resin, and beeswax as required, adding Venetian red for mahogany, and black for rosewood, and finally finish up with black.

It will be seen that by varving the amount of dry colours any number of shades can be obtained, and it will be found better to take the colours in the order suggested. If the darker colours are taken first it will be found more difficult to obtain the lighter shades, owing to the darker colours clinging to the sides of the tin or pot.

*How to use.*—Any piece of flat iron will do that will retain heat for a few minutes. To give an idea of the most convenient size, I may say that an old worn-out 6 in. flat file in a handle will do admirably, especially if, for an inch or so from the point, the file cuts have been removed by the aid of a grindstone. Suppose it is a crack, nail or screw hole you wish to fill up, select a stick of stopping the required shade, bearing in mind that if it is white wood to be afterwards stained you are at work upon, it will be necessary to select your stopping as near as may be the colour the article is intended to be finished. Then, having your iron black (*not red*) hot, run the stopping into the defective part by holding the iron in the right hand and pressing the stick of stopping against it with the left hand, somewhat similar to the way you have seen the tinker using his copper bit and solder. Do this till you have it well filled up and a little over, then press it well in while the iron is still warm. When cold, clean off level with a sharp chisel, scraper, or knife, and glass-paper.

If it is a shallow bruise it will help the stopping to hold in better if we first make a few holes in the bruised part with a bradawl or chisel. If it is burr walnut, or other fancy figured wood, round holes are best; if straight-grained, such as bay or mahogany, a straight cut from a chisel or knife is preferable.

If instead of dents or cracks the work is blistered, make in it a number of holes—round or straight as required—run some stopping on, and press down with the hot iron. With care this is a far more expeditious plan than opening and putting hot glue underneath and applying weights or pressure. The stopping holds it down like so many pegs or nails.

*Coloured Beeswax.*—It will be found useful if we have at hand beeswax made up of various colours. Slight fissures in the veneers, imperfect joints, or if the stopping has not quite filled up, the defect may, by the aid of these, be made much more presentable.

Heel-ball or cobbler's wax, as one sometimes sees used, cannot be recommended, as it seldom takes polish well. If the coloured beeswax is made up in the form and size of heel-balls, it will be found most convenient, and can be made by oneself by melting and adding the various colours as suggested for stopping, then running it into moulds. The writer has found it a good plan to bore a few 1¼ in. holes through a piece of hard wood, about ½ in. thick; then screw this to another piece and run in the melted wax; when cold, unscrew the top piece—the wax is then easily removed.

*Finishing.*—Having shown how defects in new and old work can be rectified, it is unnecessary here to give particulars as regards French polishing; that has already been done in WORK. Enough for me and our purpose to remind my readers that, if the work is old and been previously polished, it will be found that in making good the defect its necessary cleaning off will leave a bare patch; this should be wiped over with a little linseed oil and "bodied up," allowing a few hours or over-night to elapse before the final bodying up and finishing.

French polishing has already attracted, and doubtless will continue to attract, the attention of many readers of WORK, for whom it seems to possess a marvellous fascination.

## A SMALL POULTRY FARM.

BY G. P.

COVERING FRAMEWORK: OF HOUSES, OF ROOFS, OF RUNS—DOORS: LEDGE DOORS, FRAMED DOORS — WINDOW — INTERNAL FITTINGS: NESTS, ROOSTS, LINING, FLOORS—FINISHING: PAINTING, GRASS PLOT—CONCLUSION.

IN my first paper I described the materials to be used, gave the dimensions of the various parts, and described and illustrated the method of constructing the necessary framework. I now proceed to show how to complete the work.

**Covering Framework.**—Having now got all the framework put together, we may proceed to cover it with the necessary materials. As already stated, Willesden Roofing is to be used for the roofs, and match-boarding for the other parts, although there is no objection to confining ourselves to Willesden Roofing, except that match-boarding will do as well seeing that the house is to be lined inside. One objection to covering with match-boarding is that it is affected by the weather. However, if it is kept well painted, this danger is considerably lessened. For the roof, however, it is an entirely different matter, and I would on no account recommend match-boarding, when Willesden paper is to be had so cheap.

*Of Houses.*—The framework of the houses, then, is to be covered with ½ in. match-boarding. When covering, however, remember to leave spaces for the doors and windows, as shown in Figs. 1 and 8. A small exit-hole must also be left in the match-boarding between the large house and the run, so that the fowls may enter or leave the house at pleasure. This hole should be about a foot square; the edges of the wood should be rounded off; and it should be furnished with a small door, sliding backwards and forwards on two runners, so that at any time communication may be cut off.

*Of Roofs.*—The mode of fixing Willesden paper on roofs is clearly shown in Figs. 4, 5, 6, and 7; there is therefore little need for a detailed description here. When speaking of the rafters, I said they were to be spaced 16 in. from centre to centre; this is so that, when the roofing (which is 19 in. wide) is laid on, the edge of one sheet laid vertically from eaves to ridge, and over the ridge to the eaves on the opposite side, will overlap the edge of the adjoining sheet 3 in. at every joint, and thus make a perfectly water-tight roof. The manufacturers tell us that, "In all cases Willesden Roofing must be fixed with outside wooden battens, 2½ in. by 1 in., and nailed or screwed through batten and roofing to the rafter beneath, in order to provide good holding. Nails or screws should not be less than 2½ in. to 3 in. long." Always follow these instructions (see Fig. 6). These outside battens should be of good wood, free from sap and large knots, and must receive three coats of oil paint before fixing. When cutting the roofing, care should be taken to allow sufficient to turn under the eaves board (Fig. 6), which bend may be easily effected by placing the *ends* in water for fifteen or twenty minutes, but *never* plunge in the whole sheet. As "accidents will happen even in the best regulated households," it is well to know how to repair any accidental damage. All that is required is to fix a piece of 1-ply Willesden paper on each side of the fracture, with a waterproof solution composed of white lead and best gold size. I have no doubt that Waterproof Liquid Glue would suit the purpose quite as well, although I have no experience of it. When the Willesden Roofing is fixed, and the fascia and soffit boards put on, the ridge will have to be made and fitted on (see Fig. 7), after which the small turned pinnacles (see Fig. 1) are fixed on. This completes the roof, and we will now turn our attention to the run, and the fence round the grass plot.

*Of Runs.*—With regard to the run, the framework circumscribing it must first be covered, 2 ft. up, with ¾ in. boards—of course, omitting the space which will afterwards be occupied by the door (see Fig. 1). This done, the remaining portion is covered with 2 in. mesh wire netting,* 2 ft. wide, and the edges of this are covered by nailing over them small laths, 1 in. broad and ¼ in. thick; this prevents the loose ends of the wire from tearing one's clothes, or scratching one's hands, should one happen to come in contact with them. The top is covered with similar wire netting, but first we must have supports on which to fix it. For these we shall require three pieces of wood 8 ft. 4 in. long by 1½ in. broad by ¾ in. thick; these are fixed at equal distances along the top. The top rails are rebated to receive them, as shown in Fig. 9; the ends of the supports are laid into these rebates and nailed down to the top rails. The wire netting is then laid along lengthwise, and fixed with small wire staples.

It is well to have a portion of the run covered at the top, so as to afford shelter for the fowls in rainy weather. The Willesden Roofing may be used for this also. Before fixing the wire round the grass plot, it is well to nail a narrow board at the foot of the posts round the plot. This furnishes a firm hold for the wire netting at the foot, so that there will be no possibility of small chickens escaping under the fence. The board should be 4 in. wide by ¾ in. thick. It should first be well tarred, and then

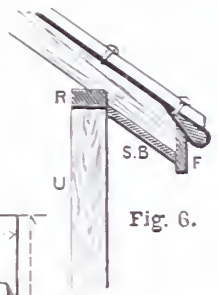


Fig. 6.

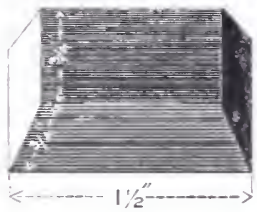


Fig. 9.

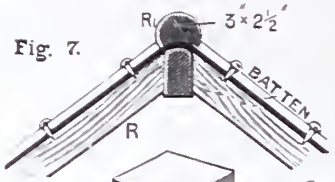


Fig. 7.

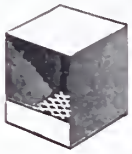


Fig. 12.

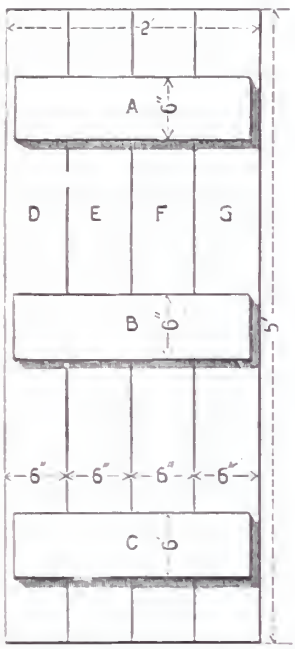


Fig. 10

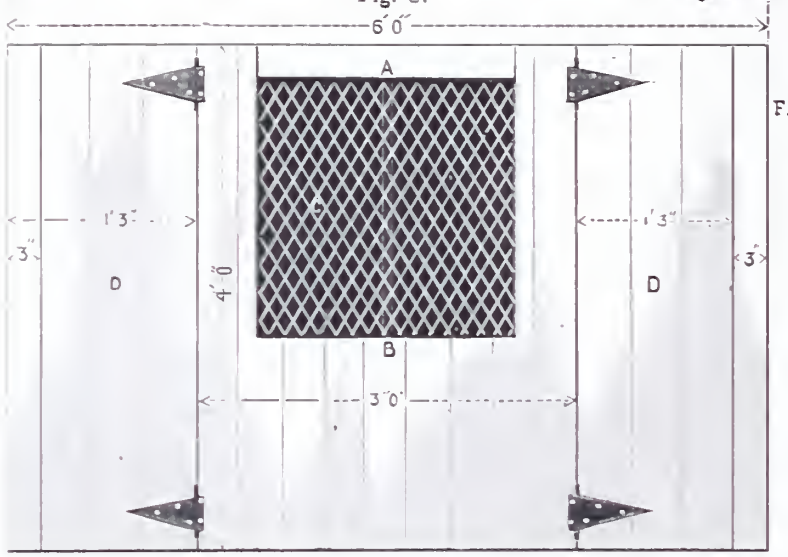


Fig. 8.

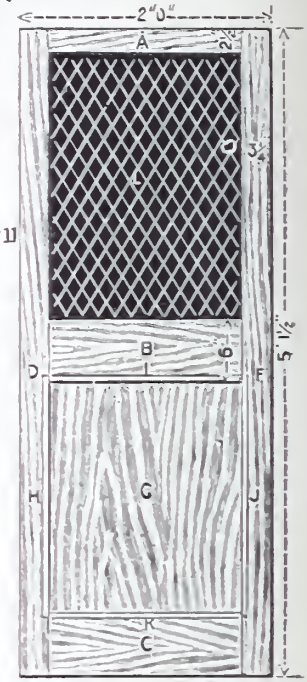


Fig 11

Fig. 6.—Section of Roof at Eaves—U, Upright; R, Rail; S B, Soffit Board; F, Fascia Board. Fig. 7.—Section of Roof at Ridge—R, Rafter; R1, Ridge. Fig. 8.—Front View of Coops—A B, Division between Coops; C, Window of Wire Netting; D, D, Doors. Fig. 9.—Rebate on Top Rail of Run to receive Supports for Wire Netting for Roof. Fig. 10.—Ledge Door for Hen-House—A, B, C, Ledges; D, E, F, G, Match-boarding. Fig. 11.—Framed Door—A, B, C, Rails; D, F, Stiles; G, Panel; L, Wire Netting. Fig. 12.—Form of Nest.

* Mr. Scott's article on "Wire-work," on page 437, Vol. III., of WORK, should be carefully read.

placed an inch or two into the ground. The netting is then fixed with small staples, and, if the fence is composed of two lengths of netting, one above the other, the edges must be connected with galvanised tying wire—*i.e.*, the top edge of the lower length must be connected with the lower edge of the top length.

**Doors.**—We now come to what will be to many the most difficult part of the construction—viz., the doors. The doors for the hen-house and coops are of the kind known as "ledge doors." Those leading into the grass plot and the run are "framed doors."

*Ledge Doors.*—As already stated, three of these are required: one for the hen-house, and one for each of the two coops. Fig. 10 is an illustration of the hen-house door. No description is needed, it would only waste valuable space. The doors for the coops are similarly constructed, but are 4 ft. long by 1¼ ft. broad.

*Framed Doors.*—The illustration (Fig. 11) shows the elevation of a framed door. Two doors are necessary, but both are the same size. They are for the entrances to the grass plot and the run, and are of this kind because they present a much more satisfactory appearance. Ledge doors would certainly look very out of place in the positions in which I have shown the framed doors in the illustrations; and framed doors would be equally out of place in the positions occupied by ledge doors. The doors consist of three rails, A, B, and C, of which B and C are wider than A; two long stiles, D and F, forming the sides of the door; a panel, G, which is inserted in grooves cut in the stiles and rails for its reception as shown in the Fig. by the dotted lines, H, I, J, K; and, lastly, a piece of wire netting, L, which is nailed on the inside of the stiles and rails. The dimensions of the door and its different parts are marked on the Fig., and it only remains to add that the stiles and rails are 1¼ in. thick, and that the panels are made of sound, straight-grained ½ in. stuff. The rails and stiles are joined by mortise and tenon joints. The doors must now be hung and latches put on; those for the house and run doors should be similar to those shown in Fig. 1, while the other doors are fitted with 3 in. cabin hooks.

**Window.**—A small window is shown in Fig. 1: this is 21 in. long by 15 in. broad, and is made of two pieces, 21 in. long by 1½ in. broad by 1½ in. thick, and two pieces, 15 in. long by 2 in. broad by 1½ in. thick, mortised together. This frame is divided into four smaller frames by two cross-pieces, 15 in. by 1 in. by 1½ in., and 21 in. by 1 in. by 1½ in., joined at right angles to each other, and mortised and tenoned to the frame, as shown in the Fig. The window is then glazed with 15 oz. glass and hinged to the top horizontal rail with two 1½ in. butt hinges, so that the sash may be opened upwards and inwards. This concludes the outside work for the present, so we may proceed to fit up the inside.

**Internal Fittings**: *Nests.*—With regard to nests, they may be of any form, but are best on the ground. A long box may be employed, divided by partitions into separate compartments; or separate boxes may be used, which is preferable, as they are more easily cleaned. These separate boxes are illustrated in Fig. 12; they are open at the bottom, and also in front, with the exception of a strip, 3 in. high, to contain the straw. A piece of wire netting should be nailed over the bottom of the box to prevent rats from burrowing their way in; and the nests may then be placed in a row at the end of the house at which the window is placed, so that the fowls may be shaded from the light. The nests for the coops may be arranged any way, so that no one can see into them, with the one proviso that they be actually *upon the ground*. Chicks thus obtained always show more constitution than those hatched on a wooden bottom at a higher level. Let one of the boxes above described be placed in the back corner of the coop, touching the side, the front being turned to the back wall, and about 9 in. from it. The hen will be in the strictest privacy, and will be both perfectly sheltered and kept cool. Inside the nest put a layer of *damp* earth, or, in frosty weather, *ashes*. Make a hollow in the middle of this, and line the nest with straw cut into short lengths, and a few feathers in winter, sprinkling with a handful of flower of sulphur in summer.

*Roosts.*—Two perches will be required; these should be fixed not more than 18 in. from the ground, should be 1 ft. apart, and 4 in. in diameter. A rough pole with the bark on answers best; the claws cling to it nicely, and bark is much softer than planed wood.

*Lining.*—It is really necessary to line the interior with some sort of material. For this I recommend Willesden 1-ply paper, 56 in. wide, at 6d. per yard run for brown. Thus we get about 13¾ square feet for 6d., which is surely as cheap as anyone could desire for the excellent material obtained. The paper should be laid vertically, with an overlap at every joint of not less than 3 in., and be firmly tacked along the edge with galvanised tacks, 1 in. long. These joints must all come over the uprights.

*Floors.*—The floors of the houses and run should be covered with at least 3 in. of gravel, which should be renewed every year. This is essential, for in a short time the poultry will have cleared off all the *sharp small stones* which are so necessary for assisting them to digest their food.

**Finishing**: *Painting.*—The whole structure

LIST OF MATERIALS REQUIRED.

| *Pieces.* | *Length.* | *Width in Inches.* | *Thickness in Inches.* | FOR | REMARKS. | *Approx. Price.* £ s. d. |
|---|---|---|---|---|---|---|
| 11 | 8 ft. | 4 | 2 | Corner-posts of large house and run | To be placed 2 ft. in ground in position A (Fig. 2). | 5 6 |
| 11 | 7 ft. | 1½ | 1½ | ,, of grass plot | To be placed 2 ft. in ground in position B ,, | 3 0 |
| 5 | 6 ft. | 2½ | 2 | ,, of coops | To be placed 2 ft. in ground in positions C ,, | 1 10 |
| 3 | 4 ft. | 2½ | 2 | ,, ,, | To be placed 1½ ft. in ground in positions D ,, | 9 |
| 4 | 5 ft. | 3 | 1½ | Horizontal rails of large house | | 1 0 |
| 4 | 8 ft. 4 in. | 3 | 1½ | ,, ,, ,, | One must be cut to make room for door, the remaining part to be used for sill. | 1 9 |
| 4 | 14 ft. | 3 | 1½ | ,, ,, for run | One must be cut, as above. | 3 0 |
| 2 | 8 ft. 4 in. | 3 | 1½ | ,, ,, ,, | | 11 |
| 3 | 4 ft. 4 in. | 2½ | 2 | ,, ,, for coops | To be fixed between tops of posts C2, D; C, D; and C, D (Fig. 2). | 9 |
| 3 | 4 ft. | 2½ | 2 | ,, ,, ,, | To be fixed between the above, 1 foot up. | 8 |
| 4 | 6 ft. | 2½ | 2 | ,, ,, ,, | To be fixed, as directed, at front and back. Parts, cut to allow doors, to be used as sills. | 1 6 |
| 5 | 4 ft. 2 in. | 7 | 3 | Rafters for hen-house | Two flat cuts to be made in each, which will give 3 rafters each 3×2¼. | 5 3 |
| 2 | 4 ft. 8 in. | 7 | 3 | ,, for coops | Ditto, ditto. | 2 4 |
| 1 | 8 ft. | 4½ | 2½ | Ridge board | | 1 0 |
| 2 | 8 ft. 4 in. | 4 | 1 | Eaves boards for hen-house | Fixed, as in Fig. 4. | 8 |
| 1 | 6 ft. | 4 | 1 | Eaves board for coops | | 3 |
| | 280 sq. ft. | 6 | ½ | Match-boarding for framework | | 1 0 0 |
| 6 | 9 ft. 2 in. | 19 | 4-ply | Willesden paper for roof of hen-house | When ordering, get No. B.1.80. | 13 9 |
| 4 | 5 ft. 6 in. | 19 | 4-ply | ,, ,, ,, of coops | Ditto. | 5 6 |
| 3 | 12 ft. | 9 | ¾ | Boarding round foot of run | Shorter, owing to space for door. | 3 0 |
| 3 | 14 ft. | 9 | ¾ | ,, ,, ,, | | 3 6 |
| 3 | 8 ft. 4 in. | 9 | ¾ | ,, ,, ,, | | 2 1 |
| | 129 ft. | 24 | | Wire netting for run | 2 in. mesh, galvanised (*see* WORK, Vol. III., p. 437). | 18 0 |
| | 80 ft. run | 1 | ¼ | Lattice lath for covering ends of netting | | 8 |
| 1 | 8 ft. 4 in. | 5 | ¾ | Supports for wire netting at top of run | Two flat cuts to be made in it, which will give three pieces each 1½ in. by ¾ in. | 9 |
| 3 | 20 ft. | 4 | ¾ | Boarding round foot of grass plot | | 5 0 |
| | 120 ft. | 30 | | Wire netting for grass plot | 2 in. mesh, galvanised. | 1 1 0 |
| 3 | 2 ft. | 6 | ¾ | Ledges for hen-house door | See A, B, and C, Fig. 10. | 6 |
| 6 | 1 ft. 3 in. | 6 | ¾ | ,, for doors of coops | | 7 |
| 4 | 5 ft. 2 in. | 3 | 1½ | Stiles for framed doors | See D, F, Fig. 11. | 1 1 |
| 2 | 2 ft. | 2½ | 1½ | Rails for ,, ,, | See A, Fig. 11. | 3 |
| 4 | 2 ft. | 6 | 1¼ | ,, ,, ,, | See B and C, Fig. 11. | 11 |
| 2 | 1 ft. 10 in. | 20 | ½ | Panel for ,, ,, | | 4 |
| 4 | 9 in. | 6½ | 15 oz. | Glass for hen-house window | Approximate size only. | 6 |
| | 20 yds. | 56 | 1-ply | Willesden 1-ply paper for lining | Order No. B.1.80. | 10 0 |
| | | | | | | 6 17 7 |

should now receive three coats of paint. The houses, runs, etc., should be painted "stone" colour, and the roofs, "slate" colour. "Ah!" says some more than usually attentive reader, "you told us the Willesden paper was waterproof; and if that be so, why is it necessary to paint it, for paint is usually applied to articles to protect them from the ill-effects of moisture?" Yes, you are right; but does not Longfellow remind us to

> "Trust no future, howe'er pleasant,
> Let the dead past bury its dead!
> Act—act in the living present!
> Heart within and God o'erhead."

Therefore, let us "trust no future," but "make assurance doubly sure" by painting our roofs, even although made of "Willesden 4-ply paper."

*Grass Plot.*—The best time for sowing grass is in the spring, at the end of March. Dig the ground even, rake it perfectly level, and then sow with a mixture of grass and clover, at least 2 oz. of the mixture to the square yard, passing a roller over afterwards; or, what is the same thing, treading well, and afterwards beating with the back of a spade. When your grass becomes well established it should be frequently cut and rolled; cutting alone will not secure a good bottom without the compression which the roller tends to give.

*Conclusion.*—In conclusion, I may say that late autumn is the time for building your houses and runs. Secure good vigorous stock. Do not keep too many—twelve or fifteen are plenty for the house described. Do not feed wholly on corn or corn meal. Avoid damp soil. In winter look out for cold draughts of air, such as come from broken panes of glass. Remove the droppings from under the roosts at least three times per week. The hens must have a place to dust themselves, if you do not want to feed a lot of vermin. Dry sand, sifted ashes, with a little sulphur, will be excellent. There is one more essential for winter eggs—hens of suitable age. I prefer chicks hatched the last of April or beginning of May. After your chicks are hatched feed them liberally. But, you will say, is all this necessary? Yes, it is for the best results in this climate. And if you do not want to do the work, don't blame your hens because they don't lay. Answers to queries will be attended to in "Shop."

Thus the principal materials for our poultry-yard cost £6 17s. 7d. To this a few items must be added, such as gravel, nails, paint, etc., but these would not bring the cost up to more than £10. Then the labour item enters in and makes a big difference, for if a workman were employed to make a house, etc., according to the above plans, he would never think of charging less than £50. This amount the real student of WORK will save himself.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 108.—An Electric Night Light.

The long, dark, winter nights are still with us, and early risers have yet to use an additional number of matches in consulting their watches during the small hours of the dark mornings. To such, the latest electrical novelty brought out by the Electric Stores Co., London, E.C., will be hailed by our readers as a great boon. This novelty consists of a mahogany box, nicely polished, and fitted with four cells of the E.S. dry battery connected to a 4-volt incandescent lamp fixed to the front of the box over a hook and velvet pad, on which is to be hung the watch of the owner. A flexible cable of insulated wire, terminating in a pear-shaped pressel, is coiled on a brass cleat on the side of the box. The box may be placed on the dressing-table, a watch hung against the velvet pad, the cable uncoiled, and the pear pressel placed under the pillow. When the owner of this novelty wishes to see the time, he has only to place his hand under his pillow and push in the stud of the pressel, when sufficient light is given by the lamp to see the time on the watch and light up the room enough to see all the objects in it distinctly. By fixing a small switch on the box and connecting this to the lamp, it may also be used to light the room whilst dressing or undressing. It is not advisable to use the lamp for more than ten minutes at a time, or the battery will soon run down; but with moderate use one battery should last during the winter months. As I have only had this novelty in use for a few weeks, I cannot vouch for its durability; but, as the material and workmanship are good, it ought to last for many years with an occasional renewal of battery cells. These are perfectly dry and safe to use; they give off no fumes nor offensive odours. The price of the set complete is 32s. 6d.

### 109.—Angel's Collar and Saddle Linings.

Though the horse is the best slave man has in the animal world, much of man's industry is devoted to waiting upon the horse, which shows that reciprocity exists to a large extent. For seat, the back; for draught, the shoulders of the animals have to be guarded from harm. How best done has occupied the thought, skill, and labour of humane man of all ages since the horse was subdued to saddle and harness. The main part of the horse to be guarded from injury is the shoulder, where the collar bears. Collars are made so variously now that the saddler must be a mechanical craftsman to be equal to making and repairing some of the collars horses wear in England and on the Continent. But, after all, the wear, like the wear of the sole of a boot, must be repaired from time to time, if the bearing is yielding stuffing or straw, flock, or other such matters. Dray and 'bus horses are subjected to great pressure on the skin of the shoulder and underlying muscles and blood-vessels. We cannot feel what the horse feels, but can imagine the persistent concussion of the collar on the shoulder of a horse that has three or four tons to haul at a trot often, must be painful if the bearing surface of the collar becomes hard and badly fitting; for after a certain point of fitness has been obtained by wear, then the collar becomes gradually ill-fitting, pressing on parts of the neck, throat, and withers, which should not be pressed upon severely, and the unyielding, compacted stuffing causes the collar to be as hard as a board. Galls and sores result sometimes; then, when the horse cannot earn money for his master, relieving the collar is thought of and done, and the horse is rested for the shoulders to get right again. This was noticed by Mr. Angel, a gentleman who has to do with a firm using many horses for heavy draught; and the frequency of the collars going to the saddlers' to be re-lined at 3s. 6d. each time, sometimes with unsatisfactory results, suggested to his inventive faculties that a simpler plan would be to have suitable linings ready made up and formed with a lacing-in arrangement to the "wale" and "face" of the collar. Being practical, he soon had the lining made of stout flannel, known as collar-serge, and two thicknesses sewn together, and a lace run in in loop-stitch form, round the edge. This lace is run through the metal eyes sewn on all round the collar-face and "wale," so that it can be laced in quickly and as quickly removed. This thin lining is stuffed with granulated cork, which has an agreeable yielding spring to the pressure of the horse's shoulders in drawing loads, and its well-known non-absorbent qualities prevent saturation by perspiration, so that sweating under the collar is lessened. As their prime cost is less than collar lining, and carters can take them out to dry and put them in easily again, it is obvious that there is economy as well as philo-animo feeling to recommend their adoption. They are patented, and have had about two years' successful trial with the leading brewers and carriers in London.

### 110.—Philips' Patent Revolving Orrery.

The Patent Revolving Orrery, which was invented and patented by Mr. J. G. Parvin, and is published by Messrs. George Philips & Son, has been sent us. It is a cleverly constructed and inexpensive appliance for finding the position of the various planets for every hour in the year, for indicating the position of a planet, the moon, or a fixed star, and for telling at what hour they will rise, south, and set. It will also indicate the phases of the moon, and show when eclipses will take place. It consists of two parts, which may be roughly described as two cards, one square and fixed, the other a movable circular disc. The square card is about 8¾ in. square and 12¼ in., or very nearly so, in diagonal measurement. The round card is 10¼ in. in diameter, and is placed concentrically on the square card and above it, being pinned thereto by a wooden knob with a spill that passes through both cards and is then fastened down, the circular card revolving on the spill as about an axis. The edge of the circular disc is marked with concentric circles nearly ⅛ in. wide. Of these, the first and outermost is divided into degrees, the second into hours, the third shows the signs of the zodiac, the fourth the seasons, the fifth the names of the months, and the sixth the divisions corresponding to the days of the months numbered consecutively, or, rather, in alternation, as the space at command does not admit of more than this. Above the circular disc is placed another card, also square, which is fastened to the square card below the disc at the four corners, the edge being cut in such a manner between the corners that the graduation and lettering on the bands at the edge of the disc are visible. The edge thus formed on the topmost card, which is covered with paper in imitation of grained leather, is divided into twenty-four spaces corresponding to the twenty-fours of day and night, and, moreover, shows relatively morning, noon, evening, and midnight at intervals of six hours. In the inner portion of the circular disc the zodiacal belt, comprising the twelve signs of the zodiac, is drawn. Within this broad belt the motions of all the planets are performed, and on it are shown the positions of the stars that form each sign. Screwed concentrically to the central knob or button already spoken of are two brass hands, one to represent the position of the sun, and the other that of any planet. These hands are slotted and graduated in degrees along the edge, and in the slot of each is a pointer. It should be said that the large oval opening in the uppermost square card, through which the zodiacal belt appears, represents the actual horizon. With this appliance, on the back of the square card, is given, first of all, an explanation of all the astronomical terms that apply to this instrument, and this is followed by full and clear directions for using the orrery. These, however, take up too much space to be inserted here, and they would not be clear and intelligible if they were given, seeing that it is highly desirable to have the instrument before you when attempting to follow them. For this reason I have confined myself to a description of the instrument itself, in the hope that this, coupled with the mention of the various results that may be arrived at by its aid, will induce many to get the appliance and try for themselves what they can do with it. It seems likely to be of use, not only for children in private families, but in schools also, and especially in those where apparatus of a more costly character, in the form of a celestial globe, cannot be afforded.

THE EDITOR.

# SHOP:

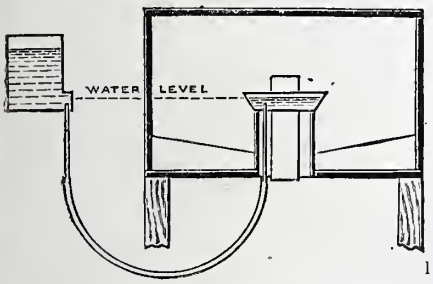
## A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Incubator.**—LEGHORN writes:—"Since writing my Incubator article I have been experimenting with a view of providing some easier method of keeping the water in evaporating tray quite constant. Whilst visiting the late Dairy Show I was impressed with an idea which has since borne fruit. My improved plan consists of the adaptation of the principle of the ordinary poultry fountain, of which I subjoin a rough sketch, but which, I think, will




Evaporating Arrangement and Fountain.

make matters clear. The figure on the left is an air-tight zinc vessel, of rectangular form preferably, with a semi-circular piece cut out of the front at the bottom, and round this is soldered a semi-circular cup, into the bottom of which is soldered 2 or 3 inches of small brass tubing. This is to be connected with the 'overflow' pipe of evaporating tray with rubber tubing. The fountain part of the business will, I take for granted, be understood by all, so that by the laws of gravitation of liquids it will be seen that the height of water in the evaporating tray will be on a line with the water in the cup of the fountain, which should, I think, stand on a shelf away from the incubator, or might be hung by a nail to a wall, a lug being soldered on the back for the purpose. By raising or lowering the fountain we have therefore ready command over the water inside the machine, which can be increased or diminished as required, according to the state of the external atmosphere. The water container is easily filled from a jug without disconnecting, by tilting it, as in filling an ordinary poultry fountain. If made 6 in. high, 4 in. wide, and 3 in. thick, it will hold about a quart; if 2 in. by 4½ in. by 3½ in., about 3 pints; and if 8 in. by 5½ in. by 3½ in., about half a gallon. If not clear to anyone I will endeavour to give a more lucid description."

**Incubator.**—H. E., otherwise LEGHORN, writes:—"Replying to B. A. B. (p. 571, No. 140), I beg to apologise if I have been too impulsive in criticising his suggestion on p. 461, No. 133; at the same time I must repeat that his suggestion is utterly useless for the purpose recommended. WORK is nothing if not practical, and I deem it the duty of every reader to correct any representation he *knows* to be wrong. No, Mr. Editor, I have not tried B. A. B.'s plan, as it is quite needless to test foregone conclusions. It is freely conceded that 'mercury is used in several instruments' where its expansion is 'the feature of the invention'—the thermometer, for example; but surely B. A. B. does not contemplate regulating an incubator on this principle? If so, using a tube of proportional size to that figured on p. 461, he will require a bulb considerably larger than the incubator he is about to regulate. I certainly do not know what query evolved that reply; but the 'suggestion' is quite as remarkable as such as it would have been as an 'invention.' My remarks were not, and are not, written in a hostile spirit, but merely to save others from falling into the same pitfalls as I myself have done in past days when I had no beacon-light ahead. I note B. A. B.'s covert allusion to my criticism of Mr. Walker's incubator, but this was surely unnecessary, as neither he nor anyone else can, I think, justly find fault with that criticism. Before this is in print *my* article will probably be published, and if B. A. B. or any competent reader can improve on it, I hope they will do so, as much for my own benefit as for that of any other interested subscriber. Further, replying to L. G. W. (p. 573, No. 140), permit me to add that my regulator will suit Hearson's machine as well as any other, but as L. G. W. has one of their machines, he will find no difficulty in getting one of their patent regulators, if he can return the old one, but not, I believe, otherwise."

**Tempering Axes.**—J. C. K. (*London, N.W.*) writes:—"You must not quench the axe in salt and water as directed (see page 573, No. 140); it would spoil the eye, making it too brittle. It should not be 'low red,' but 'cherry red' heat. 'Then let down;' and to 'let down' should be explained, and how it is let down: here is the *main art* of tempering axes, or spoiling them by doing it wrongly. 'If you find the temper is soft,' etc., shows J. is only a poor describer of perhaps what he knows."—["My correspondent, J. C. K., says: 'You must not quench the axe in salt and water as directed; it would spoil the eye, making it too brittle.' Nevertheless, I repeat that salt and water is a very good and very common mixture, not only for axes, but for other tools. And besides salt, I might have named with equal truth such medicaments as saltpetre, sal-ammoniac, prussiate of potash, and other salts, all of which have a decidedly intensifying effect, and are therefore employed by many workmen who know full well how to do any job of tempering. My correspondent says, 'it' (the salt) 'would spoil the eye, making it too brittle.' Now, if J. C. K. knew much about the matter, he should be aware that the eye of a manufactured axe is not made of steel, but of iron, which cannot possibly be tempered, but that steel is only used for the cutting edge and for the poll. But supposing that the axe is made entirely of steel, as in a home-forged job, even then the eye is never tempered. It is not tempered any more than the shank of a cold chisel, or of a drill, or the tang of a file is tempered. It is the cutting edge only, and the steel for from half inch to an inch back from the edge that is let down and quenched, and so tempered. The veriest tyro knows something about these things, and I thought also that I had made these elementary matters clear in my paper on 'Hardening and Tempering,' on p. 546 of the present volume. Again, my correspondent says: 'It should not be "low red," but "cherry red" heat.' I ask, Why one more than the other? So long as the steel is not overheated, either will do, and if it makes no difference which, why say one is wrong and the other right, in a captious fashion? You shall take half-a-dozen smiths, and each one will quench at a different tint, and each, if asked, will name similar tints by different qualifying terms. Besides, a cherry red on a dull day will be a low red on a bright day, and how will you draw a line, unless you use degrees Fahr.? Further, if J. C. K. had done much work in steel, he would have learned ere now that almost every separate brand of steel requires to be worked at a different temperature, and also requires different manipulation, hammering, etc. Again, my correspondent complains that I do not explain how the tool is 'let down.' No, I did not; but I certainly thought that a correspondent who asks for information about tempering a particular tool has also the very elementary knowledge involved in the understanding of the term 'to let down.' Set information on elementary matters is given in articles, as in that of mine, for example, on p. 546; when questions are asked, the reply is confined rigidly to the scope of the question. Lastly, my critic finds fault because I say: 'If you find the temper is soft,' etc. Yes; and I repeat it most emphatically: if the temper is soft the tool must be re-tempered at a higher grade of heat. Unless you use a lead bath, which is done by wholesale manufacturers, and steel of a uniform grade, tempering tools is always a tentative operation, so that a tool may have to be re-tempered three or four times over, not merely where amateur work is concerned, but by skilled tool smiths. My correspondent ends: 'J. is only a poor describer of perhaps what he knows.' Well, I didn't ask J. C. K. for his opinion, and if I please the readers of WORK generally, that is all I care for. Still, it is well that he should know once for all that the staff of WORK is not composed of hack writers by profession, whose literary work is a mere digest of their *reading*. J. has earned his living as an engineer for thirty years past, and earns it thus still, and knows how to work, even if he is a 'poor describer' of what he knows. And he will always be glad to learn a thing or two from J. C. K., or any other correspondent, always provided the element of personal criticism is left out, for this is not suitable to WORK."—J.

### II.—Questions Answered by Editor and Staff.

**Piano.**—A. P. M. (*Notting Hill*).—I would advise you to purchase the Index to Vol. I. of WORK, and also the numbers relating to piano making. You will see the address of an ironmonger, where you will be able to obtain an iron frame to suit your requirements. You will also find the address of action makers; if you write or call on these firms, you will be able to get prices.—T. E.

**Piano Making and Hand-screws.**—J. W. H. (*New Lenton*).—We are always willing to assist our readers, and pleased to know that you have received help from the pages of WORK. I should write to G. Buck, tool-maker, Tottenham Court Road; or Berry, Old Street, St. Luke's, London, for your hand-screws, or try Melbuish, Hobday, and others who advertise in WORK. For making wrest planks, iron cramps are generally used in factories, but if your woodwork is well planed and true there is no reason why hand-screws should not give all the pressure you require. I should advise you to order 18 in. screws for large work, such as ends, cheeks, tops and wrest plank, but a few 12 in. screws would be useful for general work. The price is usually one penny per inch, measuring the length of the drops, not the screws, so that 18 in. hand-screws would be 1s. 6d. each. You ought to get them in Nottingham.—T. E.

**Fork Crown.**—J. B. (*Dundee*).—The fork in the rough for narrow or broad tires can be bought of Brown Bros., Great Eastern Street, London; St. George's Cycle Co., Upper Street, Islington, London: Home Company, Bridgeton, Glasgow, and most cycle dealers. It does not require to be hardened after being brazed to steering tube.—A. S. P.

**Electric Scarf Pin.**—H. B. R. (*Leeds*).—Your friend was right. An electric scarf pin was described in "Shop," p. 520, Vol. II., in No. 84, and a battery for the same was described and illustrated at p. 792, Vol. II., or in No. 101. Both pins and batteries are now supplied by Messrs. Cathcart, Peto, & Radford, whose address has been given frequently in WORK.—G. E. B.

**Whitening Piano Keys.**—PIANO.—As you have scraped and polished your keys, and you say that yellow streaks still remain, it is probable that they are stained entirely through the ivory. You might try to bleach them by allowing a little spirits of turpentine to remain on them for a short time, keeping them exposed to the light. If this does not answer, I am afraid there is no other alternative than by having them replaced by ivory or celluloid, which would cost less than ivory.—T. E.

**Dulling a Blackboard.**—ART T.—If you will consult the indexes to Vols. I. and II. of WORK, you will find many references as to how to treat blackboards.

**Aquafortis.**—T. B. (*Sheffield*).—There is no method of making aquafortis less fluid and of a gummy consistence. By boiling, it would all boil away without getting thicker: but by freezing to −67° Fahr. it becomes a buttery mass. Of course it would have to be kept frozen; for, as the temperature rose, so would it become more and more liquid until it again reached its normal condition. Had you mentioned for what purpose you required it, I might have suggested some method of overcoming your difficulties. For instance, phosphoric acid is added to very fine sand until the sand will not absorb any more without becoming quite wet. In this state the acid can be conveyed, and is often sent abroad in barrels. For many purposes the presence of the sand is of no moment, and thus the acid is carried in a solid instead of liquid form; whereas, if the presence of the sand be objectionable, the acid can be washed out with water.—F. B. C.

**Chemistry.**—B. E. (*Plaistow*).—The best book on the manufacture of sulphuric acid is Dr. Lunge's "Manufacture of Sulphuric Acid and Alkali," Vol. I. "Sulphuric Acid," published by Gurney and Jackson, Paternoster Row, at £2 2s. A new edition has just come out, and contains 374 illustrations, drawn to scale. This is the standard work on the subject, and will contain all you wish to know. It might, however, be sufficient for your purpose to consult Dr. Ure's "Dictionary" of Chemistry as applied to the Arts and Manufactures," which you could see at the London Guildhall Library. The best book of tests for metals and acids is Clowe's "Practical Chemistry," published by J. and A. Churchill at 7s. 6d. Thorpe and Muir's "Qualitative Chemical Analysis," published by Longmans, Green, & Co., at 3s. 6d., is also a good book, and has the advantage of being cheaper, although I prefer Clowe's.—F. B. C.

**Mathematical Instruments.**—G. B. H. (*Leeds*).—I bought a small set of instruments for a guinea in Holborn some six years ago, and they have proved very satisfactory. But there is no need to send to London, for any good mathematical instrument-maker (and there must be several in Leeds) will sell you satisfactory instruments singly. These instruments depend principally upon the material of which they are made, and if you require good tools you must be prepared to pay for them. Do not get any that are all brass, those with steel points wear far better.—F. B. C.

**Chromic Acid Battery.**—AMATEUR ELECTRICIAN.—The glass jar form of chromic acid cell as shown in your sketch is constructed as follows:—Procure a glass jar similar to those in use by confectioners. Get a cover of mahogany turned to fit the jar, and collar of brass fixed to this cover, fitting the jar as shown in your sketch. Have the cover smooth and nicely polished. Now get three carbon plates, reaching from the cover to within ¾ in. of the bottom of the jar, and cast a lead head on each, enclosing a brass screw pin for connections. These pins will come up through the cover, and be secured by small brass nuts to a strip of brass connecting all three together. On one of these strips must be mounted a binding screw, to form the positive terminal of the cell. Next, get two zinc plates half the length of the carbon plates and ¼ in. in thickness. In one end of each drill and tap a socket for the screwed end of a ¾ in. brass rod two-thirds the length of the carbon plates, and screw these rods into the zincs. These rods should terminate in brass knobs, and must slide tightly in two pieces of brass tube soldered to two brass strips secured to the cover; the brass strips must be connected together, and fitted with a binding screw to form the negative terminal of the cell. It will be readily understood that the brass strips to which the carbons are connected must not touch those coming from the

zinc plates. If the rods holding the zincs are made to slide stiffly in the brass tubes, the plates will be held up when drawn out of the solution, and a good conducting connection will be formed between the terminal and the plates. There should be an inch of space between the carbon plates; this will give nearly half an inch between the zinc and carbon surfaces. A chromic acid cell thus constructed will have a low internal resistance, and give a large volume of current through a circuit of low resistance. Its E.M.F. will be two volts—no higher than a smaller cell—and therefore will not be more powerful than a small cell in a circuit of high resistance, such as that of a small electro-motor. Two cells of pint size will suit your purpose better, as you only want to work the motor for a few minutes at a time.—G. E. B.

**Induction Coil.**—R. M. (*Chingford*).—Replying to your questions in the order put by you:—(1) If you put four layers of wire on the core for a primary instead of two layers, you will increase the resistance of the primary circuit and the inductive influence of the coils on each other, but you will also increase the magnetic reluctance of the core and the back current in the primary. The probable result will be a less efficiency in the coil, unless a good condenser is employed, and also a strong battery. (2) If you use No. 40 wire instead of No. 36, a thinner spark will be obtained from the secondary; and if the same weight of wire is employed in both cases, you should get a longer spark from, say, a pound of No. 40 than you would from a pound of No. 36. (3) The divisions made in induction coils are intended to divide the total electrical stress of the current in the secondary circuit. By splitting the secondary circuit into sections, and separating these from each other by insulating divisions, the danger of internal sparking is reduced to a minimum. All coils to give over a ¾ in. spark should be thus divided. (4) For a core 6 in. × ¾ in., use ¼ in. ebonite for the ends. Use two layers of No. 18 silk-covered wire for the primary. With 12 oz. No. 40, and a condenser of 60 sheets 4 in. × 4 in., you should get a ¾ in. spark when worked with current from three cells.—G. E. B.

**Hot-Air Engine for Dynamo.**—W. (*Bradford*).—As I have not had any practical experience with the Robinson hot-air engine mentioned on page 570, Vol. III., nor know any person who has worked one, I cannot pronounce on its merits as a motor. If it will do all that its inventor and its makers claim for it, there should be no difficulty experienced in its use as a motor for a small dynamo.—G. E. B.

**Driving Cotton-Spinning Spindles by Electricity.**—P. W. (*Stalybridge*).—There need be no difficulty whatever experienced in applying electricity as a motive power to the driving of cotton-spinning machinery. But if you already have sufficient power, and this has been applied to the machines, why desire a change? If you have to convert steam-power into electricity, and re-convert this into motive power for the spinning engines, the extra cost will be something considerable for plant alone, and you will only get 80 per cent. of the steam-engine's power in the spinning machinery. If, however, you wish to build a new mill in the vicinity of water-power, and wish to bring this power to your mill by other means than gearing, rods, or chains, then it might be advisable to have a powerful dynamo, driven by the water motor, and transmit the electric power to the mill through wire cables, where it can be used in driving electro-motors attached to the machinery. In any case, there need be no alteration of the spindles or machinery, the same wheels and the same bands being used, and any required speed can be obtained from an electro-motor.—G. E. B.

**Oak Panels in Cabinet.**—T. A. (*Little Bolton*).—I fear "Shop" space is too valuable at present to give a design suitable for utilising your oak panels. It might be too elaborate for the use of other readers. But perhaps you could convert the cabinet in No. 141, Vol. III., in such a way as to accommodate your panels; then you will find plenty of designs which are applicable for the carving—not in the style of the periods you mention, perhaps, but still very good. The sideboard in Vol. I. (see Index, price 1d.) might offer many attractions for you. Back numbers contain several designs which could be put to serviceable use.—J. S.

**Writing-Desk.**—AMATEUR (*Paddington*).—"The way to make a writing-desk . . . . about the average size," is rather a vague question. I presume you mean a small portable article; but I would like to know if I am right, or whether you need an office desk, or *what*. About the time you see this, drawings will probably appear in "Shop" relative to a small box desk with hinged flap—similar to an office article.—J. S.

**Model Electric Lights.**—E. P. (*Waterloo Road, S.E.*).—(1) I congratulate you on your success in making electric lamps. The cement employed in connecting the carbon filament of the Bernstein lamp with its platinum wires is merely finely powdered coal-dust mixed with an ordinary cement. Some makers clip the ends of the carbon filaments in sockets made of flattened wire, and then electro-deposit copper on the joint to make it secure. I had no idea of anyone attempting to manufacture lamps from the instructions given in my articles on "Model Electric Lights," so did not give details of their manufacture therein. (2) Platinum wires must be employed to conduct the electric current through the glass stem of the lamp, because no other metal will expand in the same ratio as glass when both are heated. Platinised copper would expand more rapidly, and thus crack the glass. (3) The voltage of current from a dynamo may be increased by winding a finer wire on the armature, but such finer wire would not have the capacity of the larger wire, and in consequence, the volume of current in ampères would be reduced, or the insulation of the wire destroyed by internal heating of the machine. If there is room enough on the armature, the number of turns of wire and the voltage may be increased, but then there should be more wire on the fields to balance the wire added to the armature coils. Driving the machine at a higher speed will increase the output of current. If you wish for a greater output, choose a larger machine.—G. E. B.

**Blacksmith's Forge.**—S. S. (*Grantham*).—In my sketch of spark arrester I am assuming that the lower part of the chimney is brick; you say that the top is composed of a C.T. stove-pipe. To fit the arrangement on the top would be rather inconvenient, as you will see. I have shown in Fig. 1 a rough perspective sketch of the hearth and chimney of a blacksmith's forge; a part of the chimney I have shown broken away, in order to give a better idea of the position of the spark arrester, which is shown to a large scale in Fig. 2. Should your stove-pipe (4 in. diameter) start from the fireplace, you must yourself arrange from these sketches some contrivance to suit. Just below the spark arrester the chimney should be round in section, as shown at A; so if your chimney is now square—which most probably is the case if it is brick—you should have it made round, as shown in Fig. 2. Centrally above A must be hung a circular metal deflector, B, two and a half times larger than A, somewhat in the shape of an umbrella with the upper part pushed down, thus forming a hollow in the top and a corresponding projection inside, as shown (Fig. 2). This must be carried by a bolt, C, hung from the centre of a moderately fine-meshed wire gauge screen, D, considerably larger than the diameter of A: say, about three and a half times. This increase in diameter is so that the smoke will have sufficient area to pass through the gauze, as it will be considerably obstructed thereby. This screen should be built into the chimney, which should be enlarged as shown. E is a circular cast-iron water-trough running concentrically round A; there should be an overflow pipe for the water from it, or the trough, as it becomes filled with ashes, will overflow; an inlet for water is also necessary for replenishing after cleaning, the water being run off by means of a valve, F. G is a small door, through which the trough can be reached in order to clean it out. It is on account of this cleaning out that I should suggest it being placed as low down as possible. You, however, being on the spot, will be better able to judge the most suitable position for it. The smoke, sparks, and gases pass up through A, the steam being divided and deflected downwards by B, as clearly shown; the cinders being heavier than the gas, when once their course has been altered suddenly, will continue it, and fall into the trough of water and be extinguished, while the smoke proceeds upwards through the gauze, which will most probably arrest any few sparks that may have escaped the bath. If you settle on this arrangement, you must first decide where and what diameter A shall be, and all the other contrivances should be made proportional to it, and can be measured from the drawing when you settle the scale, which is the same as deciding the diameter of the chimney, A.—P. B. H.

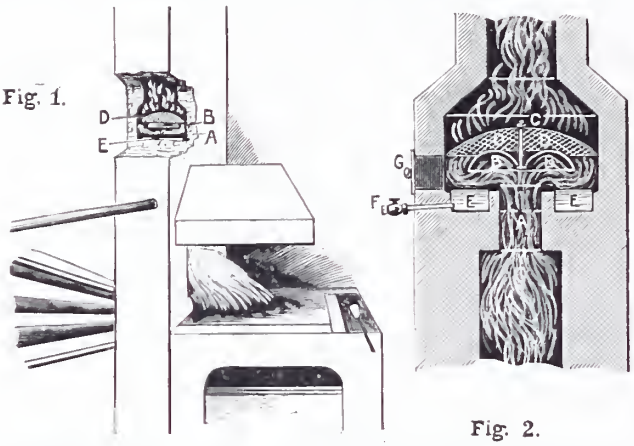


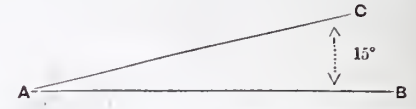

Fig. 2.

Blacksmith's Forge. Fig. 1.—Hearth and Chimney. Fig. 2.—Enlarged Section through Chimney, showing Spark Arrester.

**Original Designs for Wall Papers and Calico-Printers' Patterns.**—T. W. (*Accrington*). Advertise these in WORK. In the meanwhile, send a few samples, that I may see what you can do.—ED.

**Coal Vase.**—J. T. P. (*Bow*).—I must ask you to explain more fully your query. Do you mean the manner in which they are jointed together, board to board, or some mechanical contrivance? By pivoting, countersinking the pivots, and filling the holes up afterwards, the door or flap could be secured to open as usual without exhibiting the means upon the outside. Is it a collapsible article you allude to?—J. S.

**Spiral Cutters.**—SPIRAL.—I am not much of an authority on spirally grooved cutters. I have not cut many, and those have only been for my own use and not for the trade. I usually make the angle of the spiral about 15° to the plane of the axis of the cutter—that is, if A B is the axis of the cutter, A C, which makes an angle of 15° with it, is the angle of the spiral groove. I have used this rate of spiral on various-




sized cutters with good success. Some makers seem to use a little less. I do not know whether SPIRAL'S set of change wheels is the full set supplied by the makers, but there seems to be sufficient to cut all the different spirals he is likely to require, at all events for cutter-making. Supposing it is required to cut a spiral of one turn in 6 in., that is 6 in. pitch. Now, since the screw in the slide has four turns to the inch of traverse, it must evidently make twenty-four turns while the mandrel makes one. The worm wheel on the spindle has forty teeth, single thread; the worm shaft must therefore make forty revolutions for twenty-four turns of the screw. The change wheels must therefore be in this proportion, 24:40, the larger wheel being on the screw. I think if SPIRAL follows out this reasoning, he will see how to get his wheels for any pitch. Of course, if two wheels will not do, he must compound exactly as in screw-cutting, keeping the proportions the same.—DAMON.

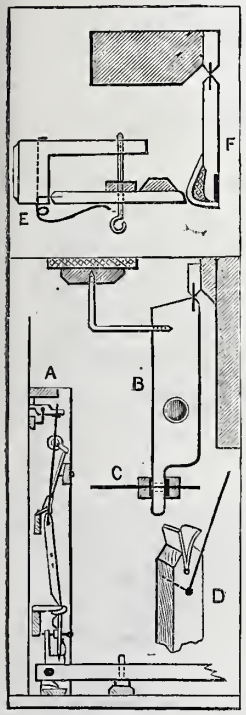
**Galvanic Water.**—READER OF WORK.—You have seen an electrical apparatus in which a basin of water containing a coin was placed, and persons not in the secret were challenged to take the coin out of the water. This they could not do, because the water was said to be galvanised. The basin of water was connected to one pole of a powerful induction coil, and the water thus formed a conductor of the electric current, just like the handle of an ordinary shocking coil. The water was not galvanised, nor is there such a thing as galvanic water. The experiment you saw performed may be repeated by you with one of the coils mentioned in my series of articles on "Induction Coils" now in the Editor's hands, in which such instruments are described and illustrated.—G. E. B.

**Magnetic Saturation.**—C. B. (*Regent's Park*).—The saturation limit of magnetism in best soft iron is 200 lbs. per square inch. It will take 5,000 amperes of electric current flowing through a suitable wire wound over soft iron to magnetically saturate one cubic inch of the iron. In malleable iron the saturation limit varies considerably with the hardness of the metal and its purity. In ordinary commercial iron the limit will rarely extend above 120 lbs. per square inch. In cast iron the saturation limit is lower still, so that a 5,000 ampère current will not magnetise a cubic inch of it beyond a power of holding 100 lbs. The variation in this limit will also be larger than in best soft iron; hence the frequent expressions of dissatisfaction with the results obtained from small dynamos.—G. E. B.

**Power to Drive a Dynamo.**—C. B. (*Regent's Park*).—Find out the total output for which the dynamo is built. If this is expressed in watts, divide the figures by 746, and the product will be the horse-power required to drive the dynamo. If the output is given as so many ampères at a pressure of so many volts, multiply the volts by the ampères, and divide the product by 746 as before. As a dynamo works best when more than enough power is provided, it is safe to allow 10 per cent. for loss in friction and slipping of belts, but this should be increased when small machines having small driving pulleys are to be driven at a high rate of speed. Much also depends upon the width, tightness, and length of the belt. A tight, narrow, and short belt will absorb more power in overcoming friction than a wide and long belt moderately tight. It is not usual to run all the current through a voltmeter and ammeter on a lamp circuit, so as to always read the state of the current on these instruments. They are usually mounted on the switch-board as shown at Fig. 92, p. 837, Vol. II. of WORK, and connections are made with them as required by means of switches, the connections being shown in diagram Fig. 94 on the same page.—G. E. B.

**Zincography.**—LIONEL.—There is such an affinity between zincography and lithography that almost everything that has been already said in the different papers running through the third volume of WORK on "Artistic Lithography," applies equally well to the above branch of the art, the great difference being, as the name implies, that one is

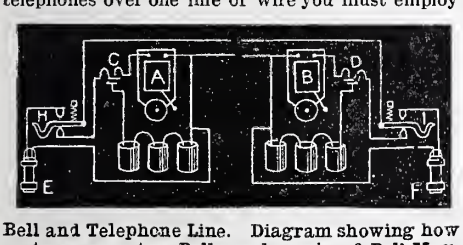
drawn on and printed from a litho-stone, and the other from zinc plates, so I can only ask you to refer to the back numbers for an idea of *drawing* on zinc or stone. To give an outline of *printing* from zinc or stone would take up a great deal too much space in "Shop," as a whole volume might be written on the subject, and to write a brief sketch would only give you, or any other reader, an imperfect knowledge of what is required. One principal thing to be noticed is, that drawing an outline on stone in lead peneil, and working over this a tint, it may or may not print with a white line or space, wherever the peneil has touched the stone; but on zinc the pencil line would print as a solid black line, therefore I must warn the artist to be most careful to put the drawing on the zinc by means of the red chalk transfer paper mentioned on p. 115, No. 112, Vol. III. of WORK. Another thing is that zinc not possessing quite the same qualites as stone, the ink, or chalk, etc., does not penetrate it to quite the same extent, so the artist has to be much more careful in etching the drawing in case of accidents to the work. Damp weather has a great effect on the zinc plates, although in a rather different way to stone, therefore the neecssity of keeping the plates as dry as possible. A preparation of nut-galls must be used instead of nitric acid in etching the plates.—A. J. A.




**Pianoforte Action—A, Section; B, Damper; C, Damper Wire; D, Sticker; E, Hopper; F, Lever.**

**Pianoforte Action.**—W. D. (*No Address*).—The action you have in your piano is known in the trade as the "sticker" action, and I should think it is powerful enough for your piano, as it is probably strung light, or with thinner wire than is used now. Of course, your piano would be much improved if you added dampers and re-hinged the stickers with new leather, also covered the levers with leather in the same manner in which they are covered. I have sent a sketch with letter, which will make plain to you how to attach dampers. I would not attempt to make them if I were you, as you can purchase for 4s. 6d. a set of 60, and if the hinges of the levers are worn out, get a set of new ones made to pattern 1, which will cost you 3s. a set. The dampers are hung with glue on a rail which extends from one upright of action to the other. If you will look at No. 46, Vol. I. of WORK, you will see how to fix damper-rail, and you could fix a soft pedal as described there. Materials you can purchase from Mr. Hallpike, of Mare Street, Hackney, E., who will send you them by parcels post. If you order the dampers, send a rough sketch from mine, and he will understand what kind you require; and ask for damper wires complete. You will see that the damper wire goes through the side of the sticker, then through a hole in the damper, and is fitted with buttons and cloth washers to pull it down. If you think you cannot manage to repair the action, I should send it to the above address, and ask Mr. Hallpike to repair it and add dampers to it. I don't know that I can say any more at present. If you are in difficulty, write again.—T. E.

**Bell and Telephone Line.**—A. B. G. (*Ascot*).—To ring two bells and work two ordinary bell telephones over one line of wire you must employ




**Bell and Telephone Line. Diagram showing how to arrange two Bells and a pair of Bell Magnetic Telephones to work over one Line—A, B, Bells; C, D, Three-way Keys or Pressels; E, F, Bell Telephones; H, I, Automatic Hook Switches.**

two batteries, and connect them as shown in the annexed diagram. To do this, you must employ a three-way key, or pressel, and an automatic hook switch for the telephone at each end of the line. In the three-way key, a brass spring, shaped as shown in the diagram, engages with a hooked spring when at rest, and thus forms a bridge for the current. When the long spring is pressed down on the T contact beneath it, the current is diverted in another direction. The automatic hook switch is also constructed on the same principle, and its form is shown in the diagram. When the telephone is hung on the hook of this switch it is pressed down on the lower contact stud, and connects this stud with the pivot on which the lever of the hook works. When the telephone is off the hook, this lever is drawn by a spiral spring against the upper contact stud, and cuts the bell and battery out of circuit at the same time as it provides a closed circuit for the telephones. When both telephones are hung on the hooks at each end of the line, both bells are placed ready to be thrown into circuit with the batteries on bringing either of the long springs of the key with the T contact pieces. If you wish to ring bell A, the telephones must be hung on the hooks, and the key, D, pressed down; the current will then pass from the battery under B to the spring, D, from this to the under contact of the hook, I, then by the line wire to the hook, H, and by its lower contact across the bridge, C, through the bell, A, and back to the battery by the other line. When the bell, B, is to be rung, the bridge, C, is depressed, and the battery under A is thrown into circuit with the opposite bell. The length of the circuit—that is, the distance of the two bells apart—will make no difference at all to the arrangement of the instruments. If the telephones are to be hung in rooms at some distance from the bells—as in your case, where the bell is in the passage—then have the keys near the telephones, and thus control the circuit. These are little matters of detail which can be worked out by the aid of the diagram.—G. E. B.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Shoe-Mending.**—DUMMY writes:—"Would any reader kindly inform through 'Shop' the simplest way to fix bristles into wax-ends, with a sketch?"

**Engraving on Brass and Metal.**—NELSON writes:—"Can any reader of WORK kindly tell me what course I had better take? I wish to learn the engraving for work on coffin-plates, brass and metal. Where could I get instructions and tools for the same? I am a fair writer."

**Fan-Power for Lathe.**—WORKITE writes:—"Will some reader please give me the sizes of a circular fan (on the Canadian principle) which would have sufficient power to drive a 6 in. screw-cutting lathe, and also instructions and dimensions to make same?"

**Tailors' Cutting and Fitting.**—G. R. D. (*Chetham*) writes:—"Will any reader inform me whether there is a work to be had on tailors' cutting and fitting, where to get it, or any information on the subject, as I wish to learn it?"

**Model Ship-Building, Rig, etc.**—CUTTER writes:—"Will anyone advise me as follows: 26 in. racing yacht, 6 in. beam, 7 in. depth, 8 lb. lead keel, length of spars, how to rig, size of sails, etc.?"

**Paste and Varnish.**—C. R. (*Birmingham*) writes:—"Can anyone give me a recipe for making paste as used by best leather-workers; also the varnish used for delicate-coloured leather goods, and how used? What preparation, if any, is first put on? Also I should be glad of the address of the makers of a patent paste. There is a Company somewhere in London, but I forget the address."

**Market for Fretwork.**—FRETWORKER writes:—"Will anyone kindly tell me if I can sell brackets, etc., when made up, and where?"

**Lucifer-Match Making.**—ANXIOUS ENQUIRER writes:—"Will any kind reader of your valuable paper tell me the various compositions, and how to mix them, so as to enable me to make the common lucifer-match?"

**Paste Diamonds.**—J. H. (*Bury*) writes:—"Will any jeweller reader of WORK kindly give me any information as to how paste diamonds are made?"

**Upholstery.**—SILLY S. writes:—"Will anyone kindly inform me through the medium of 'Shop' the addresses of the best houses to obtain upholstering materials and requisites from?"

**Crib and Dresser.**—JOINER writes:—"Could any reader give me a good design, with all particulars, for a baby's crib (wood); also for a kitchen dresser, the latter to be about 8 ft. in length, or inform me where I could find good designs?"—[JOINER should purchase the indexes to Vols. I. and II., wherein much upon these matters appears.—ED.]

**Maguay Lamp.**—ELECTRIC LAMP writes:—"Will anyone kindly inform me through 'Shop' where I can purchase Maguay's electric lamps?"

**Gas Engine.**—LATHE writes:—"I am contemplating the purchase of a gas engine. Will any brother reader inform me as to the most effective, with the least floor space?"

**Marble Table-Top Stand.**—W. R. (*New Cross*) writes:—"I have an inlaid marble table top, and would thank any reader to kindly give me a design for a stand to it. The size is 2 ft. 8 in. by 1 ft. 6 in. I thought of having it in oak or some other hard wood."

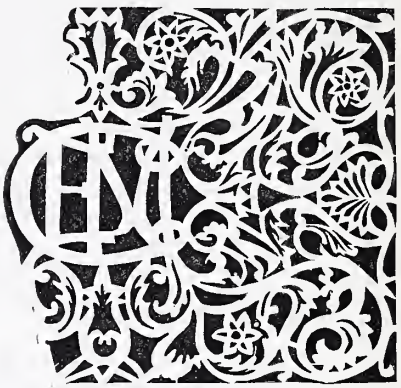
**Bamboo Flower Stands.**—MELTON CONSTABLE writes:—"Can any of your readers inform me as to the cheapest place where I can obtain bamboo cane for making flower-stands, etc., and can anyone suggest an easy method for making the same?"

**Naval Architecture.**—ART T. writes:—"Will any reader name a good, moderately priced book or books on naval architecture as applied to the present time? I have a book by Peake, but it seems too old-fashioned in its matter (timber ships only) and in its manner of stating things and drawings. Are no rules for finding capacity, and other matters, asked for by the Science and Art Department at the annual examination?"

**Fishing-Rods.**—W. J. T. R. writes:—"I shall be much obliged if any reader will tell me (1) what description of cane is used in the manufacture of split-cane-built fishing-rods; (2) where it can be got; and (3) probable price."

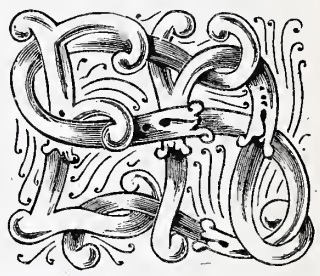
## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Monograms.**—F. J. (*Exeter*) writes:—"In reply to some of your correspondents requiring monograms, I send two, hoping they may suit. The first is for MUGGINS (see WORK, p. 606, No. 142). One of the best methods he can employ to put the monogram E. M. C. on a box is to cut out a design in



**E. M. C. Monogram for Box Cover.**

fretwork, the same size as the top of the box, with the monogram in the centre, and glue it on with a small bead round the edge. Unfortunately, he does not give the size of the box, but this design is suitable for enlarging three or four times. He will see that the initials stand out boldly against the adjoining fretwork, as the latter is of a smaller pattern, which makes the monogram very distinct. I have shown one-half only of the design, but the other part is similar: only reversed, of course. The initials E. H. S. are for G. S. (*Gateshead-on-Tyne*) (see WORK, p. 606, No. 142), for illumination. If the letters are intended to be gilt, where they overlap they must have a dark tint to separate them and throw up the top letter. Shading may be put in similarly, the light being supposed to come from the left upper corner. The ground could suitably be a light blue, with faint white or gold curved lines on it. In these designs I have endeavoured to make the monograms as plain and clear as possible, the ornament being treated as a harmonious accessory, so that one's time is not wasted in trying to decipher them, as in many cases where letters and needless curves are run into each other, and make it extremely doubtful what letter comes first. They ought to be called 'puzzle monograms.'"



**E. H. S. Monogram for Illuminating.**

**Chuck.**—M. (*Bishop Auckland*) writes, in reply to YOUNG TURNER (see p. 590, No. 141):—"If you refer to p. 28, No. 54, of WORK, you will find drawing and description of chuck, which you may make in wood. If there is any part not clear, if you write again I shall be glad to help you."

**Gum.**—W. L. F. (*Dublin*) writes, in reply to GUM (see p. 622, No. 143):—"A good gum for ordinary purposes can be made by dissolving gum-arabic in sufficient warm water to bring it to the consistency required, and when cool, a few drops of oil of cloves or alcohol will preserve a quart from turning sour."

**Horse-Collar Hames.**—F. H. (*Battersea*) writes, in answer to L. M. (see p. 637, No. 144):—"Horse-collar hames are not lacquered, but covered with thin brass, fixed on the rim with a soldering-iron. Any harness-maker will get them re-covered for you. If you had sent your address, I might have told you of a firm near."

**Re-transfer Ink.**—A. J. A. (*London, W.*) writes, in reply to LITHO (see p. 558, No. 139):—"I do not know of any printer who would spend the time in making his own re-transfer ink from plate to stone, as it is one of the things much better bought ready for use; but should you require to make your own ink, then take equal proportions of tallow, wax, soap, shellac, pitch, and litho printing ink, and set on fire the first three, and burn for a quarter of an hour; melt the rest, and mix. Should the ink be still very soft, keep it on the fire at a great heat (without burning) until it is sufficiently hard; the different things should be melted in the above order. If you use varnish and lamp-black instead of the printing ink, then the proportions should be varied to correspond, using more shellac and pitch, as in the first receipt the printing ink already contains these in greater proportions."

**Transfer Drawings.**—A. J. A. (*London, W.*) writes, in reply to DRAUGHTSMAN (see p. 590, No. 141):—"To make a transfer drawing for zincography proceed in exactly the same manner as if it were to be used for stone. You should not use a transfer ink for drawing with, as that is only for the use of the printer. The best litho ink is either 'Lemercier's' or 'Vanymbert's,' both in sticks, which rub on a saucer and mix in the same way as I have already mentioned on p. 66, No. 109, Vol. III. of WORK. It should be of just sufficient consistency to stick to the saucer and not glide off from it. It is not advisable for you to use crow-quill pens; there are special pens prepared for lithography, the best of which are Tillott 290, Somerville, and Mitchell, and if you use either of these pens with the above ink I think you will find your difficulties vanish."

**Glue.**—EDDIFRA writes, in answer to CONSTANT READER (see p. 606, No. 142):—"The best way of preparing glue, and which is used in large cabinet-makers' shops where a quantity of veneering is done, is to get a fruit pan of six quarts, or an iron boiler that is used for boiling clothes, and nearly fill with broken glue; cover with water, and allow to stand twenty-four hours; then place on hot stove, and let a boy stir it and look after it for eight hours (often have I stirred glue that length of time). When cold, there will be no way of cutting it out except by warming chisel or plane irons in hot water previously; then it is placed in ordinary glue-pot, and water added."

**Wool-Working Machinery.**—MESSRS. T. G. AND SON (*Sheffield*) write, in reply to D. G. (*Oldham*):—"We beg to state that the largest makers in the world of these machines we believe to be The Arbey Wood-Wool-Making Machine Company, of Paris, for whom Messrs. T. & W. Cole, London, E., are, or have been until quite recently, the English agents; but we now believe that the firm (Arbey Company) have now ceased to push the trade in England. The North of England Wood-Wool-Making Company, of Leeds, supply a good article, and this firm or Messrs. Cole can give your friend every particular. We ourselves make the knives for these machines."

**Preserving Stone.**—E. H. S. (*Corfe*) writes, in reply to H. L. P. (*Montrose*) (see p. 526, No. 137):—"You ask for a preservative for the stone of a church spire. I may state that a dressing with a liquid called 'Fluate,' obtainable from the Bath Stone Firms, Limited, Bath, has proved successful in arresting decay in stone both in France and England."

**Fire Extincteur.**—THE ASSISTANT ENGINEER, Hackney Union (*Homerton, E.*), writes, in reply to W. L. (*Dalston*) (see p. 606, No. 142):—"I shall be pleased to show or tell W. L. how to charge the same."

**Saw Hammering.**—A. R. (*Scorrier*) writes, in reply to J. S. (*Keighley*) (see p. 606, No. 142):—"The face of the anvil should be a little convex for saw hammering. The best method for saw gulleting is to gullet with the emery-wheel. The fly-press tends to cripple the plate, and merely punches out a piece of steel, leaving the teeth to be sharpened to the bevel required after, while the emery-wheel gives the teeth their proper rake and bevel at the same time the gullet is being ground."

**Continuous Alarum Clock.**—M. W. (*Manchester*) writes, in reply to A. S. (*Lavender Hill*) (see p. 654, No. 145):—"A Mr. Cook, of Shakespeare Street, Manchester, is agent for a new electric alarum clock, which acts for forty-five minutes. I should think this is sufficient. It is quite a new thing, and the clock is removable, and can be used separate from the podestal, which also constitutes the battery or cell. I believe the price is about 16s."

**Alarm Clock.**—F. C. (*Slaithwaite*) writes:—"In No. 145 of WORK, A. S. (*Lavender Hill*) wants to know where he can obtain a continuous alarum clock. I beg to state that Mr. Bassindale, of this place, receives orders for same."

**Tailoring.**—TAILOR writes:—"If APPRENTICE (see p. 654, No. 145) will write to the *Tailor and Cutter* office, 93 and 94, Drury Lane, London, W.C., for their chart and catalogue, he will find the books he requires for all tailor-made garments."

**Upholstery.**—A COUNTRY CABINET MAKER writes, in reply to W. W. (*Notting Hill*) (see p. 590, No. 141):—"I have just seen your query in WORK, and will try if I can help you. I do not know whether your difficulty arises from want of knowledge or want of experience, but you will excuse me if I treat it as being want of knowledge, as I think I can make my explanation clearer by that means. You also omit to say whether your roll is hair, fibre, or alva, and whether the stuffing is single, with roll stretched on (London cheap style), or the old 'first and second stuffed'; but if I describe the latter thoroughly, and you thoroughly master it, you can always modify. I shall therefore take that style with fibre and flock. I will assume that you have got on your web and canvas, or web, springs, and canvas, as the case may be. Now start a row of loops of twine round the edge for the fibre; start from back corner and give about two loops on the sides, and three in front, pointing the needle backwards, so that the second loop begins two or three inches *behind* the end of the first, and so on all round. Of course, you will understand that in all stringing it is only made fast at the beginning and the end, so that each loop can draw upon the others. Now, having your fibre nicely picked, tuck it under the strings evenly, and when you think you have got enough in, go round and regulate it with your fingers till it is nice and even all round; upon this depends the regularity of the work when finished. Then fill in the middle with flock, and put your open canvas (scrim) over, being very careful to get it on straight, for crooked threads are often a cause of hills and holes; then tack it down with temporary tacks to about shape of seat, and then stitch through with a row of twine about 4 in. from the edge all round, to keep all in place. If time will allow, it will be well to go round again, and tack it down more nearly to the shape; but this is not imperative. Then start in middle of front, cut away all waste canvas and turn in with regulator, and put in two or three tacks, about 1 in. or 1½ in. apart; this must decide the height of the pad. Then work each way from these, and keep testing the height by pressing it upright between thumb and finger at the middle and at the point you have reached at the same time, and comparing them; these tacks are not driven home. Then go round it with regulator, and equalise any little irregularities. Next give a row of tack stitching; start at back corner, and fasten twine round first tack, then pass the needle up, but not quite out, and bring the eye point down on the right-hand side of the next tack or next but one; draw twine down, and pass needle up on left hand of same tack, and so on all round; then drive tacks home. Then give one row caught stitch, passing needle up, out at top, and in again about 2 in. back, knotting the first stitch; then, taking about 2 in. each time, bring the needle down just in front of the previous stitch, and loop the twine round it below; this will make a nice even roll if you keep it an equal distance from the edge. Then go round again in the same way a little distance from the edge, and this will make up a little roll about as thick as the finger, or less, and if you have used the regulator well there ought to be no lumps or hills and holes in at all, but a nice even edge all round. This description may seem long and tedious, but I think if you follow it out carefully on one or two seats, you will find that they will come out about what you want, and you can then put less work in if you require to do so; but you will find a little extra painstaking at first will pay in the end. Any further hints I shall be glad to give as far as I can."

**Darning Weaver.**—RALPHO writes, in reply to MART (see p. 621, No. 143):—"You can get the darning weaver from Edwards & Barnes, Broad Street, Birmingham. I do not know the price, but it is quite trifling."

**Mangle Rollers.**—EDDIFRA writes, in answer to LEARNER (see p. 651, No. 145):—"The plan I follow in turning rollers, beech and lignum vitæ, is to procure the rough sawn roller, and bore a hole in each end, by means of an auger, small enough to allow the shafts to be driven in a permanent fixture; the hole in the beech roller may be smaller than the lignum vitæ, as the latter is terrible stuff for splitting. Drive in shaft as true as possible, run in dead-centre lathe, and drive by means of a carrier fixed to shaft. Run lathe as fast as you can without undue shake, and trim down roller with a ⅝ in. or ¾ in. turning gouge; finish off with a 2 in. chisel or a jack-plane iron fixed in wood handle. The ends may be turned true with a lathe cutting chisel —or the safest is a round-nose—and finished with a diamond point, as there is not so much danger of slipping against the iron shaft."

**Steel Springs.**—W. P. writes, in answer to WING (see p. 686, No. 147):—"If he will write to me, William Park, 8, Cobden Street, City Road, Hulme, Manchester, sending rough drawing and all particulars, and gauge of thickness, I will send him prices."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—R. W. (*Fence Houses*); R. D. B. (*Finsbury*); J. T. G. (*Glasgow*); E. A. F. (*South Woodford*); W. B. (*Rushden*); ACTUAL; A. C. (*Manchester*); E. P. B. (*Penge, S.E.*); A. W. A. (*Durham*); R. McG. (*Glasgow*); F. B. (*Clapham, S.W.*); PORTLAND; T. G. (*Paddington, W.*); H. McD. (*Glasgow*); A. D. (*Sheffield*). W. S. (*Carr Bridge*); A. S. (*Hockley*); W. S. (*Gosport*); W. P. (*Hulme*); MAGNET; F. J. T. (*Beckenham*); G. N. (*Manchester*); DICK H.; FENTON; STILL; J. W. (*Kirkham*); INCUBATOR; RESIN; BANNER; J. G. (*Holloway*); INTENDING CARPENTER; R. H. (*Lancaster*); E. W. L. (*Newcastle-on-Tyne*); J. C. J. (*Gloucester*); C. E. M. (*Birkenhead*); IVY; W. S. B. (*Barking*); W. C. (*London, W.*); YOUNG TURNER; J. P. B. (*Birmingham*); W. G. (*Leeds*); F. C. F. (*King's Cross*); G. E. B. (*Stoke*); SCIENTIFIC; DROFSABA; G. N. S. (*Bigoleswade*); G. P. (*Elgin*); L. J. K. (*Dublin*); YOUNG READER; CONSTANT READER; J. A. (*Wandsworth*); G. L. (*Sheffield*); H. W. (*Byfield*); A. D. (*Blackburn*); J. W. C. (*Sussex*); BONA FIDE; AURIPHONE; A SUBSCRIBER; POOR MAN; F. C. (*Leytonstone*); P. L. (*Selly Oak*); S. S. (*Grantham*); M. D. (*Blackburn*); R. S. (*Chorley*); YOUNG CABINET-MAKER; W. J. M. (*West Kensington*).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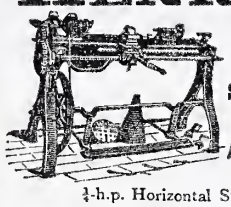

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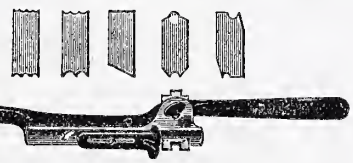

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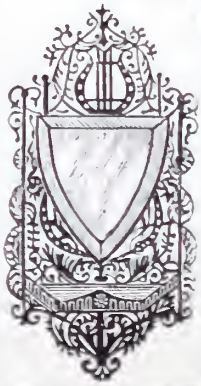

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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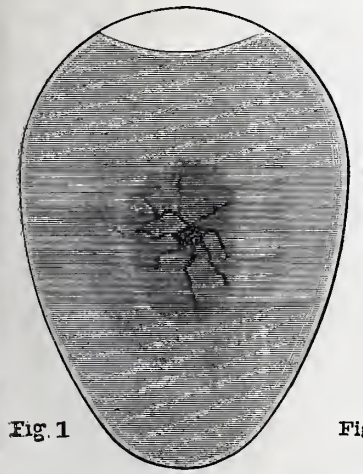


Fig. 1

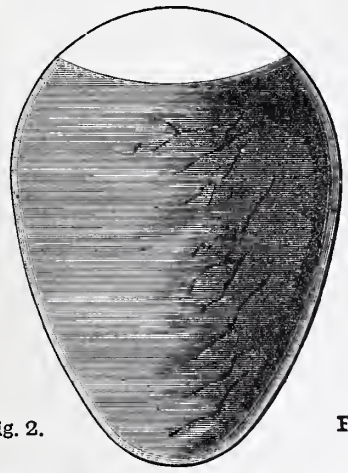
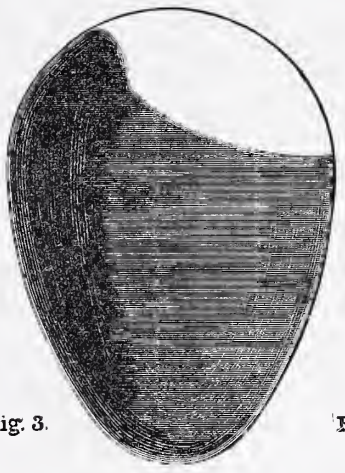


Fig. 2.



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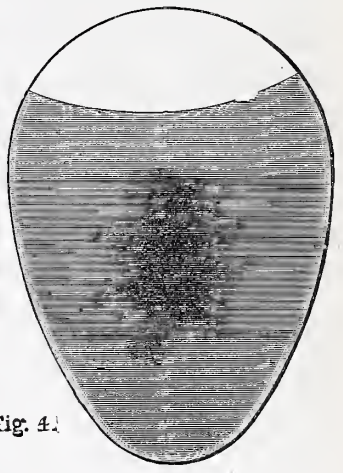


Fig. 4.

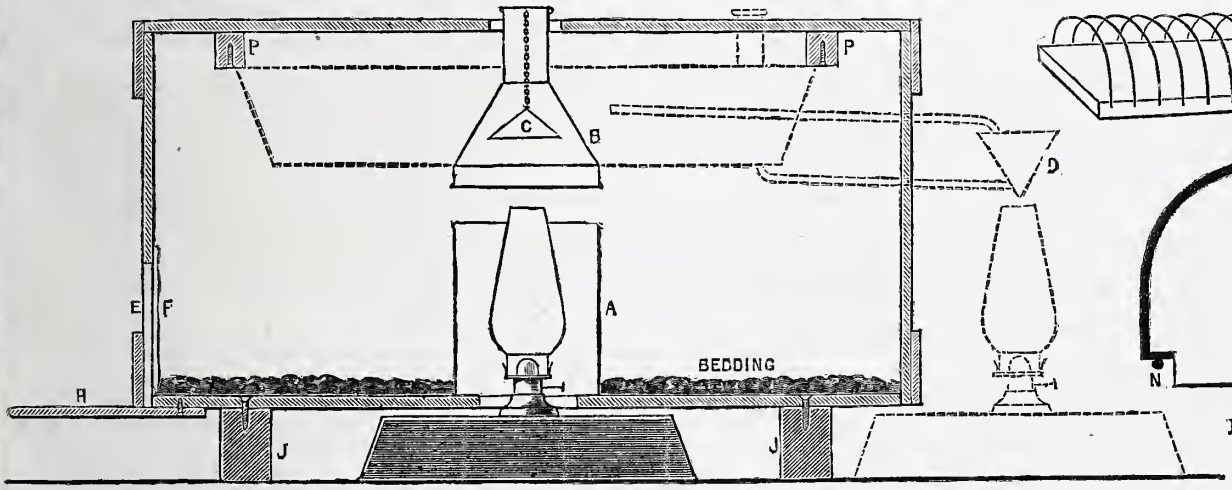



Fig. 5.

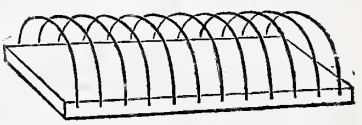


Fig. 8.

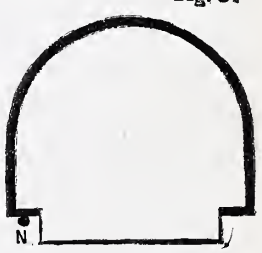



Fig. 9.

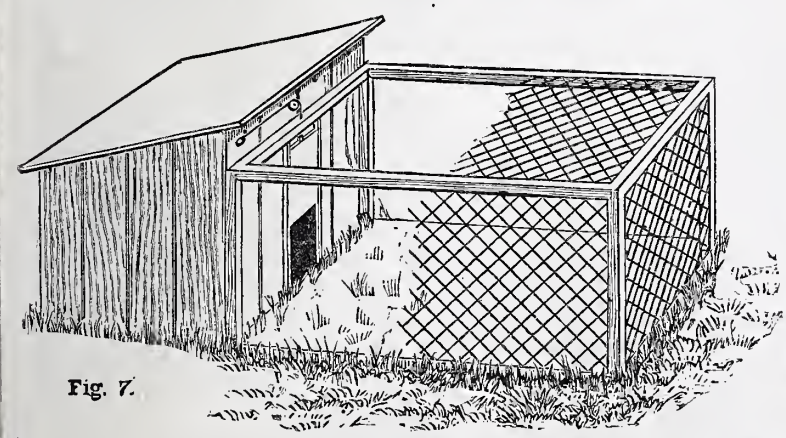


Fig. 7.

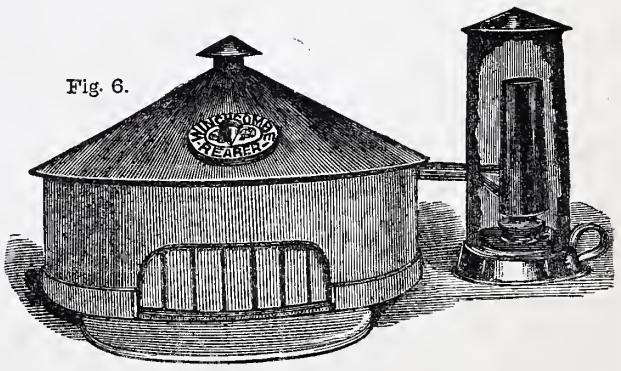



Fig. 6.

CHICKEN-REARING APPLIANCES: HOW TO MAKE AND USE THEM.

Fig. 1.—Fertile Egg after Seven Days' Incubation. Fig. 2.—Ditto after Thirteen. Fig. 3.—Ditto after Twenty. Fig. 4.—Addled Egg. Fig. 5.—Section of Rearer. Fig. 6.—Winchcombe's Rearer. Fig. 7.—Coop and Run. Fig. 8.—Guarded Feeding Stage. Fig. 9.—Block or Gauge for bending Wires.

## CHICKEN-REARING APPLIANCES: HOW TO MAKE AND USE THEM, ETC.

BY LEGHORN.

TESTING EGGS—TIME OF INCUBATION—REARERS—COOP AND RUN—FOOD UTENSILS—MANAGEMENT OF CHICKS—AILMENTS AND REMEDIES.

*Testing Eggs.*—As promised in my last article, I will, before describing the construction of rearers, etc., give instructions for testing eggs at various periods of incubation, which will apply to both the natural and artificial methods. It will be best to test them after dark by means of a piece of cardboard or similar opaque material, in which a hole the shape of an egg, but slightly smaller, has been cut, using a strong light behind for illumination. Taking the card in one hand and the egg to be tested in the other, held (between the thumb and forefinger) over the hole previously cut, all extraneous light being now cut off, we can see almost through the egg. Experienced operators can distinguish fertile eggs from infertile or clear ones at four days, but the tyro will do well to leave them until the seventh day, when, if fertile, they will have something of the appearance of Fig. 1: a semi-opaque central spot (the germ), from which the blood-vessels, in the form of spidery arms, radiate in all directions. If this appearance is absent and any egg looks clear throughout, it should be removed and, if necessary, replaced by a fresh egg, previously warmed as before mentioned. Infertile eggs removed from the incubator are quite good enough for cooking purposes, or even for eating if anyone is partial to the taste of a "new-laid Frenchman," or may be put aside as food for the young chicks. If the eggs are dark or thick-shelled there may be some difficulty in forming a definite opinion as to their fertility, and in such case it will be well to leave them for a few days longer before discarding them. By the thirteenth day they should have the appearance of Fig. 2, at which stage the embryo chick may be said to live, and from which time development is rapid. Fig. 3 represents a good egg of twenty days' incubation, by which time it is almost entirely opaque, the head of the chick being plainly visible, and in a good many cases its chirp and tap, tap against the side of the shell can be distinctly heard. An addled egg—that is, one in which the germ had lived, but from some cause had died and putrefied—is represented in Fig. 4. A large dark central mass, shifting with every movement of the egg, and suspended in a cloudy liquid, is its characteristic.

*Time of Incubation.*—The egg of a hen takes 21 days, pheasant and partridge 24, duck and turkey 28, goose 30.

*Rearers.*—Now we come again to the constructive part. Rearers should always, if possible, be made round. If square, the chicks are very apt to crowd together into the corners for warmth, sometimes suffocating the weaker ones. With round appliances no such trouble can occur. A capital machine can be made from a cheese-box, obtainable from most provision merchants for about 2d. or 3d. Look out a sound one, with a decently fitting lid. They are of various sizes; one about 16 in. in diameter and 9 in. deep will house about five-and-twenty chicks. It is not advisable to keep a larger number than this together, and on no account should birds of various ages be put together, or it will probably be a case of the survival of the *not fittest*, but *strongest*. We have the choice of two methods of heating—by hot water and by direct heat from a lamp. I use both, but cannot claim any particular advantage for either over the other. With the first-named method there is no danger of chicks perishing through cold should the lamp go out at night, as there would be sufficient heat stored in the tank to last for some hours.

On the other hand, with a direct heating arrangement there need be no fear of drowned chicks through the tank giving way, and no bother about filling or renewing tanks. I think, perhaps, I should give the preference to "hot water" in cold weather and "direct heating" in warm. In Fig. 5 (following the thick lines only) I give a section of a direct heating arrangement, in which A is a cylinder of metal (a large tin canister, about 5½ in. in diameter and 4 in. high, will suffice) fixed to the bottom of our cheese-box, a hole sufficiently large to admit the lamp being previously cut.

Now make or procure a funnel, B, and secure same to the lid in a central position over A. The hole in lid should be cut ½ in. larger in diameter than the size of the top (inverted) of funnel, to prevent the heated metal being in contact with wood, and also to provide ventilation. Two or three ⅂-shaped straps must be riveted to top of funnel, and the latter by these fixed with screws to the lid. No "soft tommy," or ordinary tinman's solder, must be used in this funnel, but if soldered, threepennyworth of silver solder should be procured, the soldering being done with a blow-pipe, using powdered borax as a flux. A small radiator, C, hung from the top by a wire or piece of small chain, will economise heat by radiating it against the sides of the funnel. A small burner, taking a half-inch flat wick, will serve to supply the required heat, and should be mounted on a flat reservoir, as shown in Fig. 5, and as previously described for incubator lamp. Select a burner where the flame will be as far away from the oil as possible, to minimise the chance of the lamp catching fire.

This same design can be applied to the hot-water method, a tank, as shown by dotted lines, being fixed under the lid. A round stamped steel baking-dish will answer the purpose (of course, zinc or copper will be preferable, and last longer), and should have a sheet of tin plate or galvanised sheet iron soldered to the top, leaving a rim or lugs for fixing, as shown at F, F. Cut holes as required, and solder in the cone, E, and provide a pipe in the top for filling. In this case ordinary solder will answer our purpose to all parts where protected by water.

If an outside boiler is preferred, it can be arranged as shown by dotted lines on the right-hand side of Fig. 5, in which D is a small hollow cone, 2 in. diameter and 2 in. deep. This should be made of copper, and have a flow-pipe carried from the top—with the inside of which it must be soldered flush, to prevent air trapping—well into the centre of the tank, and a return-pipe at the bottom, issuing from the bottom of tank. The lamp is then placed in position under the cone, the water in which is quickly heated, and immediately passes by the flow-pipe into the tank. Colder water, entering at the bottom, is again heated and passed on, thus keeping up a continuous flow as fast as its temperature is raised by the lamp. The reason for carrying the flow-pipe into the centre of tank is to prevent the hot water issuing from it from being drawn immediately down to the return-pipe, and thus leaving a large bulk of the water cold. By arranging the pipes as shown, regular and steady heating will follow. One point I must mention: and that is, let the flow-pipe have a slight rise from the boiler and the return a fall to it. A reference to the sketch will make this clear.

Whichever plan we adopt, we shall, after selecting our box, require to cut an entrance, E, 5 or 6 in. wide and about 3 in. high, and over this, on the inside, tack a piece of felt or baize, F, large enough to cover the opening, and cut into lippets to allow the chicks ingress and egress. We now require an alighting board, H, or front doorstep, and for this we shall want a piece of ½ in. deal, about 8 in. by 5 in. Round the edges and corners, and fix it to the bottom, below the entrance, by means of screws. Two fillets, J, 2 in. by 1½ in., and about 14 in. long, fixed across the bottom will keep the rearer off the ground, and also provide space for the lamp reservoir.

If the hot-water arrangement is followed, we shall also need three or four distance-pieces, P, to secure the tank to the lid, which may be about 3 in. long, and 1 in. by 1 in. in section. Holes for lamp, etc., having been cut, and all fixed in position, a couple of coats of paint will improve its appearance and durability. Before moving our family into their new house, we must provide some bedding, which may be hay, straw, chaff, or any warm material, but avoiding fabric of every kind. Straw makes about the best bedding material if cut into short lengths, and rubbed between the hands till soft. Whatever is used, it must be frequently changed, and on no account allowed to become foul, or disease will assuredly ensue. The quantity of excrement deposited by a brood of chicks in a single night is enormous, compared to their size. Cleanliness in every operation of chicken rearing cannot be too highly estimated.

Fig. 6 shows Winchcombe's patent hot-water machine for outdoor use, fifty chick size, with special wind-proof lamp. Another size, for twenty-five chicks, is made for indoor use. They answer the purpose for which they are intended as well as many of higher price. The one I use works very satisfactorily, the maximum heat obtainable with the lamp turned full up being 90° Fahr. It has a deep tank fixed to the lid and an outside boiler, the inner case of which also forms the lamp chimney, a special burner being used, which fits well into the bottom of chimney shaft, thus doing away with the trouble of broken glasses. The oil reservoir is large, holding sufficient fuel for three days' supply. The lamp burns for forty-eight hours without attention, will not catch fire, and only costs about 3d. or 4d. a week for oil.

A cold brooder to take the chicks after removal from the rearer can be made from another cheese box (if somewhat larger all the better), and needs no internal fittings or furniture beyond bedding.

*Coop and Run.*—Fig. 7 illustrates a very handy coop and run, which may take the place of the cold brooder if the chicks cannot be allowed their liberty—in fact, it might be so used from the first by placing the rearer inside the coop, the run then proving a safeguard against depredations of the feline species. A range of three or four of these coops, etc., may with advantage be built together, and thus effect a saving in cost over the same number built separately. They will always be useful as pens for isolating cockerels, birds preparing for the show-pen, or suffering from infectious diseases.

A useful size for the coop will be 2 ft. square by the same height at back, and 6 in. higher in front. The run may be 4 ft.

long, 2 ft. wide, and 14 in. high. If the purse is low, and strict economy has to be studied, a suitable packing-case may often be obtained for a trifle, which can easily be adapted to suit individual requirements; but if eleganee and some degree of finish are aimed at, what is known as "match-boarding" will make a comfortable house, each board being tongued into its neighbour. Draughts will be excluded, with benefit to the inhabitants.

The whole of the back should be hinged to form a door, "cross garnets" being used for the purpose; a hole cut in front for access to the run, and provided with a drop shutter for use at night, and ventilation holes must be bored at the top of front, as shown. Slate batten, 2 in. by 1 in., is just the thing for the run, costing about 2s. 6d. per 100 ft. run. After being planed, the rails should be mortised and tenoned, or halved, painted, and covered with ¾ in. galvanised netting. The roof of coop should be covered with stout unbleached calico, closely tacked under the edges, and well painted, when it will last a long time without repairs. If it is desired to cover the run as well, it will be advisable to alter the pitch of roof, and slope it to one side instead of to the back, as shown.

For coop, as shown, we shall require, say, 48 ft. of 6½ in. by ⅝ in. match-boarding, and 20 ft. of batten as ledges, to secure the boards together; and for the run we shall want another 30 ft. of batten, making 50 ft. in all (these quantities allow for no waste, so allowance must be made in buying), and 18 ft. of 12 in. galvanised netting, or 10 ft. of 12 in. and 4 ft. of 24 in.

*Food Utensils.*—As chickens, if left to their own devices, will trample their food under foot and foul their water, it is necessary to take some special precaution that this is not done, as besides the waste occasioned, the scattered particles of food are apt to get sour or tainted with excreta, in which state they become highly dangerous. Prevention being better than cure, it will be an economy to provide a guarded feeding stage, as illustrated in Fig. 8, which consists of a base of wood, say, 8 in. long and 3 in. wide, to which wires are affixed, about ¾ in. apart. To bend these regular, a gauge will be necessary, which can easily be constructed, as shown in Fig. 9. A piece of wood is eut to shape as shown, 3 in. wide and about 3 in. high. This is fixed to another piece of handy size, and a screw or nail, N, fixed as shown. The thick black line is intended to represent the wire bent on the gauge, and is almost self-explanatory. Pieces of suitable stout wire are first cut to length, one end inserted between the gauge and the screw, then bent round to shape, giving a few taps with a hammer at the angles.

Having the bent wires ready, bore holes in the sides of baseboard, into which the wires will fit tightly. A few blows with a hammer will now make all secure. The food can (and at first should) be sprinkled on the board, or placed in a pan or trough, made of tin or zinc, to fit under the cover. Water can be protected by the same means, but I much prefer to use a small poultry fountain of glass or glazed earthenware, which can be procured for a small outlay at most china warehouses.

*Management, Feeding, etc.*—As soon as the chicks are hatched, they can be placed in the rearer, which should be well warmed, and kept during the first day at about 90° Fahr. It will also be well during this period to stop up the doorway. Leave them alone for twenty-four hours, during which time they will require no food, being sustained by the absorption of the yolk into the abdomen, this being the last operation before leaving the shell. One special word of advice—Don't follow the stupid and useless plan of ramming a peppercorn down their throats as soon as hatched, and don't attempt to remove the horny excrescence at the tip of their beaks. It is a natural provision to protect their soft and delicate bills, and will disappear naturally when no longer needed.

The first meal should consist of bread-crumbs, moistened with a little dripping, and mixed with grated hard-boiled yolk of egg. This course will do during the first day, after which egg should be excluded, and their diet varied as much as possible. Any of the prepared meals sold for poultry can be used, Spratt's being very good for the purpose, although somewhat expensive. From the first, for the last meal at night some grain food should be given, starting with coarse oatmeal, following with canary-seed, of which they are very fond, then bruised corn, and finally, when large enough to take it, the whole grain. A little animal food given daily is a necessity; and if only a few are kept the scraps from the table will suffice, but if a large number have to be fed something additional must be provided.

Spratt's "Crissel" (granulated meat) is very suitable, and is much relished. Green food must always be given if the chicks do not enjoy a grass run, and may take the form of chopped grass, dandelion, onion, lettuce, etc. A supply of grit is also a necessity, and a sprinkle of bone-dust over their soft food will be a preventative of diarrhœa and leg weakness. Boiled rice (get Patna), with a little milk, will also act as a check against the former, but should not be given sloppy. Never leave food about to become stale. As soon as they have finished feeding, remove the feeding vessel until the next meal-time. As to whether water should or should not be given, I will not venture a decided opinion; but if it is given, it must be pure and frequently changed, so as not to become stale. I believe that mortality among chickens could, if traced, in the largest number of cases be attributed to impure water. As the chicks grow, the quantity of food given must be increased, and the intervals between times of feeding lengthened. Every hour during the first week will not be too much, whilst at four weeks four meals a day should suffice, being further reduced to three at two months. For the first week, the heat of rearer should be about 75° Fahr., and gradually decreased until the third or fourth week, when, according to the state of the weather, it will only be necessary to supply it at night; and after the sixth or seventh, if the weather is favourable, it may be entirely dispensed with, and the brood transferred to the cold brooder or coop. I have not space to treat on the subject at length, so for additional information I must refer my readers to one or other of the numerous treatises on the subject.

*Chicken Ailments.*—Just a word, and I've done. With proper care and attention, illness should be unknown; but in case it should occur, I will just touch upon the symptoms of and remedies for treatment of the most common.

*Gapes* is a disease I have never been troubled with, but once get it among a brood, and it is difficult to eradicate. It is caused by a small worm, which infests the windpipe, causing the sufferer to gasp or gape for breath; hence the name.

Remedy: A little carbolic acid should be placed in an iron spoon and held over a candle. Into the fumes given off the head of the affected bird should be held until suffocation almost ensues. This will dislodge the worms; and, if carefully done, the chick will be none the worse—left alone, it will surely die.

*Roup* is a severe cold, and takes the form of a running at the nostrils, ruffled plumage, and loss of appetite.

Treatment: Isolation and warmth, and a course of Vale's or Cook's roup pills or Spratt's roup paste. A severe case is, generally speaking, incurable.

*Diarrhœa.*—Caused by stale and sour food, dirty water, and want of cleanliness.

Boiled rice, sprinkled with powdered chalk, will generally give relief; if severe, two or three drops of chlorodyne in a teaspoonful of water will generally prove curative.

*Leg Weakness.*—Heavy, fast-growing birds, especially cockerels of the larger breeds, are sometimes subject to this, but if bone-dust is used during rearing, it will rarely occur.

Treatment: A stimulating food with meat.

My task is finished. To all whom it may concern, I would say, "Go in and prosper." Poultry rearing is a profitable and interesting hobby; and these papers may, I hope, induce some who do not at present keep fowls to commence to do so forthwith. I am always ready, through "Shop," to help and advise anyone in trouble, and shall be pleased to smooth away any difficulties that may arise.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

GARDEN ARCHES: EFFECTIVE UTILITY OF ARCHES—ARCHES IN ONE FRAMEWORK—ARCHES COMPOSED OF TWO FRAMEWORKS—TOP UNITING IRONS—TWISTING ZINC RIBBONS OR RODS—MACHINE FOR IRON RIBBON TWISTING—THE WORKING OF THE LATTER—THE CONSTRUCTION OF THE LATTER.

**Garden Arches.**—These are effective and useful. I have very great admiration for the pretty effects obtained by the use of garden arches when they are covered and completely hidden from view by creeping plants, etc. A few of them fixed over a path at very short distances from each other, and entwined with Nature's adornments, will produce a pleasant shady spot for the leisure hours to be spent within; the sun or the moon peeping through the interstices above will bring up memories when one strolled through the country lanes, with the overhanging branches forming natural arches. But there is a far greater pleasure to be gained oftentimes by passing the hours away in our own gardens, as outsiders are not allowed to trespass; whereas in public walks one is always open to the intrusion of men and vehicles.

No necessity exists for a garden arch to be of elaborate construction. What is required is little more than a framework up and around which plants may be properly trained, as the latter should completely hide the former. Fig. 171 is a sketch of the most ordinary pattern made, and Fig. 170 represents one of slightly more pretentious appearance. These are sometimes made in two parts, sometimes in but one only. They are half-circular at the top. It will require very little arithmetical ability to arrive at the extreme length of one of these

articles if the height and width are given. A size they are frequently made in is 7 ft. high, 4 ft. wide, and 1 ft. deep at the sides. In these measurements I have not included the stakes at the ends; these are for the purpose of fixing them properly to the ground. I will deal firstly with those made in single pieces.

*Arches in Single Frameworks.*—These are formed of a pair of long rods to which are meshes used vary to a great extent. It is the endeavour of most workmen to so place the work that the junction of the meshes on one side are situated as nearly as possible against the long rods, as in Fig. 172, and also to have the stay-bars in such a position that they as well will cover junctions (Fig. 177).

When the piece of work is ready, the wires are turned over at odd intervals to

Figs. 170, 171.—Alternative Patterns of Garden Arches. Fig. 172.—Arch before being bent; not necessarily representing Arch in Fig. 170, as the latter is supposed to be in separate halves, some being made whole and others in halves.

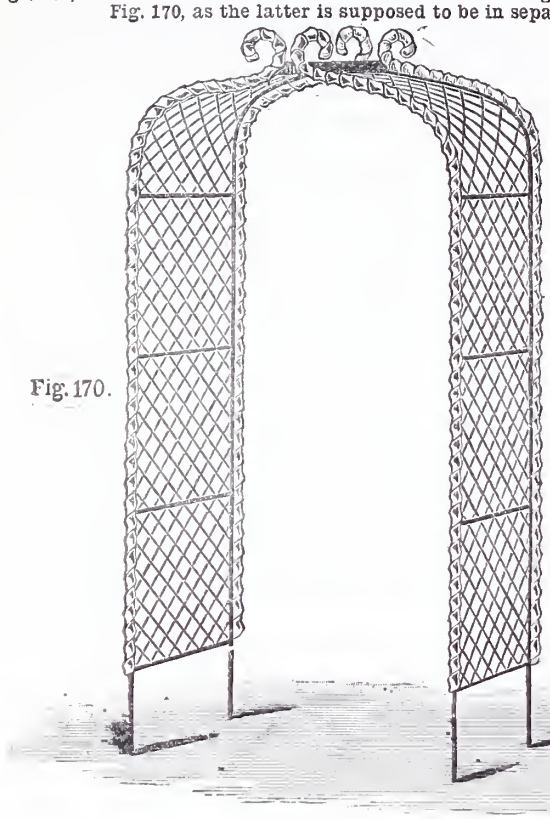


Fig. 170.

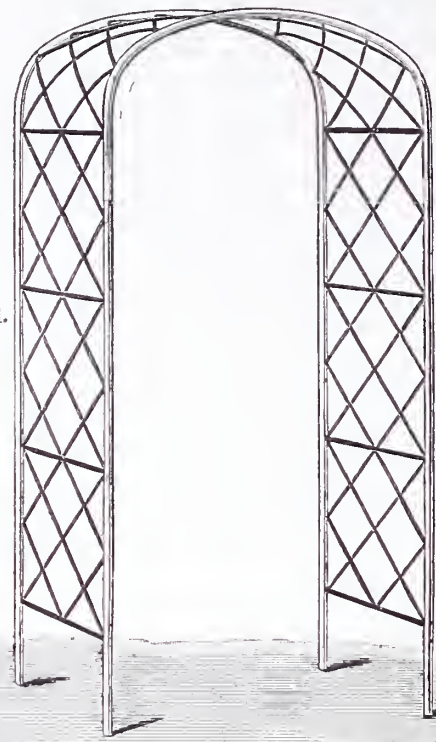
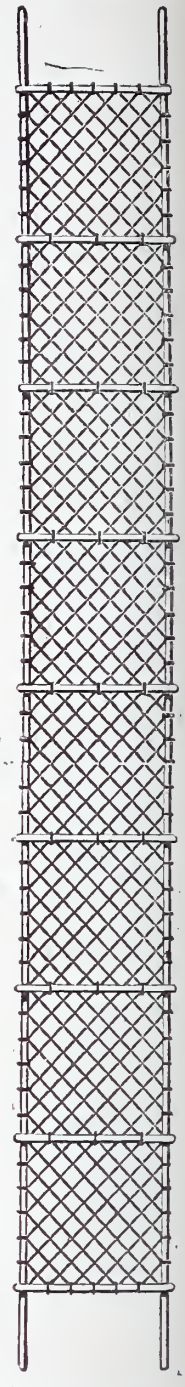


Fig. 171.



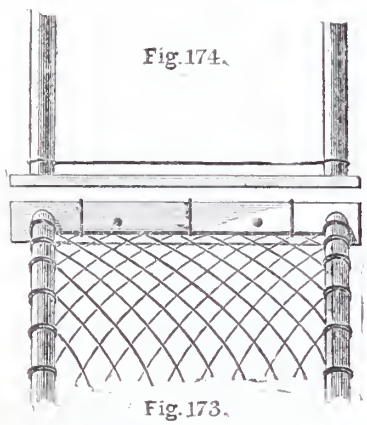


Fig. 174.

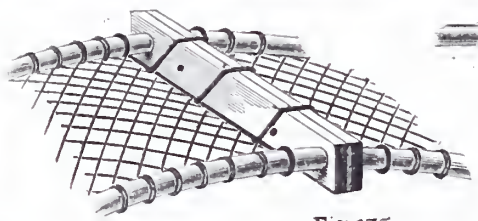


Fig. 175.

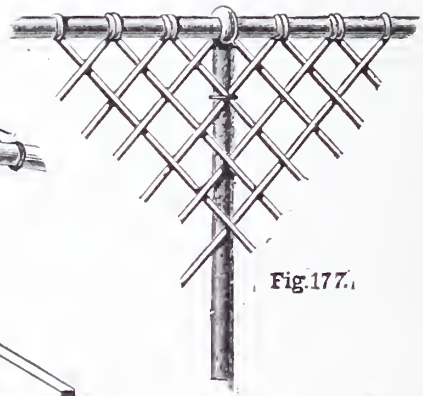


Fig. 177.

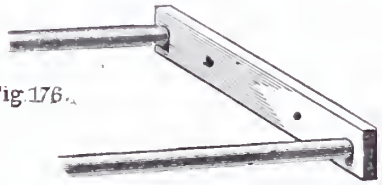


Fig. 176.



Fig. 173.

Fig. 172.

Fig. 173.—Appearance of Fig. 175 when viewed in Elevation. Fig. 174.—Plan of Framework of Fig. 175. Fig. 175.—Perspective View of Top of Arch when made in two separate halves. Fig. 176.—Perspective View of Fig. 174 minus the Cross-Wire. Fig. 177.—Enlarged Portion of Fig. 172, showing how Cross-Bars are attached.

secured stay-bars of the required length, as shown in Fig. 172. There are usually about nine of these. A portion of each long rod is left free to act, as before said, as a stake. The longer these free portions are, the stronger will be the hold they will afford the arch when the latter is fixed; but 1 ft. lengths will be very suitable.

When more than one arch of the same description is to be made, the number of meshes contained in the first one is noted, and taken as a guide for cutting out pieces of work for after use. The number of hold it in position for the final turning over. The wires are then secured to the stay-bars by being tied to them in about three places each. When thus far ready, the whole is carefully bent in the middle round a cylindrical object, and the arch is finished, with the exception of the galvanising, painting, or whatever process it is intended it shall undergo.

*Arches composed of Two Frameworks.*—Frequently these articles are made in two separate halves. Each half is at first a flat frame; each has two projections at one end for purposes named in connection with the one spoken of above, and at the other end there is a flat iron with two holes in it. They are each bent in such a manner that a proper arch results when two are placed together in a reverse position, with the two flat irons exactly in the middle of the arch, where they will be fastened to each other by means of screws and nuts, and thus make the whole a solid job. But before this point is reached I must say more concerning the turning over of the wires.

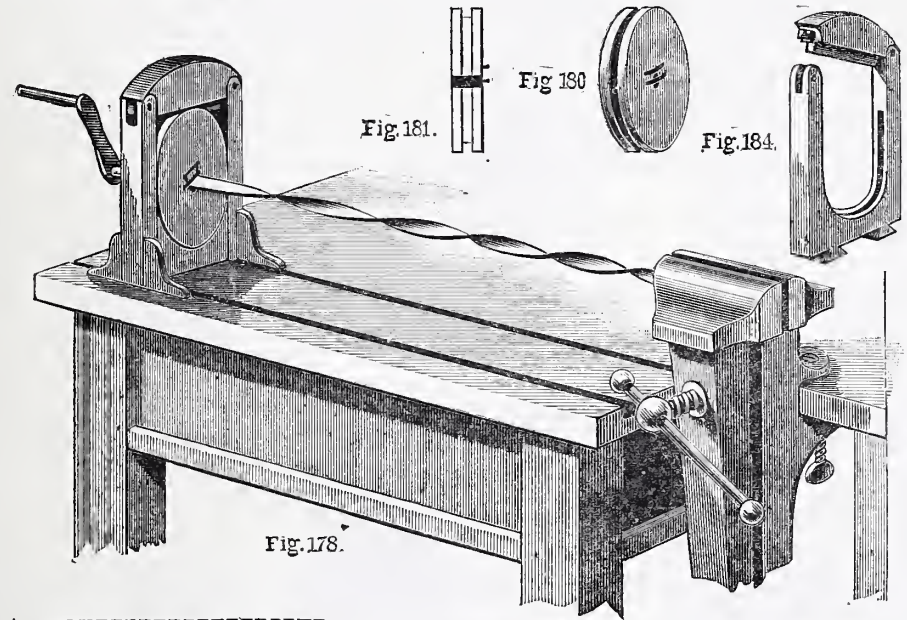
*Top Uniting Irons.*—It will be understood that at the ends where the flat irons are the wires cannot be turned over on to them. To overcome this, a wire of the same gauge as those composing the meshes of the arch is fastened to that end of the frame, leaving a small space between itself and the flat iron. Over this the wires can be conveniently turned. After this operation, the single wire is bound to the flat iron in two or three ties by a piece of wire being bent over

both at each point, as in Fig. 173, in which diagram it is supposed a side elevation is shown of the frame when arched.

The same particulars as those dwelt upon above will apply also to the arch shown in Fig. 170. The difference is that the meshes are smaller and the article is ornamented by having twisted iron rods or ribbons fixed to it by means of wire ties. These are made in various degrees of twists.

**Twisting Iron Ribbons or Rods.**—A method of twisting these rods, which are originally flat, is by fastening one end in a vice and one end between a pair of pincers, and turning it regularly and carefully. But the machine which I show in Fig. 178 will be acceptable to the workman using it, both on account of the advantage of performing the work much quicker and much more symmetrically than could be accomplished by hand.

*Machine for Iron Ribbon Twisting.*—One end of the iron ribbon is passed through a pair of catches on the wheel (Fig. 180), while the opposite end is held firmly between the jaws of a vice. The wheel is turned sharply, and the ribbon is consequently gradually twisted, as represented in the drawing. It is obvious that at each twist or turn the distance occupied by the iron between its two ends proportionately diminishes. Therefore, allowance must be made for this shrinkage. This is accomplished by permitting the machine to travel within a couple of grooves in the bench. Thus, when being used, the iron as it diminishes in length draws the machine nearer and nearer to the vice, thereby making all necessary allowance. To retain the appliance continually in direct contact with the bench, it will at once be seen that dovetail grooves, as in front elevaton, Fig. 179, will be advisable, in which may travel the bottom dovetails of the machine. Something also is needed to keep the device always perpendicular, and this something is found in the shape of two pairs of brackets, attached in such a manner that their bottom edges are in loose or free touch with the surface of the bench.



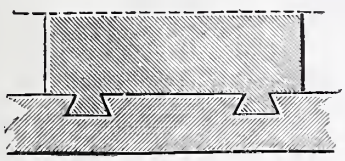



Fig. 179.

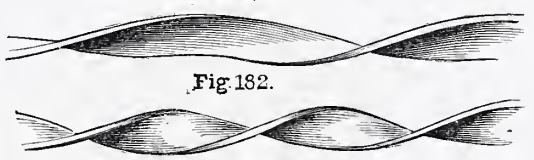


Fig. 182.


Fig. 183.

**Fig. 178.—Machine for twisting Iron Ribbons. Fig. 179.—Elevation or Section of Bottom Part of Machine and Bench, showing Dovetails, etc. Fig. 180.—View of Wheel of Machine. Fig. 181.—Section of Wheel. Figs. 182, 183.—Appearance of Ribbon or Lathing whilst being twisted. Fig. 184.—Standard of Machine.**

*The Working of the Machine.*—It will be expedient that the jaws of the vice meet and hold the end of the iron ribbon *exactly* opposite to the catch in the wheel, otherwise the twist may be irregularly made.

Space necessarily confines the piece of imaginary iron supposed to be undergoing the operation of twisting, in Fig. 178, to a very short piece; but it can, of course, be understood that any length may be turned by it, provided sufficient accommodation is supplied.

While using the machine, it will be well to hold it by one hand at the top, in order that it may not be drawn too quickly in the direction of the vice, for it will be noticed that frequently the ribbon will present symptoms of following a "barber's-pole" appearance—that is to say, instead of twisting as it should, it will appear inclined to bend to the same shape that it would be seen the red line of a barber's pole does if the same could be taken bodily off the pole.

It will be observed that there is a recess in the bench to accommodate the vice, so that the ribbon may stretch away from the machine precisely at right angles to it, thus allowing the vice end to be opposite to the catch.

In Fig. 182 a section of the ribbon is shown twisted to a certain degree, and in Fig. 183 it is represented after having further undergone that operation. It is not an essential matter concerning the degree of the final twisting, as workmen use their own opinions of the effects to be obtained. Many would deem that in Fig. 183 quite satisfactory; many would consider a closer twist preferable.

*The Construction of the Machine.*—Perhaps I may now particularise the details and construction of the machine. It needs no telling that it will be best if made in metal; but hard wood, lined with metal on those parts where friction will result—and there will be plenty of it occasioned by the revolutions of the wheel—may be used with comparative utility as substitutes. In Fig. 184 is shown the main portion of it. It matters little whether this consists bodily of one piece, or is formed by two uprights dovetailed at the bottom, and joined together by a cross-piece shaped half-circular on its upper edge.

Around the half-circular portion of the inner edge should be fixed a runner or a projection. This ought in all reason to be of metal. At the top of each upright is a deep notch or mortise, into which will be pivoted one end of a top rail. The outside surfaces of this rail should be flush with the surfaces of the portions to which it is pivoted. It will therefore be necessary to have small tenons on the ends of the top rail. To retain the free end when required, it will only be needful to run a pin through the holes in the upright and through the particular tenon between them. Along the middle of the top rail, at the bottom of it, will run a projection of the same depth as that upon the inner edge of the standard.

The wheel is grooved completely around its circumference, as in section, Fig. 181. This wheel is then fitted over the projection on the inner parts of the main portion of the machine, and is retained thus when the top rail is lowered into position and secured. The handle will, of course, penetrate the wheel through the centre. The larger the handle, the easier and quicker will the use of it be found; but it will be unnecessary, perhaps, to say that it must not be too large, otherwise it will be prevented from revolving by colliding with the bench. It is on this account that I have shown the machine as of rather large dimensions proportionately compared to the drawing of iron ribbon, etc.; for, no doubt, it can be comprehended that a very tall machine will permit of the introduction and use of a deep handle.

Exactly outside the centre hole of the wheel there will be a catch, simply consisting of a piece of iron bent and driven into the wheel in such a manner as to allow the zinc to pass underneath it, as does a strap under a buckle. Parallel to this, at a short distance from it, will be another catch exactly similar to it, to permit the iron to have a firmer security by being bent around it in addition to the first mentioned.

If the grooves in the bench are open completely to the end of the latter, the whole of the machine may, when not required for use, be taken from its position, in order that it may not by its presence be an impediment in the way of jobs which do not need its aid; whereas, if the ends of the groove are closed in, it must be apparent that the machine must always remain and be a source of inconvenience upon the bench.

In another paper or two my subject must be brought to an end here, although much yet remains to be said about machines, appliances, processes, ways and means used and resorted to in wire-working. The art is a useful one, and deserves to be known and practised far more widely than it is, and especially by amateurs who have a turn and liking for practical work.

## SIMPLE HEATING APPARATUS.

BY THOMASO.

A CORRESPONDENT, J. D. (*Arran*), wrote for information on a subject which could not be given intelligibly within the limits of a "Shop" answer. It has therefore been necessary to put it in the form of an article. But as the answer (while it may be useful to other readers) has special reference to the needs of that one correspondent, it has been judged advisable to let the article retain the phraseology of a "Shop" answer, otherwise it would scarcely be apparent to the general reader why one particular case was treated of and other contingencies merely glanced at.

Our correspondent wants to warm a bird-room which has no fireplace, by means of oil, without vitiating the air, and he says he has tried the ordinary paraffin stoves, but they fail in that one particular. I must assume that, there being no chimney, the ventilation is provided for in another way. Now, there are two ways in which the room can be warmed. The first is to have an oil warming stove in the room with a sheet-iron pipe over it, to carry away the fumes to the outer air. I expect the pipe was omitted, hence the vitiation complained of. This arrangement is very simple, particularly as there are windows in the roof. The pipe can be bought ready-made in lengths. One end of the pipe rests on the top of the oil stove and the other goes straight up, and out through one of the windows. A pane of glass must be removed, and a piece of sheet iron, with a hole through it large enough to admit the pipe, substituted. On the top of the pipe a large cone is placed, to prevent rain or snow beating down, and if the other end of the pipe is too small to cover the top of the stove where the heated air escapes, it must have a funnel-shaped piece attached to it large enough for the purpose. The different pieces of the pipe are joined by tapping the end of one inwards until it is small enough to enter the end of another piece, when it is riveted in place. By this method the iron pipe is made the heating agent. It gets hot, and gives out its warmth to the air in the room, none of the heated vitiated air or smell from the lamp escaping. Heated iron always gives out a more or less close smell; but in the present case it will be slight enough to be disregarded. The pipe is of course unsightly; but it cannot be helped. Blacklead it if it is not galvanised. Use no paint or varnish, or it will smell for a long time.

The other arrangement is more ship-shape, and consists of a simple portable (or otherwise) hot-water heating apparatus, which you can easily make yourself if you can use the soldering-iron. The general arrangement is shown in Fig. 1. A is a small boiler of stout tinned plate, which is shown in section in Fig. 2. The chimney is 2 in. in diameter, and after rising a short distance above top of boiler, it is bent sharp back and taken out through a hole in the wall, then turned up for a little distance, and the end covered with a cone. The other dimensions of the boiler are unimportant. Height may be a foot, and outside diameter 7 in. or 8 in. One thing must be kept in mind: viz., the object to be attained is to expose the greatest amount of surface to the heat of the lamp, and at the same time have as little water space as possible. I do not expect your warming-stove lamp will do for heating the boiler. Get a small oil cooking lamp having a double-wick burner, if possible, or at any rate one with a wick as wide as possible. See that it is not too far away from the level of the bottom of the boiler, or it will not warm the water sufficiently. Support the boiler on anything uninflammable which has a hole in the top large enough to expose the boiler to the heat of the lamp. Into the side of the boiler solder two tubes of tin plate, to the ends of which brass flanges have been soldered. These flanges are subsequently screwed or bolted (with red lead between) to corresponding flanges connected with the hot-water pipes. If you do not anticipate having to move the concern, it might be soldered together instead of using the flanges. The pipes are made of thick tin plate or sheet zinc, and may be 3 in. diameter. I think a total length of 9 ft. or 10 ft. (excluding the uprights) will be enough for your purpose. You may divide this length into three or four, if more convenient. Zinc is an unusual metal to use for hot-water pipes, but I cannot see any objection to it other than the corroding of the metal where it comes into contact with iron or copper, owing to galvanic currents being set up. Zinc is freely used for toilet jugs and cans meant for hot water, and an old zinc-worker

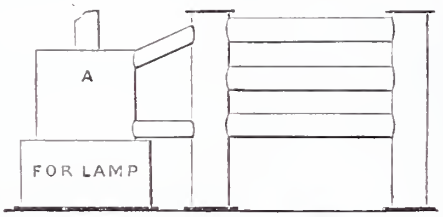



Fig. 1.—Simple Hot-Water Heating Apparatus, complete.

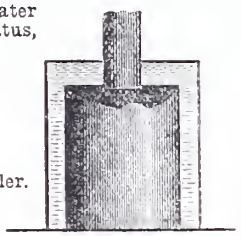


Fig. 2.—Section of Boiler.

tells me he has made hundreds of feet of zinc hot-water pipe in his time. Zinc is to be preferred to tin plate, as it does not rust. It must not, of course, be used for the boiler.

The uprights may be round or square: round is easiest. They must be larger than the other pipes, as a matter of convenience when joining them together. One upright will be wanted about every 3 ft. On the top and bottom of each solder a flat piece of metal, the bottom one projecting all round, to allow of the apparatus being screwed to the floor. You can put the pipes at any height you like, bearing these rules in mind—no part of the lowest pipe is to go below the level of the bottom of the boiler, and no part of the highest is to go below the level of the top of the boiler, the principle of the thing being this: hot water is lighter than cold, and therefore ascends to the highest point of the apparatus, while the cold water rushes in to take its place at the bottom, and is in turn heated and goes up aloft. And so the circulation of the water is kept up.

In the top of the upright, farthest from the boiler, make a round hole, and fit a sort of flat kettle-lid to it. The little steam that escapes will serve to keep the air from getting too dry. If it is objectionable, let the steam escape to the open air by way of a small pipe. For a greenhouse, for instance, the steam would be rather an advantage than otherwise.

The heat is of course regulated by turning the lamp up or down and opening ventilators. The water must always be kept high enough to entirely fill the top pipe. Examine it frequently.

Paint the whole appliance with some dull black paint, such as vegetable black and gold size diluted with turps. A dull black surface radiates heat better than a bright shining one. Before painting zinc, roughen it all over with coarse emery-cloth, or the paint will peel off.

If you increase or decrease the size of the pipes, increase or reduce the total length correspondingly. If preferred, you can have only two long pipes, and carry them along one side of the room on supports fixed to the wall, and thus save the trouble of making uprights. Of course, the two pipes must be joined at the end farthest from the boiler, and they should gradually rise so as to have the highest point of each as far from the boiler as possible. A very slight rise is sufficient. If you like, you can, of course, put lamp and boiler outside under a small shed, and carry the pipes through the wall. There is no possible chance of air vitiation then.

Whatever warming apparatus you decide on, be sure and have plenty of water about the room in shallow bowls or trays, otherwise the air will get so dry that the birds will suffer. You might put their drinking water in shallow zinc trays. They like to paddle in it, and it would thus be—

"Contrived a *triple* debt to pay."

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Mouldings, Chamfers, and Beads.

WE have hitherto dealt with the plainest of construction, but as nothing is made without some effort to please the eye, we will consider mouldings as a relief lesson, for mouldings are themselves a relief to the squareness of construction, which becomes tiresome to the spectator if too unbroken. Moulding in wood-working is a misnomer; but as the term is well understood, we will not trouble ourselves on that point. A dictionary definition is: anything cast in a mould, or as if so; a projection beyond a wall, column, wainscot, etc. Clearly this meaning supposed something built up, whereas our mouldings are produced by wasting the superfluous wood.

The simplest moulding is that known as a chamfer, which is merely the removal of the external angle (called by the workman the arris) to any desired extent. Chamfers, however, are not confined to the removal of the external angle of the stile or rail; when boards are intended to meet together, sometimes to form panels, the edges in contact are often chamfered, forming what is called a V joint. A chamfer can be made with any plane, but in order to obtain regularity of angle and distance, special planes are often used.

When the chamfer does not extend from end to end of the piece of wood, it is called a stop chamfer; and these stops may be of various patterns, and often give a very ornamental character to the article, as may be seen in the well-known Oxford frames. In making stop chamfers, a special plane is often used, but with care the amateur can do very good work with a well-sharpened chisel. A very good plan to make stops of an

ornamental character is to make a template of wood or sheet zinc, or even a piece of cardboard cut to the worker's fancy, and used to mark the work with. Vertical mouldings of the ordinary types are often terminated by a stop, or chamfered horizontal rail; the intersection of the stop with the moulding frequently develops beautiful curves. Examples may often be seen in Gothic stone-work as well as in wood-work.

The next simple mouldings are beads. These are of varied kinds, and have divers uses. The beaded edge, which is the reduction of the square edge of a board to a semi-cylindrical contour; the "stuck" bead, generally made with a bead-plane, but it can be made by a suitable scraper. This consists of a groove called a quirk, about one-tenth of the width of the bead, while the other nine-tenths of the nominal size consist of a semi-circular outline. Bead-planes are to be had in various sizes, from $\frac{1}{8}$ in. upwards. A bead-plane having a cutter set at a certain angle, shaped to fit the figure of the plane, cannot have all parts of its edge formed in the most favourable way; the ends of the semi-circle must be formed more by scraping than by cutting the wood. Hence there is a limit to the size of bead-planes, and this will be an explanation of the difficulty found by learners in handling moulding-planes; the plane-maker has set the iron so that it is in its best average position to cut the entire moulding, and that involves the need of the plane being held at an angle often very inconvenient to the beginner. Beads are often applied to flat surfaces and margins, to break up the surface and give variety of effect.

## PADS TO OPEN AND RELEASE A FALLEN HORSE.

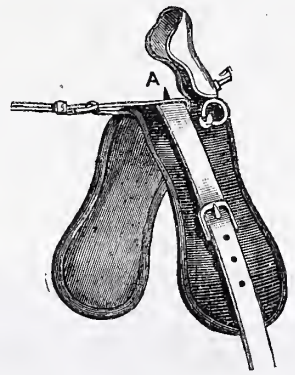
BY JOHN CHARLES KING.

"ANOTHER horse down!" This ejaculation is heard often in damp weather when horse traffic is on asphalte roadways; less frequently on wood pavement, less still on stone pitching, and rarely on macadam roads. As the system of using asphalte pays some of the interested parties well, the roadways are made of it, to the serious harm to horses, harness, and vehicles, besides stopping for a time the onflow of the road traffic.

The trouble when a horse is down is to keep him down until his harness is unbuckled, about which there is plenty of help and suggestions, and sometimes the knife is used to divide a stubborn strap that cannot be unbuckled. Even carters and coachmen are sometimes puzzled which strap or chain to undo first. A moment's glance at a horse harnessed to any vehicle will show that the traces have two attachments: one to the vehicle and one to the horse. As the horse often lies upon one trace, and has a free kicking leg over or under the other uppermost one, the unhooking is awkward to effect, and a lot of pulling and hauling is the result, with muddy clothes, caused by kneeling on the road, to do that which it is a mistake to attempt to do. At the ends of the traces attached to the horse's collar is the proper place for detachment, as it is done in an instant easily, by unbuckling the bottom hame-strap; then the hames and both traces can be lifted back along the back of the horse to the vehicle out of the way.

The next fixing is a tug on each side of the back-band in which each shaft goes. The best chaise-harness has a buckle on each side that fastens the back-band, so that either one releases this part of the harness from the horse, but the tags, being still on the shafts, have to be got off somehow; the best plan is to pull the vehicle back: this draws the shaft points out of the tug-loops. This part of the harness has been improved to facilitate rapid detachment of a fallen horse from a vehicle; and as it is simple, inexpensive, and self-fastening, and may be of service to WORK readers who are carriage users, it is given to them.

The illustration shows a hinged saddle-top to the pad, which, when unlatched and open, shows the crupper strap holding the back-band strap in its looped end; both are held by a short spike standing up at A. Now it is obvious that if the back-band buckle is undone the shafts are free to be lifted up away from the horse till checked by the pad through which the back-band slides. If the pad-top opens, as is shown, and the back-band and crupper be lifted off the spike, the whole of that part of the harness with tug-loops still on the shafts, and kicking and breeching straps still fixed to the shafts, can be lifted clear of the horse, and the horse can rise without breaking any of his harness. He will still have on his collar without harness, his pad and girth without back-band, crupper, or breeching, and his bridle, which will not have been interfered with. Replacing the harness and back-band by lowering the shafts, fastening the hame buckle and back-band buckle will be all that is needed to make the horse ready for a start again.




Pad to open and release Fallen Horse.

At a "horse down" scene on asphalte, amidst shouting, straining, and even vainly trying to unhook traces from a kicking horse, a lady, driving a gig, reined in, and, handing the reins to her groom, said: "If you will all look on I will get the horse free of his harness." All was silence: they did look on. A bystander held the horse's head; the lady unbuckled the hame-strap; the harness sprang back out of the collar "wale"; she unbuckled the crupper-strap from the pad—this was to release the breeching from the horse. "Pull back the cart now," she said. It was done, and she stepped into her gig and drove off as the horse rose free of his traces and breeching, and quiet, by the steady, quick handling of one who knew.

From this it appears that practical knowledge of their business is not to be found in all who have the care of animals, and especially of horses. This is shown far too frequently by the brutal treatment to which horses are too often subjected by their drivers who use the lash, at times without reason, and when it is in no way required. It has been well said that more is done by patting than by scratching any day, and this is pre-eminently true with reference to horses.

## SCREWING TACKLE.

BY "DAMON."

TAPS—TAP-WRENCH—SOCKETS.

IN my last paper, which appeared in Vol. III., page 343, of WORK, I endeavoured to describe a method of grooving taps so as to give them the section which is now universal among tap-makers. Before proceeding, I must make a brief digression to explain why this section has been adopted, to the exclusion of the rest. Various methods of producing the cutting faces have been followed at different times. Originally, the ordinary method was to file four flats or faces on the thread, giving four cutting faces at right angles to each other. A tap of this kind is shown in section at A, Fig. 1. This form is a very bad one, especially for tapping cast iron. The cutting angle is 135°, which is far too great—in fact, it hardly cuts at all, but acts more by squeezing the metal into the form of a thread. Cast iron crumbles to pieces under the pressure, and the resulting thread is very poor. Great exertion is required to turn a tap of this kind, and it is necessary to make the shanks extra strong, or they would be twisted off with the strain. Owing to the power used in turning them round, they are more readily broken than taps of a weaker section which cut more freely.

A great improvement on this form is the triangular one (B, Fig. 1). In this case the cutting angle is 120°. It does not, however, leave much room for the cuttings, and if much thread is left between the faces it is hard to turn. Backing off the thread a little improves this, but the clearance thus given must not be excessive, or the points will dig in and be broken off.

The half-round section (C, Fig. 1) has also been advocated. This gives a cutting angle of 90°. It cuts freely, and is said to stand well in spite of its apparently weak section. It, however, has only one cutting face, and is easily displaced from its true direction when in use, which is a great drawback.

In the fluted form having a radial face (as at D, Fig. 1), the cutting angle is also 90°. It has three cutting faces, which lessens the exertion required to turn it, and it is readily kept true in the hole being tapped. If the grooves are made as at E, Fig. 1—as is usual with some makers—the angle approximates to 90°, and the taps are easier and safer to harden. Of course, if the cutting faces are made as at F, Fig. 1, the angle is keener, but when the forward motion of the tap is reversed so as to withdraw it, the extreme points of the thread are apt to break off. However, as I have previously explained, the larger sizes of taps are often made this way, because the thread being stronger they stand better. A great deal depends, too, upon the hardening—it is so easy to burn the points of the threads when they break off at once.

Patents have also been taken out for taps having loose or, rather, detachable cutters, but this is only available for the large sizes, while the fitting is quite beyond the skill of the ordinary amateur.

It would seem, therefore, that the three flutes as usually cut give the best results, and have the fewest disadvantages. Now, to resume our tap-making. The style of grooving shown (D and E, Fig. 1) can be cut with ordinary care on taps down to $\frac{1}{4}$ in. diameter. In the case of smaller ones the operation becomes more difficult, and calls for more skill on the part of the operator than the amateur usually possesses, although

I have seen three spiral grooves cut in a ⅛ in. tap by an amateur on a double-geared milling machine, capable of driving 6 in. cutters; but this, of course, required great care and skill. However, for taps from ⅛ in. downwards, it is better not to cut grooves, but to file flats on the screw. The obtuseness of the cutting angles is not so great an objection in the small sizes. It is better in all these small taps to make the square on the shank stronger than usual, so as to avoid the risk of breaking from the torsion.

Machine taps for tapping nuts are generally made as shown in Fig. 2, so that one tap only is required to cut a full thread. From the point a portion of the tap is turned down to the bottom of the thread. This part is inserted in the hole in the nut, and acts as a guide to the tap while the thread is being formed. As the tap revolves the nut is moved forward until the tap starts cutting. At the top end of the tap a portion about equal in length to the diameter is left parallel. The rest of the body is tapered. The tap is passed right through the nut, and the thread is thus cut at one operation.

When the tap is intended to be used for cutting dies, etc., more flutes are usually put in. The flutes are cut with an angular cutter, just leaving a round at the bottom of the grooves. About nine flutes may be put in a 1 in. tap of this class. These taps are commonly called "hobs," and are used to cut worm wheels, chasers, and similar work. As space cannot be given in this paper, I will not attempt to describe the manufacture of dies and chasers now. The hob for cutting a worm wheel is made the counterpart of the worm, being the same diameter and same shape of thread. The flutes are then cut parallel to the axis of the worm. The threads are backed off a little, and the hob is hardened in the usual way.

In drilling holes for tapping, a little clearance is generally allowed in excess of the diameter of the screw at the bottom of the thread. This allowance should really be greater for wrought iron than for cast iron, but in practice the same drill is used for both. A short time ago I gave in the "Shop" columns of WORK a list of the sizes of tapping drills I use. I will, however, make out a fuller list, and, if I am permitted to do so, give it in a future paper, as it may be of use to some readers.

Although the hole intended to be tapped may be drilled quite square and true, the tap, owing to unskilful usage, may not follow the hole, and so get out of its true direction. To avoid this, steady, even pressure should be exerted on both ends of the tap-wrench while the tap is being started. Care should also be taken to watch the progress of the tap, and if the eye is not a sufficient guide, a small square should be applied in two different directions as a test.

The tap-wrench, or lever used for turning a tap round, is shown in Fig. 3. The square hole in the middle is to receive the squared part of the tap shank. The corners of the hole are generally relieved, so that the corners of the shank will not get the pull. The handles are round, and generally tapered. Their length varies according to the diameter of the tap. The wrenches are generally stamped with the diameter of the tap they fit.

The socket shown in Fig. 4 is used when some obstruction prevents the wrench being turned round. The square hole A at the one end fits the shank of the tap. The end B is made square to fit the wrench, which by the length of socket may be lifted clear of the obstruction. In fact, the socket is just like an ordinary "box-key," and answers a similar purpose.

In tapping wrought iron and steel, oil should of course be used as a lubricant, but it is not necessary for cast iron and brass.

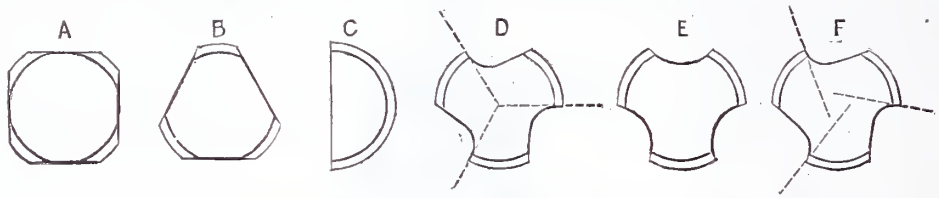



Fig 1.

Fig. 2.

Fig. 3.

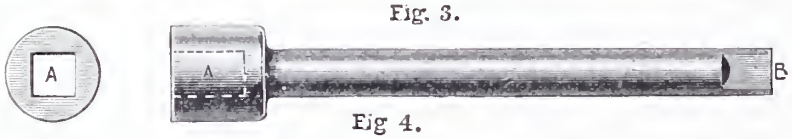



Fig 4.

Fig. 1.—Sections of Taps. Fig. 2.—Representation of Machine Tap for tapping Nuts. Fig. 3.—Tap-Wrench. Fig. 4.—Socket.

After use, taps should always be wiped clean before being put away. They should not be allowed to knock against each other, as it spoils the thread.

## PHOTOGRAPHY AS A MEANS OF HOUSEHOLD DECORATION.

BY WALTER E. WOODBURY.

THE method of mounting prints, described in the preceding paper, can also be utilised in various other ways; mounted in plush they form very handsome wall plaques. I once saw a very pretty card-table made with a number of photographic prints. Fig. 7 will give some idea of the manner in which it was constructed. A piece of deal is cut to the shape shown, and a piece of glass also; to this the photographs are mounted as described, a black paper strip being pasted in front of all the joints. A brass edging to hold the glass and wood firmly together completes the top.

Many amateurs work with a small quarter-plate or detective camera; with these photographs a very pretty chess- or draught-board can be constructed. Fig. 8 shows the idea. A piece of white cardboard is marked out into sixty-four squares of the size required, and the photographs pasted on. Thirty-two will be required to form the usual black squares. After mounting, the whole can be varnished with several coats of a good protective varnish, and the board stiffened with wood or stout boards.

A much better plan, however, is to mount the pictures in optical contact, as already explained, to a sheet of thick plate glass. The position of the pictures is obtained by laying the glass on a sheet of paper, previously ruled, with the correct-sized squares. A piece of white paper is then mounted on the back, and the whole attached to a wooden frame or table-top. The glass thus forms the top of the table, and the constant moving of the chessmen cannot injure the views.

This method of mounting prints to glass may often be employed for improving unsightly objects. To give some idea of what I mean, I will give a case that recently attracted my attention. A friend had a rather handsome mirror standing over his dining-room mantelshelf, but by some accident, or by the effect of dampness, the silvering of the glass in a portion of the centre had completely left it in places, forming a very unsightly spectacle. My friend, however, removed the mirror from the wall and carefully scraped away a portion of the silver, leaving an opening about 8 in. by 14 in. All the affected parts were thus removed, and he then backed the opening up with a carefully selected artistic photograph gelatinised and squeezed on. The effect surpassed his expectations. The unsightly portions were removed, and the presence of the picture much improved the appearance of the mirror.

We now come to a very important process, *i.e.*, the transferrotype. With this, photographs can be transferred to almost any substance. The Eastman Company and their agents supply a transferrotype paper which they manufacture. This is briefly a paper coated over with a soluble gelatine, and afterwards with an insoluble gelatine sensitive emulsion. With this paper, prints are first made as with bromide paper; they are then transferred to any substance by squeezing them into contact and laying in warm water, which dissolves the soluble gelatine film and releases the paper support, leaving the insoluble gelatine image upon the new support.

I, however, much prefer a transferrotype collodion process, with which I have had much success. Briefly described, this process consists in the preparation of a collodio-citro-chloride emulsion, which is coated over paper previously treated with gum arabic. The sensitive paper thus prepared is printed

in the ordinary manner. To remove the collodion film from the temporary support, after the image is printed on it, it is only necessary to immerse the print in cold water. The gum substratum is then dissolved away, leaving the film attached to any suitable material or object.

The first thing to be considered is the preparation of the collodion emulsion. For this we first of all require a plain collodion. This can best be prepared by mixing equal parts of ether and alcohol, and adding from two to three per cent. of English pyroxyline. I find that the best proportions of the latter are two per cent. during the summer, and three per cent during the winter months. A thin collodion will always be found preferable to work with—it gives an evener film; and if it be afterwards found to lack density, it is not a very difficult matter to coat the paper twice or to allow the emulsion to remain a little longer on the paper before pouring off the superfluous fluid. It is a well-known fact that collodion likewise improves with age. An old collodion should always be preferred to one freshly made, as it works clearer and cleaner. It is, therefore, advisable to prepare the collodion some little time before it is required for use, and

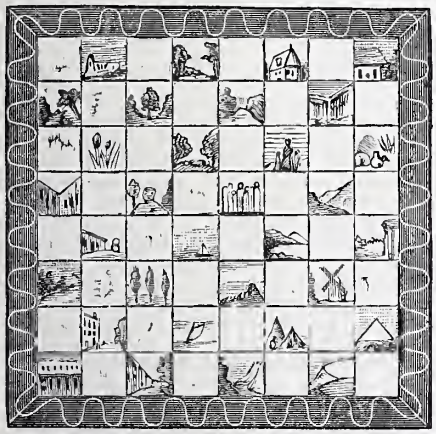


Fig. 8.—Chess- or Draught-Board.

to carefully decant it into another bottle without disturbing the sediment at the bottom of the bottle. The addition of a half per cent. of castor oil gives a wonderful finish to the glaze of the picture, and also improves the tone.

Into a glass measure capable of holding about 100 c.c.,* place about 13 grammes of silver nitrate, and 15 c.c. of water. Thoroughly dissolve the silver, and add 50 c.c. of alcohol—the addition to be made very slowly—rapidly stirring the solution the while. Into another small measuring glass dissolve 3 grammes of citric acid in 50 c.c. of alcohol, and in another 3 grammes of chloride of strontium are dissolved in 50 c.c. of alcohol.

We now have four vessels, one containing the collodion, one the citric acid solution, another the silver solution, and one with the strontium chloride. When all the ingredients have been dissolved, the citric acid and the strontium solution are added together, stirred up well, and placed in another vessel containing 100 c.c. of the plain collodion. We have now two solutions, *i.e.*, the collodion containing the chlorine and the acid, and the silver solution. We must now remove to the dark-room, or to a room lighted by gas or yellow light. The two solutions are now added together by gently pouring the silver solution into the other. The whole must be rapidly stirred and shaken up. As soon as the two solutions are added together, the sensitive emulsion is formed, the silver combining with the chloride to form sensitive silver chloride held in suspension by the collodion. The next operation is to filter the collodion; this can be accomplished by means of a tuft of cotton-wool placed in a glass funnel. It is then ready for use.

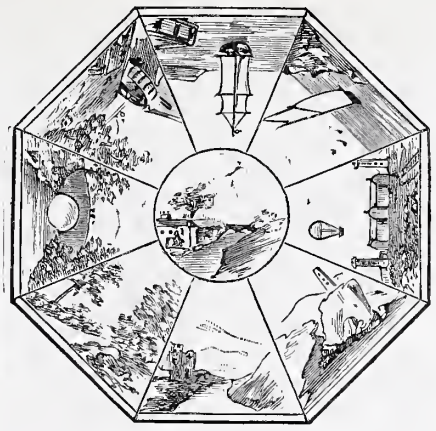


Fig. 7.—Octagonal Card-Table.

The paper to be used can be obtained at any large stationer's. It is best gummed paper doubly coated with gum arabic. A sheet of this paper is laid on to a sheet of glass and coated with the collodion. Those who have not had much experience in collodion work had better turn up the edges of the paper for about $\frac{1}{16}$ in. all round to prevent the collodion overflowing. A little of the collodion is poured on to the upper right-hand corner of the paper and worked all round till it covers the sheet. The superfluous collodion is then poured off, and the paper hung up to dry. When quite dry it is ready for printing upon. It is cut up to size, placed in the printing frame behind the negative, and printed out in the ordinary manner. If required to be transferred to glass for transparencies, it will be necessary to print very darkly indeed.

The surface to which it must be transferred is now thoroughly cleaned and treated with a ten per cent. solution of gelatine, either by coating or by means of a brush. The print is then trimmed to the size required and squeezed into close contact, the gelatine, while damp, causing it to adhere very firmly. The next process is to tone and fix. The print attached to its support is laid in cold water, when the gum layer dissolves, and the paper will float away. It is then treated with an ordinary gold-toning bath, and afterwards fixed in hypo. I prefer, however, to do these two operations with one solution—a combined toning and fixing bath. This is made up as follows:—Solution No. 1: distilled water, 36 ozs.; sodium hyposulphite, 8 ozs.; sulpho-cyanide of ammonium, 1 oz.; acetate of soda, 7 drachms. Add to this—water, 6 drachms; sodium chloride, 2 drachms; silver nitrate, $1\frac{1}{2}$ drachms. After this mixture has been allowed to stand for about twenty-four hours small flakes of insoluble compounds will be seen. These must be removed by a double filtration. While this is proceeding make up solution No. 2: distilled water, $3\frac{1}{2}$ ozs.; gold chloride, 15 grains; ammonium chloride, 1 drachm. Add solution 2 to solution 1, and, after well shaking and allowing impurities to settle, the bath is

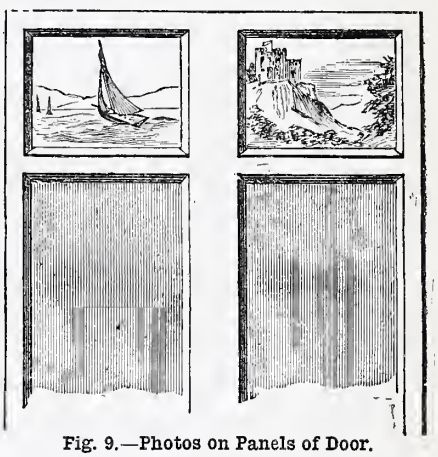


Fig. 9.—Photos on Panels of Door.

ready for use. After toning and fixing, the prints are well washed in a running stream of water.

It will often happen that the object to which it is required to transfer the photographic image is not of a nature to stand this treatment with the various solutions. In this case the print is first immersed in water, when the collodion film containing the image will leave the paper. By very careful manipulation the loose film can be toned, fixed, and washed, and afterwards transferred to the object.

With this power of transferring the pictures to any substance, the number of pretty objects that can be made is at once apparent — card and cigar-ash trays, paper weights, etc. etc.; and the number of ornaments, vases, plates, etc., that can be improved by a well chosen photograph is unlimited.

The next process we have to describe is that known as the Diazotype or primuline process of printing

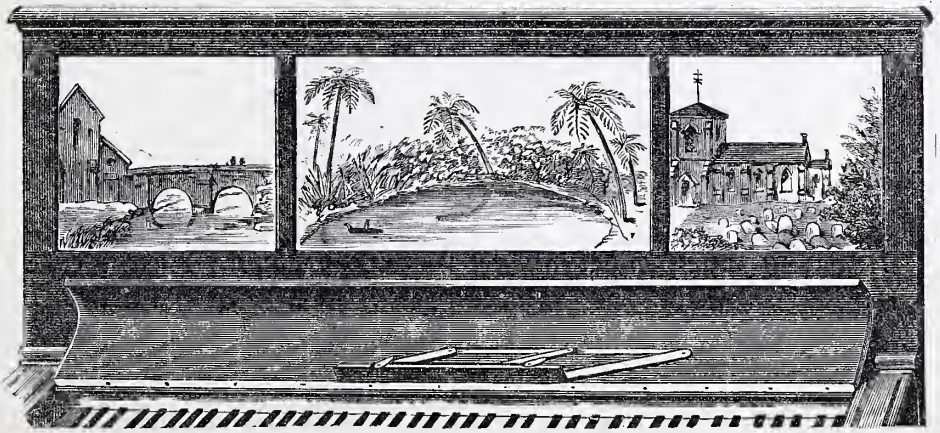


Fig. 10.—Top of Pianoforte decorated with Photographs.

* Those unaccustomed to the metric system of weights should read the figures as "parts."

upon silks, wool, cotton-stuffs, by which very pretty ornaments can be made. Photographs can be reproduced in a variety of beautiful colours upon the silk, and then handed over to the ladies to be made up into some fancy article.

All the materials for working this beautiful process can be obtained from Messrs. Green, Cross, & Bevan, who are the inventors and patentees of the process. In this process the material is first dyed with a hot solution of primuline, to which a small quantity of common salt has been added. About 15 to 30 grains of primuline are added to about a gallon of hot water. The addition of the common salt increases the affinity of the colour, and hastens the operation. For silk and wool the water must be nearly boiling, and twice the quantity of primuline used. In this solution the fabric acquires a primrose-yellow colour. It is then wrung out and well washed in cold water. If necessary, the material can be dried and kept until required for use.

The next operation is to diazotise by immersion for about half a minute for cotton, and two or three minutes for silk and wool, in a cold solution of sodium nitrite, ½ per cent., sharply acidified with hydrochloric or sulphuric acid. The material is now sensitive to light, and is well washed in cold water, dried, and stretched out on a level white surface and exposed to light beneath a photographic positive. The exposure varies, of course, with the actinicity of the light. In sunlight about half a minute will be required, while in dull weather half-an-hour's exposure may be necessary. The image is faintly visible, orange-coloured on a light yellow ground. The next process is to render the image visible by development. This is done with a weak solution (about ¼ per cent.) of a suitable phenol or amine. The following have been found to give very good results, each developing the image in a different colour :—

*For red.*—An alkaline solution of β-naphthol.

*For maroon.*—An alkaline solution of β-naphthol-disulphuric acid.

*For yellow.*—An alkaline solution of phenol.

*For orange.*—An alkaline solution of resorcin.

*For brown.*—A slightly alkaline solution of pyrogallol, or a solution of phenylenediamine hydrochloride.

*For purple.*—A solution of α-naphthylamine-hydrochloride.

*For blue.*—A slightly acid solution of amido-β-naphthol-β-sulphonate of sodium (eikonogen).

If the design is required to be produced in two or more colours, the respective developers, suitably thickened with starch, must be applied locally with a brush.

After development is completed the material is well washed in cold water, and should then be dried and ironed. If the purple or blue developers are to be used, the material should be finally washed in a very weak solution of tartaric acid.

Instead of printing from a photographic picture, images may be made from leaves, flowers, ferns, insects, or other designs upon paper.

I will conclude this article with a description of the dusting-on or powder process. With this, images in all colours can be produced upon glass, wood, paper, etc. The method is as follows. The substance which is to form the support is coated over with the following solution :—Gum arabic, 30 grains ; white loaf sugar, 30 grains ; ammonium bichromate, 20 grains ; distilled water, 1 oz. After drying, this is placed under a photographic transparency. The exposure varies from five to twenty minutes. An actinometer should be used as in carbon printing. The image is then developed by dusting over powdered graphite or other coloured powders which adhere to those parts of the gelatine film unexposed to the light. It is then coated with collodion, well washed, and varnished. If a dark-coloured ground, and a light-coloured powder such as ivory dust, barium sulphate, silver dust, etc., be used, the image can be made from a photographic negative. Very effective pictures may be thus made ; for instance, if done upon wood, and inserted in the panel of a door or cupboard, they improve its appearance wonderfully (see Fig. 8).

I have recently had suggested to me, by a young lady, the idea of improving the appearance of the pianoforte top by the insertion of artistic photographs (see Fig. 10).

I am well aware that the subject I have taken up is so inexhaustive that I have only been able to give a small percentage of the number of ornamental articles, but I think I have been able to at least show how useful photography could be made to become as a means of household decoration.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### III.—"THE ART AND CRAFT OF CABINET-MAKING."

WITHIN the last ten or fifteen years marked advances have been made in what may be called "practical literature," and at the present time there are but few trades that have not as a *vade mecum* a text-book treating of the means, modes, and methods. With reference to furniture making, the above-named manual has only just made its appearance, but I may safely say that among the various technical books that have been recently published by Messrs. Whitaker & Co., there is not one, perhaps, that is possessed of such value, or is likely to command such a steady and continuous sale as a "stock book." as "The Art and Craft of Cabinet-Making," which purports to be, and really is, "a practical handbook to the construction of cabinet furniture, the use of tools, formation of joints, hints on designing and setting out work, veneering, etc., together with a review of the development of furniture." My reason for speaking in such positive terms as to its worth is that it is written by Mr. David Denning, whose name and intimate acquaintance with the subjects on which he writes are well known to every reader of WORK. Its purpose, aim, and scope may, perhaps, be best set forth and explained by an extract from the preface, which shows in plain and unequivocal terms that, in writing this work—and I know of no one who is better capable of doing it, either by reason of his power of imparting information by pen and pencil, or through his intimate knowledge of every branch of cabinet-making—the intention of its author has been, and is, "to supply amateurs and young professional cabinet-makers with a reliable guide to the construction of cabinet furniture. No attempt has been made to teach the thoroughly experienced artisan, and no new fads are advocated, either in style or processes. The ordinary reliable methods of the workshop, and nothing more, are explained, and on this account the book will, no doubt, be of greater use to those for whom it is intended than if new theories of 'construction as it ought to be,' according to many of those who presume to teach the skilled mechanic, had been advocated."

Having thus given, in Mr. Denning's own words, his apology for the existence and appearance of the volume now under consideration, let me endeavour to show the readers of WORK not *how* the writer has handled his subject, for that goes without saying, as the phrase runs, but in what way he has commenced and gone through his subject, which is one that covers a wide field and demands, in order to write on it with effect, a general knowledge which but few possess. The book consists of twenty chapters or component parts in all, and is well illustrated with two hundred and nineteen engravings of tools, appliances used in cabinet-making, diagrams explanatory of joints, parts of pieces of furniture, and processes, and sketches of many articles of furniture, useful and ornamental, most of which bear evident marks of originality—or, in other words, of having been supplied by Mr. Denning himself. Reverting to the subject-matter of the work itself, and its general arrangement, the writer first takes the opportunity to show the difference, not always clearly understood, between joinery and cabinet-making, and to show what is the special and acknowledged work of the cabinet-maker. From this he proceeds to a review of the development of furniture, giving a sketch of its progress from the Tudor period to the present day, and showing that good modern work is much to be preferred to that of bygone times, however much it may be the fashion to cry it up. After a brief chapter devoted to an account of the woods chiefly used in making furniture, Mr. Denning comes to an important section of his subject, in which he dwells at length on glue and its preparation, nails with which screws—or screw-nails, as they are sometimes called—and other fasteners are considered ; tools used in cabinet-making, wooden appliances that may be, and indeed are, for the most part, made by the user, and grinding and sharpening tools, with general directions. The six chapters devoted to these matters may be regarded as forming the second section or part of Mr. Denning's book.

In the third part he touches on the joints used in cabinet-making, various decorative and minor structural details in furniture, and the construction of parts, such as drawers, doors, cornices, plinths, etc. Following these in due sequence, he tells the reader all that is necessary to know about many indispensable adjuncts to modern furniture, such as glass, which is now very extensively used, and cabinet brass work, and he sandwiches these—if I may be permitted to use the term—with a chapter on drawing and designing and another on the process known as veneering, or putting, as may be said, a good face on a material of inferior value. The fifth and last portion is devoted entirely to the consideration of construction, and the four chapters of which it is composed touch respectively on tables, bedroom furniture, library and office furniture, and sideboards and cabinets. Now this is all desirable and necessary, but I am compelled to say that if there is not a "missing link," there is certainly a missing chapter, in which the construction of chairs and couches should have met with respectful comment and treatment ; and when "The Art and Craft of Cabinet-Making" reaches a second edition, as I trust it very soon will, it may be enlarged and improved by the addition or interpolation of such a chapter. I know that in taking a bird's-eye view of any wide and comprehensive subject it is a matter of the utmost difficulty to think of everything, and that something or other that should have appeared has been accidentally crowded out ; but this is the only "one thing wanting" that I have been able to detect in this otherwise complete, carefully considered, and well-written book.

THE EDITOR.

## SHOP:

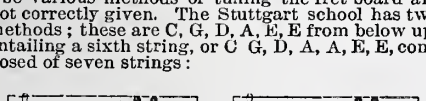
### A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—Letters from Correspondents.

**Hints on the Stringing of the Zither.**—T. G. M. (*Camberwell*) writes:—"Chancing to see No. 139, p. 550, of your valuable publication, Work, I found in it an article concerning the zither, as to its setting and tuning, with general remarks appended; but it contains inaccuracies and misleading information, to which I feel constrained to call your attention. The zither is not an easy instrument, and this is the true reason why the majority of lovers of the same fail to attain to any kind of perfection in their play, and also why so many who have not been debarred from starting the acquisition of zither-playing finally break down and give it up altogether. I am much afraid that inferior teachers are responsible for this state of things. I was fortunate myself in obtaining in London a perfectly practical instructor, who never digressed into irresponsible statements, and who thought more of his zither and pupil than of the 'main chance.' Let me first correct the following: 'Schlacht' zitber should be 'Schlag' zither, because it is struck in contradistinction to the 'Streich' zither, which is the 'bow' zitber, or Alpine violin. The Elegie, or alto zitber, tuned to E one-fourth below the outer, or A, string (which, in effect, is one octave below the fifth above the same A string), is, *par excellence*, the correct instrument for accompaniments to the voice, and also plays sentimental solos more feelingly, having a much sounder tone and longer vibration. The instrument which, however, is in general use amongst players of even mean capacity is the so-called 'Concert' zither. The 'Prim' zither is used by the peasantry of the Tyrol, when they have one at all, on account of its cheapness and handiness, and being well suited for the simple airs and dance music affected by them. The remark made that the zither can be taught in one week is ridiculous; and the statement that 'all bands' play it in the Tyrol is false. I travelled in the Tyrol two summers ago, and in the Bavarian Highlands, and made searching inquiry as to players, and always met with the same reply, 'There is only So-and-so near here;' and to the query as to what kind of music was played, the invariable answer was, 'You cannot get anybody in the country to play aught save *Ländlers* (country dances) and kindred music; they do not even rise to marches and superior dance music.' It is in the towns of Germany that the zither is cradled and made much of. On no account let anyone buy metal strings, except for the fret-board. No one uses them, all that has been said to the contrary notwithstanding. The great tension of this class of string ruins the grip of the tuning pegs, and so ruins the instrument. Their tone is harsh and clanging, and turns a sympathetic medium of music into a 'tin pot.' Metal strings 'hold up' well, but this is their only recommendation. The various methods of tuning the fret-board are not correctly given. The Stuttgart school has two methods; these are C, G, D, A, E, E from below up, entailing a sixth string, or C G, D, A, A, E, E, composed of seven strings:



The method given as the Viennese is really the Munich method, the Viennese being C, G, G, D, A, which, to be correct, must have the G between the G and D tuned one octave above the other. The Munich method is the only correct one harmonically, and is C, G, D, A, A, the two A's being tuned alike, the others being each one-fifth above one another. All the other strings of the zither are tuned in fifths, and as stated. The information given as to what there is to learn on the accompaniment and bass strings is not true; the statement being that it is only necessary to learn the position of one major chord, as all others are the same, there being nothing more to learn. One moment's consideration will show the fallacy of this. How about minor chords, augmented chords, diminished ditto, as well as incomplete progressions? Then, how about broken harmony and the various mechanical and harmonic methods not mentioned? It is due to such random statements that a beautiful instrument is depreciated by the public, and it is put down as only capable of playing 'Tum, tum, tum' music. Let me impress upon your readers that the zither well repays learning, because it is capable of such infinite variety; it is, indeed, on this account that old and experienced players are always studying—there is ever something new. To form some opinion of zither-playing, do not go to listen to 'Ländlers et hoc genus omne,' but take every opportunity of hearing good music—as solos, duets, trios, or quartettes. Ensemble or club pieces are, as a rule, too much of the 'Thrum, thrum' pattern, and not good music. As a parting word, I can also say, 'Be not afraid'; but say it as encouragement to persevere, and overcome the various obstacles lying before the student. His reward, if he has any music in his constitution, will be ample, and he will soon attain to some satisfaction."—["It is hardly kind of Dr. M. to 'slate' me so unmercifully, especially as I am a member of his own profession—which, however, is notoriously one in which 'dog' is addicted to a canine diet. Now, let us analyse the 'misleading information,' the 'inaccuracies,' and the 'irresponsible statements' contained in the article in question. The doctor will not allow that the zither is an easy instrument, in spite of my solemn assurance that I can teach, and have repeatedly taught, it in the space of a few weeks. Well, all I can say is that in the case of our critic it may, indeed, have been difficult of acquirement; while the general tone of his letter goes to prove that he would be rather sorry than otherwise to see the zither popularised—wants, in fact, to 'keep it select,' as it is, up to the present time, essentially an aristocratic instrument in this country. Nevertheless, braving the scorn and contumely of the doctor, I venture again to assert most emphatically that the zither is not only easy, but the easiest of all stringed instruments of its type. In proof that I did not at all exaggerate when I affirmed that I could enable anyone who cared to play within a very limited period, I may adduce the case of another doctor here, who, six weeks or so ago, had never touched a zither, but who is now able to play fairly well several airs, including some which embrace the very modes of accompaniment which Dr. M. says cannot be acquired by learning one major chord. That this gentleman has had no tuition other than from me, Dr. M. can easily satisfy himself, as I shall be very pleased to forward his name and address—I know Dr. M. has mine. It is ridiculous to suppose that the article assailed was ever intended as a complete compendium of the zither; nor was it intended for *virtuosi*, but for such as were open to accept simple instructions or hints at the hands of one who was perfectly competent to impart such information, and also perfectly disinterested in offering it. As to the 'inferior teachers' upon whom the learned licentiate has sat so unmercifully (and I am, by implication, included in the category), I am afraid I can only speak for myself. But in all my experience as an inferior teacher, I never yet knew of a case of relapse when once the study of the zither had been seriously undertaken; my innate inferiority, no doubt, prevented such instances from cropping up. Certainly, I was at a distinct disadvantage in every way—my practice as a teacher lying in an obscure Hampshire village called Bournemouth, of which the doctor may possibly have heard, and which, we all know, is peopled by Boors. Unkind, oh doctor! to cavil at the teacher's eye to the 'main chance.' Why, man, it was my only inducement to teach at all; yet I do not class myself as inferior to anyone in love of the zither, or as insensible to its capabilities. I am willing to believe that you are an infinitely better performer on it than I am, or than I am ever likely to be; but you surely might let experience go for something, even if only that of an 'inferior teacher. As I am always willing to admit it when in the wrong, I cry 'Peccavi' *re* the word 'Schlacht.' I simply perpetuated another man's error, as I am no German scholar; but surely no mortal in his senses could ever confound the zither proper with the Streich zither, which is an instrument of the viol family? Dr. M. is also good enough to tell us that the élegie zither is the best as an accompaniment to the voice and for slow *tempi*, which is perfectly accurate; but not so his assertion as to the concert zither being the one in most general use. As a matter of fact, the concert zither is tuned in 'G,' the prim, or ordinary, zither being in 'A;' while the élegie is pitched in 'F,' and the bass zither in 'E.' With the latter the good doctor is presumably unacquainted, or he would certainly have mentioned it in his very comprehensive letter. He also asserts that the prim zither is used by the very 'inferior' zitherists of the Tyrol, as being 'cheaper' and 'handier' than his favourite instrument — the concert zither. Now, in some German lists I have seen the two priced alike, while in an English one, which lies before me as I write, I notice that prim zithers are quoted as kept in stock up to ten guineas, and that the limit for concert zithers is £4 10s.—conclusive proof that the doctor's argument is *right*, and that the prim is invariably the 'cheaper' instrument. As to its being the 'handiest,' I don't know where it comes in, if by the term the doctor means portability, etc. This very captious gentleman also takes exception to my remark as to the universality of the zither among the peasants of the Tyrol. Now, in 'Grove's Dictionary of Music and Musicians'—a reliable and standard work, I think—under the article 'Zither' will be found the following: '. . . . as constructed about half a century back, when it became a favourite among the peasantry of the Styrian and Bavarian Alps.' I have not enjoyed the advantage of bearding the zither in its native lair—so to speak—as has the doctor; but I think it is extremely possible that the natives were shy of performing before him, as his fame must inevitably have preceded him; and, indeed, if they had any suspicion of the contempt in which he holds their beautiful 'Ländlers,' it is not to be wondered at. Now, whether these poor unfortunate zitherspielers have degenerated or not, it is a significant fact that Petzmeyer, the father of the zither in its present form (as well as Gusicow, Picco, and other world-famed players), was a perfectly self-taught player, and was not only ignorant of even the rudiments of musical science, but was also otherwise illiterate; yet he was appointed Kammer—*virtuoso* to the king—which proves that it does not follow that a man must be acquainted with music at all to be a good performer. That the *dilettanti* consider this the worst of heresy I am well aware. The doctor's moan because he could not find exponents of a class of music to which the Tyrolese were not accustomed is about as ludicrous as if one were to quarrel with a Scotch piper because he could not render an oratorio! In the towns of Germany, the doctor says, the zither has been developed. Quite so; as, even in benighted Germany, the talent flocks to the bricks and mortar. But Munich—which he gives as the seat of a distinct school—has no performer of international fame, whereas Vienna has several. There are many obsolete or little used methods of stringing besides the ones he cites, and really, whether the one I gave was Munich or Vienna, is a matter of very little practical importance. Now, so far I have followed the doctor with great interest, if not always in accord with him; but when he assails the metal strings in cold blood, it is too bad. They are infinitely superior in all respects to those of silk and gut. In the hands of an 'inferior teacher' or a player 'of mean capacity,' the former might, perhaps, be found harsh and clanging; but for great delicacy of touch, and an infinitely greater resiliency, commend me to the metal strings. It is sheer nonsense to talk of their destroying the grip of the pegs. Look inside a piano. Furthermore, they are very accurately balanced as to tension, whereas with silk and gut there are scarcely two strings alike in this respect. Which, then, is likeliest to conduce to a delicate and sympathetic touch? It is not considered gentlemanly in this town to give anyone the lie direct, which is what Dr. M. has done when he says that my remarks on the accompaniment are 'not true;' he should have added, 'in my opinion' or 'in my experience.' Our friend has probably acquired the zither, 'through much tribulation,' in the orthodox manner, and cannot believe that he has really wasted much valuable time. But, be that as it may, I hereby reassert all what I have said on the subject of the accompaniment. Minor chords, etc., I must venture to submit, do not come within the scope of elementary instruction; but all the graces enumerated by the doctor are to be accomplished when the pupil is once familiar with the positions of the strings, and this latter may easily be acquired by practising the major chords, only one of which need be taken until the stretch, etc., is mastered. Having thus vindicated the truth of most, if not all, of my 'random statements,' I may add that our English players have done nothing for the popularisation of the zither, and for this reason: each appears to be actuated by the same carping spirit which is so manifest in every line of the doctor's letter, and most so-called zither clubs are—well, 'select assemblies'—bem! We are warned not to set strong spiritual food before the catechumens, and the same is true with regard to the intending learner of the zither; so let every reader of Work peg away by the light of the few hints embodied in the article attacked, and I will undertake that there need be neither lapses nor failures. *Vale, Doctor carissime!*"—An Old Teacher.]

**Ancient and Curious Watches.**—F. C. (*Nunhead*) writes:—"I have recently had an opportunity of examining a curious watch in the possession of a well-known alderman of a sontbern town. This watch is three hundred years old, and is contained in an oval or egg-shaped case about 2¼ in. long by 1¼ in. wide. The front of the case is missing, but the remaining part is about ¾ in. thick. Over the dial is one hand only, to mark hours (like the clock on Westminster Abbey), and the watch is so constructed that this hand can be set to time, which is not the case in all similar watches. The movement is English verge, and the only defect in the watch at present is that the teeth of the 'contrate' or crown wheel are bent. Between the spring barrel and the fusee a piece of catgut supplies the place occupied in modern watches by a flat-link chain. The same gentleman owns another watch, the ball-mark in which is one hundred and twenty-eight years old. It is enclosed in a tortoise-shell and gold case, and has a verge movement. At the present time this watch runs with a variation in time of less than two minutes per diem. While speaking of watches, I may mention a curious repair effected by a Japanese workman. An English gentleman travelling in Japan found that the main-spring of his watch had snapped, and sent it to a native artisan. The watch was returned to him apparently in perfect condition, and its performance was satisfactory until he reached a damp district. On examination, it was found that the new main-spring was made of thin bamboo."

**Fairy Bell Pegs (or Pins).**—G. H. M. (*Bristol*) writes:—"Noticing a reply in 'Shop' offering to supply above at 1s. per dozen, it struck me as being a somewhat exorbitant charge, in proof of which I may say I shall be pleased to supply either of the enclosed three sizes at 6d. per dozen, postage 2d. extra, or for not less than three dozen, post free;

and wire at 4d. per ring (see 'Sale' column)."—[These pins are all that could be desired.—ED.]

**Xylonite and Fret Saws.**—H. B. (*Leeds*) writes that "he supplies xylonite in small quantities in its best forms—viz., ivory, ebony, coral, and tortoiseshell; also a new 'Lightning' fret saw' (see advertisement)."—[The samples sent are certainly to be commended.—ED.]

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Boot and Shoe Repairing.**—NOVICE.—The articles on "Boot and Shoe Making and Repairing" appeared in WORK, Nos. 112, 117, 122, 126, 130, and 137.

**Self-acting Fountain for Garden.**—A. L. (*No Address*).—The principle upon which the fountain works, as described in No. 69 of WORK, is undoubtedly the best for your purpose. If you read the article carefully in connection with the sketch now given, you will see the necessary alteration which will have to be made to make it an effective and convenient apparatus. The sketch will then need little explanation—the question of size is one which you must decide for yourself—but as the vessels are out of sight, and therefore cannot look clumsy, I would advise you to have them sufficiently large to play a small jet for. say, two to three hours

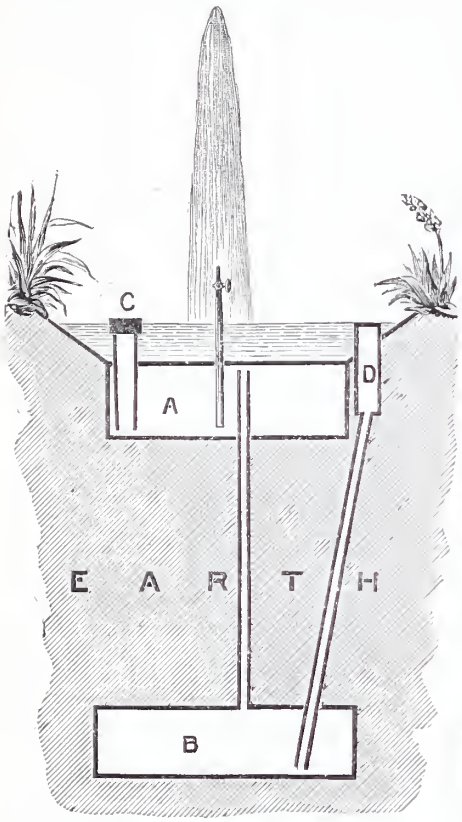



Diagram showing Buried Self-acting Fountain for Garden.

—thus: top vessel, A, 20 in. × 20 in. × 4 in. deep; vessel B, 21 in. × 21 in. × 4 in. deep; and as in the open air a feeble jet is disturbed by a very light breeze, it would be well to have a considerable force behind the jet. The latter itself need be no larger in thickness, but driven out with greater force, and hence—being much stiffer and better able to bear the wind—this force can be obtained to any extent by *increasing the distance between* the vessels A and B; the size and shape of the vessels have nothing to do with it. I would recommend not less than a clear 4 ft. between the vessels. The earth would have to be excavated to accommodate these dimensions, and when the fountain is made up, *thoroughly tested* for leakage, and filled up, a zinc cone somewhat like a milk-pan should be soldered to top of vessel to form basin, and the edge neatly built up with rustic rock-work. To use the fountain, pour water into the basin until no more will run down the pump-hole, D, and the basin is also conveniently full; then, to make it play, unscrew the plug, C, and work the pump up and down, when water from B will be sucked up into the basin, and drawn down the plug-hole, C, into A. When B becomes empty, air will come up instead of water, accompanied by a gurgling sound; then restore the plug, and *afterwards* cease from pumping, when the water will instantly rise from the jet and continue playing until A becomes empty. It is essential that the vessels and joints should be air-tight, and they should be tested to a higher pressure than they will be used at. With regard to price, this will vary very much in localities. As you do not give any address, I am unable to surmise. —C. M. W.

**Cyclometer.**—W. W. (*Stamford Hill*).—I am unacquainted with the interior mechanism of the cyclometer. It is not a job for a novice, however, but for a practical optician. I am sorry I cannot supply a drawing, as I have not the article by me. It would be cheaper and better to buy one of the makers or cycle dealers. Consult WORK advertisements.—A. S. P.

**Fitment for Small Harmonium.**—A COUNTRY CABINET-MAKER.—It would be beyond the scope and purpose of WORK to give instructions as to how to play any particular instrument, the construction of which is set out in the journal.

**Pneumatic Tires.**—A. S. (*Glasgow*).—The repair of these tires requires initiation, and no novice should attempt it without first seeing it practically done, and repairers are not fond of showing the process to everyone.—A. S. P.

**Clay Modelling.**—M. J. C. (*High Wycombe*).—The articles on "Clay Modelling" appeared in WORK, Nos. 56, 60, 64, 68, 71, 74, 77, 83, 88, 93, and 98.

**Suggestions for WORK.**—W. N. (*Homerton*).—Thanks for your suggestions. I am always glad to have these from any reader. Your efforts to make WORK better known among your friends, and your introduction of it into your school, will no doubt be productive of good all round. As to tools, you will see that B. A. Baxter is already dealing with carpentering tools, and no doubt he will treat the subject exhaustively. Your required information as to enamelling a coal vase only awaits its turn in "Shop."—ED.

**Collodion Wet Plate Process.**—AMATEUR.—Your best plan would be to purchase an elementary shilling handbook on photography, which will give you more detailed information than it is possible to do in the limited space of these columns. All the necessary materials may be purchased of almost any photographic material dealer, such as Fallowfield; or Adams, Charing Cross Road, W.C., will supply you.—D.

**Enamel.**—J. R. G. (*London, S.E.*).—You cannot do better than use the Foochow or Aspinall enamel advertised in WORK.

**Architecture.**—WOULD-BE.—Before wasting any money in buying books, I should advise you to write to the Secretary of the Royal Institute of British Architects, 9, Conduit Street, Hanover Square, London, W.; or to the Secretary of the Glasgow Institute of Architects, 115, St. Vincent Street, Glasgow, plainly stating your case, and asking their advice.—E. D.

**Bell Telephone.**—N. D. (*Sheffield*).—I am pleased to learn that you have succeeded in making your telephone so well from my instructions given in WORK. It shows that my labour has not been in vain. The further information which you require regarding transmitters and switch-board has been written out fully with drawings, and is in the hands of the Editor. Perhaps, if you and others use some persuasion, he will be induced to publish the same at an early date.—W. D.

**Sawing.**—A STUDENT.—Sawing against the grain, especially in curly or knotty wood, is, of course, more difficult than sawing along the grain of a straight and regularly grained piece of timber. From A STUDENT'S letter I should think his saw is not in good order, for sometimes "the saw seems to refuse to move altogether." Is this so? For a correct and complete answer to this, read J. H.'s article in WORK, Vol. I., p. 161, dated June 1, 1889, then examine the saw carefully in the light of the knowledge gained.—B. A. B.

**Safety Bicycle.**—ERIC.—Your correspondent is quite right in his remarks in reference to the adjustment of pedal-shaft, and I am not wrong. It is this way: As to wheels, the hubs revolve round a fixed axle. These hubs always have the spindles made with a right-hand screw, and if made with a fast and loose cone, the loose cone is always on the *left* side as described, and as ERIC says. With regard to a pedal-shaft, the hub, so to speak, is a fixture, and the shaft revolves. If the pedal spindle has a fast and loose cone—the fast cone being, as it always is, next the chain wheel, and the shaft or spindle a *right*-hand screw—then the chain wheel would be on the *left* side, and the loose cone on the *right*—just the reverse of the wheel spindle; the operation of driving would then wind a loose cone *outwards*. But nearly every safety that I have handled in the last two years for repairs had the pedal-shaft made with a *left*-hand screw, and the loose cone, consequently, on the *left* side, and it was one of these brackets I had by me when I wrote the description, which is correct when applied to the *left*-hand thread, as it was meant to be. Your correspondent, who evidently knows what he is talking about, will see that my description applies, as he mentions, to a left-hand, threaded shaft, which fact I ought to have mentioned when writing the description.—A. S. P.

**How to Make a Hot-Air Engine.**—S. T. (*Oughtibridge*).—You ask how to make one, but without saying what size. I don't know whether you mean a model or a large one. I think an amateur could not well do more than a model, because the cylinder of a hot-air engine is necessarily large, and the heater big and bulky. What could you do towards making a hot pot and displacer 12 in. or 14 in. diameter? You might make the patterns if you have a large lathe, but most of the work is done in the foundry. Then the cylinder requires a power-lathe to bore it, and so does the fly-wheel and crank; then what remains for you to do? You might make a model, and before this appears you will have seen a drawing and description of Mr. Seal's simple little engine, sent in answer to another inquiry, which plan you might follow, taking a pipe of some kind as the foundation, the furnace below the heater in the middle, and carry the crank-shaft above. I would make the cubic space moved through by the working piston one-quarter that moved through by the displacer, and if you have a 5 in. working cylinder, you might drive a sewing-machine, fret-saw, or 3½ in. lathe.—F. A. M.

**Cabinet Making.**—SIRINO.—I cannot call to mind a book such as you require. Messrs. Cassell and Co. publish "Drawing for Cabinet Makers" (3s. Read my reply in "Shop," No. 140, Vol. III., headed "Advice to Draughtsmen;" you may find some books therein mentioned of service, if you are not already acquainted with them.—J. S.

**Cheval Screen.**—N. M. (*Norwich*) may, it is hoped, find in the annexed sketch the hints he requires for making up his tapestry as a cheval screen. The uprights and cross-pieces should be about 1½ in. square. The fret (Fig. 2) must also be cut from stuff of the same thickness. The pieces A and B (Fig 1) should be of ½ in. board. For mounting the tapestry, a stretcher should be made like that over which an artist's canvas is strained, cut from ¾ in. lath, 2 in. wide, and the tapestry should be tacked tightly over it. N. M. proposes protecting his needlework both at front and back with glass. If

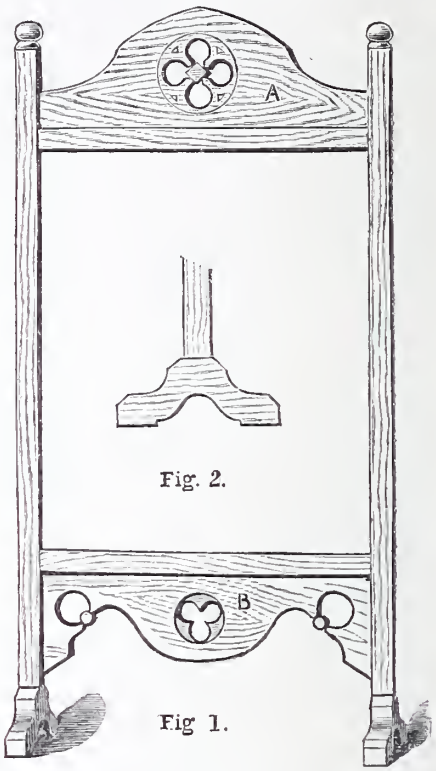



Fig. 2.

Fig 1.

Cheval Screen.

he does so, his simplest and most effective way of fixing it in will be with a narrow gold moulding, fastened to the frame with needle points. If his material is—as it most probably will be—soft wood ebonised, the gold will look especially well. I do not, however, see the necessity for glass: it will make the screen heavy and clumsy, and will always be exposed to danger, whilst the introduction of it will greatly increase the maker's difficulties. I advise him to do without it. A few dowels will then serve to keep the panel in place, and when the framework is tightly brought together round it and pegged, the whole will look solid and workman-like. The boards A and B will be fixed in shallow mortises in the uprights, and may run in V-shaped grooves in the cross-pieces.—M. M.

**Oxide of Cobalt.**—WORKITE.—You can dissolve black oxide of cobalt very easily in hydrochloric (muriatic) acid; but if you have any difficulty, warm it. Use the hydrochloric acid mixed with an equal volume of water. You might get out most of the yellow colour from the clay by warming the clay with dilute hydrochloric acid, allowing the clay to settle, and decanting the liquor. Wash well with water till free from acid.—F. B. C.

**Glass for Fountain.**—A. B. (*Aberdeen*).—You can obtain the above from Messrs. J. & W. Smith, of Farringdon Road, E.C. Ask for a 10 in. glass consumer with a hole in centre, as used for hall lanterns.—C. M. W.

**Small Engine.**—INQUIRER.—This is *too much* to ask for in a correspondence column. The drawings would take two days to make, and fill a page of the paper. Wait for some short paper on a small engine to work your 2½ ft. long model with a propeller.—F. C.

**Zinc Fern Case.**—J. D. (*Glasgow*).—An illustrated article on the construction of a Wardian case in zinc and glass is in the hands of the Editor. If the design is not just what you want, you can, of course, modify it to any extent; the general instructions, pattern of metal, etc., will hold good.—C. M. W.

**Gas Matters.**—W. H. B. (*Southsea*).—You will find on p. 541 of Vol. I. a similar question to yours answered under the heading of "How to Read the Index of a Gas Meter," with illustrations or diagrams. There is a misprint in the sentence in brackets; it should read 1,000, and not 1,090, as printed. You will find, on p. 422 of Vol. II., another answer to a question under the heading of "Gas Meter." There are also various other answers on the above subject, which you will find very useful; so you see that, although you have been a subscriber from the beginning, you have hardly been a constant reader. Your query as to "Why a consumer should pay so much for the hire of the meter when he does not have to pay a tradesman for the use of weights and scales and measures he uses?" only wants a little explanation, and I think you will acknowledge that the two cases are not analogous. For instance, the cost of a pair of scales and weights with which a tradesman can supply, say, five hundred customers would mean the cost of five hundred meters to the gas company before they could supply a like number of consumers—that is to say, it would cost the company about five hundred times as much for scales or measures as it would a tradesman. It would seem, at the first glance, that as the purchase of meters costs the company so much, and therefore must be paid for either directly or indirectly, the fairest way for them to charge would be to add so much on to the price of their gas or commodity, and get paid for them in this way, as in the case of the tradesman, though to a much greater extent. But this would hardly be right, for say the price of gas was raised 5 per cent. to pay for the purchase and repair of meters, then A, who burns, say, 1,000,000 ft. a quarter and has only one meter, would be paying out of all proportion to B, who only burns, say, 1,000 ft. a quarter and has one meter likewise; and yet A is a far better customer than B, and really is more entitled to a reduction than an increase in comparison to B, whose custom hardly pays for the initial expense of laying on the gas and fixing the meter. Therefore, in paying so much a quarter for the hire of a meter, the customer who burns the least gas pays more for it on the average than the one who burns most, and this, I think you must own, is the fairest way. We now come to your next point—viz., "That there is sometimes a considerable decrease in the consumption of gas for a certain time, through the fact of not having used it so often as usual; that, on the inspection of the meter index by the inspector appointed for that purpose, it has created a suspicion that something must be wrong with the working of the meter; but, on the other hand, if the meter registers ever so much more than the usual average of consumption, there is no remark made, no matter how one watches and economises the consumption." This cuts both ways. For example, if it is wrong for the gas inspector to doubt the meter when it does not register as much as usual, it is almost as wrong for you to doubt it when it registers ever so much more, but you both have your remedy. If the inspector doubts the meter, he has it tested; this puts you to little inconvenience, and costs you nothing if it is right and he wrong. If, on the other hand, you doubt the meter, you can have it tested by the Government inspector, and this would cost you nothing if you were right and the meter found to be wrong. Of course, if you have the meter tested and it is found to be all right, it is only proper that you should pay the expenses, and this would be but a very small sum but some inconvenience. But the improved way meters are now made and periodically inspected makes the remark, "To lie like a gas meter," practically speaking, an untruth, especially in the case of dry meters. You can get a very good idea if the meter is working properly by lighting one or more burners whose burning capacity you know. For instance, suppose you light four burners that are supposed to burn 5 cubic ft. each per hour—20 ft. per hour—then if, at the expiration of two hours, the meter has registered about 40 ft., you know that the meter is not far out. I have generally found, in practice, that a burner burns more than the amount stated. You can generally tell the number of feet an ordinary burner is supposed to burn by a number stamped on it or the number of rings chased round it near the earthenware top. A detailed description of the construction and working of a gas meter, with illustrations, would be far too long a subject for the columns of "Shop." I quite agree with you that it would be interesting to a number of readers, and, with the Editor's permission, I will write an article on it later on.—E. D. ["How to Control the Gas Meter" will shortly appear in WORK.—ED.]

**Lantern Microscope.**—S. C. W. (*Bristol*).—Microscopic slides, unlike ordinary lantern slides, require to be placed close to the objective in a lantern microscope. In this manner the small 3 in. by 1 in. slide is brought close up to the apex of the cone of light emitted by the condenser, which should be about four to six inches distant from the slide. The ordinary form of lantern microscope is generally supplied with two objectives, for the purpose of exhibiting slides having a diameter of 1 in. and ½ in., these lenses usually having a focus of 1½ in. and ¾ in. respectively. The objectives may take the form of a pair of plano-convex lenses of short focus mounted in a tube with the crowns of the lenses close together (as in an ordinary condenser), the foci varying from ¼ in. to 3 in., according to the power required; or, if preferred, the low power may be a pair of short focus bi-convex lenses, and the high power the ordinary achromatic form made to pass plenty of light. It is not always advisable to utilise microscopic objectives for lantern purposes, as lenses of this description are not always suitable for the purpose, and, moreover, they do not pass sufficient light. The body tube of the lantern microscopic, which is illustrated in Fig. 1, is made to screw into the draw tube of the lantern front in place of the ordinary objective, which is removed for the purpose. This body tube is provided with an inner spring tube, which retains the microscopic slides in position when they are inserted through the opening at the front end of the tube. This inner spring tube takes the form of a short length of tubing covered with a disc of brass at one end, which is pierced with an opening 1 in. in diameter, in order to admit the rays of light to the slide. A strong spiral of wire is coiled round the interior of the tube, and acts as a spring by forcing the tube towards the outer opening. In the better class of instruments this spring tube is held back while the objects are being inserted by the action of one or two milled screws. The objectives are mounted in separate tubes, so that they may be readily slid into a short adapter, or jacket, which is made to screw into the diminishing collar attached

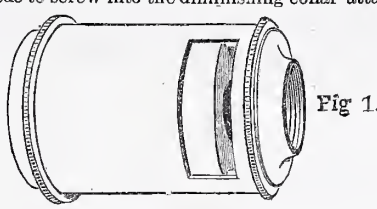


Fig. 1.

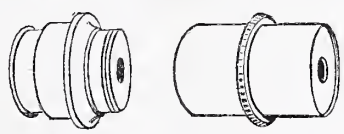


Fig. 2 Fig. 3.

Fig. 4.

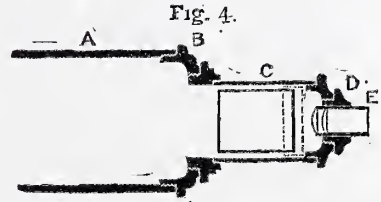



Fig. 5.

**Lantern Microscope. Fig. 1.—Body Tube of Lantern Microscope, showing Inner Spring Stage. Fig. 2.—Objective to screw into Diminishing Collar of Body Tube. Fig. 3.—Extra Power to slide into Objective Mount. Fig. 4.—Microscope with Double Stages shown at A, A; B, Objective. Fig. 5.—Section of Microscope—A, Draw Tube of Lantern Front; B, Collar of Draw Tube; C, Body Tube of Microscope; D, Objective Mount; E, Objective Tube fitted with Lenses.**

to the front end of the body tube. The focal adjustment is secured either by simply sliding the tube containing the objective in and out of the jacket, or by means of a rack and pinion attached to the latter. In Fig. 2 the high power is shown inserted in the jacket or adapter; and Fig. 3 represents the low power mounted in the short tube. Fig. 4 represents a better form of lantern microscope provided with double stages (shown at A, A) and clamping screws for the same; also an objective working with a rack and pinion adjustment, B representing the extra power which can be inserted in the rackwork tube when required. Fig. 5 is a section of the lantern microscope illustrated in Fig. 1, showing the disposition of the various portions. In the better class of lantern microscopes the light emitted by the large condensers of the lantern is received by a supplementary achromatic condenser, which reduces the pencil of light to a proper size; then follows an alum trough and the object holder for 3 in. × 1 in. slides; and in front of this the magnifying apparatus as in a tube microscope, consisting of a special achromatic objective, and an eye-piece giving considerable amplification and a wide field. The pencil of light is adjusted by means of rackwork attached to the small condenser, and the image is received upon a tightly strained paper screen, the adjustment being completed by means of a rack and pinion in connection with the objective. The lime-light alone should be employed with the lantern microscope, as no other form of illumination is capable of supplying a light of sufficient intensity to produce good results. As the heat rays emitted by the source of light are very nearly brought to a focus upon the small microscopic slide, it becomes necessary to interpose a small tank, filled with a solution of alum, between the condensers and the object, in order to absorb the heat rays, and thus protect the object from damage. There are many other matters to be dealt with in the construction of a lantern microscope that render it impossible to properly treat the subject in the form of a reply. A paper may possibly appear at some future date. In the meantime, you will find some additional information in Mr. A. A. Wood's manual, entitled, "The Magic Lantern: How Made and How Used." A description of a superior form of lantern microscope for use with the lime-light appeared in No. 29 of *The Magic Lantern Journal*. Several papers on Lantern matters will appear in the next volume of WORK.—C. A. P.

**Receipt of Deposit.**—GARTON.—Our correspondent is quite in error in assuming the receipt of the *deposit* of the application for the grant of a patent is provisional protection. When the papers he has lodged have been examined and accepted, he will then receive the grant of provisional protection. As, however, he states that he is "his own agent," he may pretty surely count upon the return of his specification for correction or alteration, as it is quite impossible for anyone who has not had a practical training and experience in patent matters to produce a document which shall meet the needed requirements. The Comptroller of Patents stated in his evidence before the Committee that "the *bad* specifications, as a rule, will be entirely those made by the applicants themselves; and the *very bad* ones are undoubtedly made by the poor inventors. It is clear that, nine times out of ten, it is *impossible* for the poor inventor to draw up his own specification in English!" In a late case before Mr. Justice North, where it seems the inventor had prepared his own documents, the learned judge said, "The plaintiff *not having been wise* in preparing his own specification, the defendant was equally *unwise* in preparing his own defence." Mr. Justice Field has said, "We all know the *sad difficulties* in which inventors are placed by reason of *want of care*, and sometimes *want of knowledge*, in preparing their specifications and drawings. It is a branch of learning which I have never yet succeeded in acquiring, and probably my life will not be long enough to enable me to do so. Many and many a perfectly good and perfectly valuable invention has been *absolutely defeated* by some *little mistake* of the *most trifling description* in a claim which was, perhaps, of no value at all." It may be taken as a positive fact that an inventor is about the *worst* person to be entrusted with the unaided preparation and completion of the documents required for obtaining a valid patent, inasmuch as there are such a great number of points requiring careful attention, wide experience, extended practical knowledge and skill, and the power of expressing, in a correct and significant manner, *what* the invention is, and *how* it is to be practically carried out, and *what* has to be protected, with the knowledge of *how* this should be done, which very rarely, if ever, is found in an inventor, and nearly as seldom in not a few of the professed "obtainers" of patents; that every inventor and intending patentee cannot be too careful in his proceedings in this direction. It is quite true that the inventor or intending patentee *must* know better than anyone else *what* his invention is, *what* he wants to do, and *how* he proposes to do it; but it must not be forgotten that the mere fact of this being the case does not, therefore, qualify him for those duties which can alone be properly carried out by those who have devoted their time, thoughts, abilities, skill, and experience *specially* to this object. It might as well be argued that, because a man is owner of a steamship, he is therefore able to navigate her or to fulfil the duties of chief engineer, and take charge of the engines and machinery. An inventor who has received provisional protection for his invention should be very careful in his proceedings, for there may be a prior application for the subject-matter of his invention, the provisional specification of which may be wide enough to admit of the comprehension of his plan in the complete, and for this he has no remedy; unless he can prove that his invention came to the knowledge of the party, and was appropriated by him, he is nowhere. We should advise our correspondent not to treat with anyone until he has filed his complete and received notice of its acceptance, especially if his invention is novel, useful, and likely to be of public benefit. Why will inventors with no knowledge of patent matters, or experience in the required proceedings, meddle with what they know nothing about? Can they expect for one moment to achieve a successful result? or can they think that the existence of a mass of invalid, useless patents will cause the capitalist public to look with favour on what is always a ticklish kind of security to have to do with? It should not be forgotten that every *penny* saved (?) in having the documents *properly prepared* will generally be found to result in requiring the expenditure of a great many *pounds*, and, in nine cases out of ten, ending in the loss of the patent. It is to be hoped that increasing intelligence and understanding upon patent matters will convince

inventors and intending patentees that the possession of an invalid and useless patent is no advantage to the owner nor any security for a capitalist, and that in future they will see that it would be wiser to abstain from meddling in matters of which they are entirely ignorant and have had no practical experience.—C. E.

**Buying Lathe Heads.**—A. V. S. (*Westbourne Grove*).—You can buy a head-stock, poppit, and rest at a tool shop; they are regularly sold for carpenters, cabinet makers, etc., who wish to make wooden bed and frame themselves. You can also get them at shops where they sell second-hand machinery, or by watching the advertisements in WORK. Try Caplatzi. £2 should buy a fairly good set second-hand.—F. A. M.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Blowing Fan.**—WAREHOUSEMAN writes:—"Will any reader of WORK enlighten me as to the best fan or air propeller for clearing a large warehouse of its vitiated air?"

**Rubber Rings.**—INDIARUBBER writes:—"I shall be glad of information as to machines for cutting rubber in rings."

**Coal Dust.**—HOUSEHOLDER writes:—"I have—in fact, have long had—large quantities of coal dust in my cellars and outhouses. Will any reader tell me of the best means of utilising it, and what to cement it with, if I wished to do so?"

**Galvanised Iron.**—COLONIST writes:—"Will some reader of WORK mind explaining the process of galvanising iron—the pickling, spelter, galvanising, and corrugating?"

**Hollow Stay Bolts.**—ENGINEER will thank any experienced in the work to explain the rolling of hollow stay bolts.

**Rock-Boring Drills.**—MONT CENIS will feel obliged to any reader who will acquaint him with the best rock-boring drills—hand or steam—upon the market.

**Corrosion in Steam Boilers.**—AJAX writes:—"Will any expert give me the cause and remedy for this?"

**Phonograph.**—RALPHO writes:—"Will some practical reader oblige by giving full particulars and drawings of a phonograph? I think there are a great number of readers who are clever enough to make one."

**Enamelling Fretwork.**—G. F. R. (*Bournemouth*) writes:—"Will any reader give me any hints through 'Shop' as to the best way to enamel fretwork? I have tried a good many things, but they are not quite a success. I find that the enamel brings the wood out rough, especially cross-grain, no matter how smooth I make it first."

**Cutting Clothing.**—DODO writes:—"Would any subscriber to WORK give information as to cutting out men's clothing, or where a treatise can be purchased? A system such as the Cosmopolitan, which ladies use for cutting their dresses, would answer."

**Whip Handles.**—G. L. (*Westminster*) writes:—"Could a worker in the trade kindly tell me how to prepare holly-sticks for whip handles?"

**Venetian Blinds and Glass Mending.**—H. R. (*Chacewater*) writes:—"Will some kind reader tell me the best material for mending glass or china; also where I could get Venetian blind laths, punched or unpunched, wholesale?"

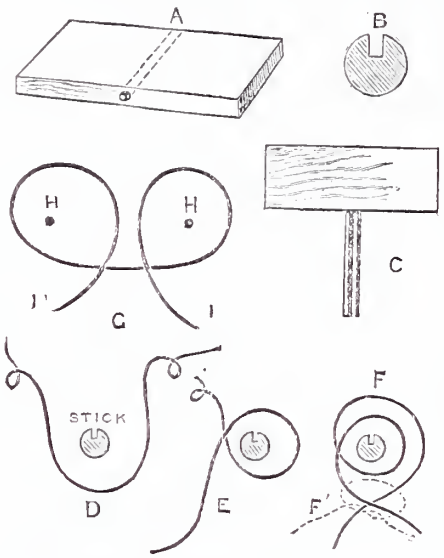
## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Brass Lacquering.**—L. L. H. (*Falmouth*) writes:—"As I understand L. M.'s query (see p. 637, No. 144), he wishes a pair of iron hames to appear as if they were of brass. This is practically impossible. If they are already covered with brass, and merely want re-lacquering, he could get it done through any good ironmonger, or even do it himself by polishing the brass-work thoroughly with Putz pomade, and then giving it a coat of the Silico Enamel Company's brassoline. If he is in any further difficulty about the matter, I should recommend him to write to one of the harness-making firms at Walsall, who would put him in the way of getting exactly what he wanted."

**Luminous Paints.**—EDDIFRA writes, in answer to R. R. (see p. 137, No. 144):—"Orange: 46 parts varnish are mixed with 17·5 parts prepared barium sulphate, 1 part prepared Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide. Green: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide. Yellow: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. Blue: 42 parts varnish, 10·2 parts prepared barium sulphate, 6·4 parts ultramarine blue, 5·4 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. Violet: 42 parts varnish, 10·2 parts barium sulpbate, 2·8 parts ultramarine violet, 9 parts cobaltous arsenate, and 36 parts luminous calcium sulphide. Grey: 45 parts varnish, 6 parts barium sulphate, 6 parts calcium carbonate, 0·5 parts ultramarine blue, and 6·5 parts grey zinci sulphide. Yellowish-brown: 48 parts varnish, 10 parts prepared barium sulphate, 8 parts auripigment, and 34 parts luminous calcium sulphide."

**Besom Makers.**—H. M. S. writes, in answer to L. S. D. (see p. 635, No. 144), asking for address of besom makers:—"I might say that they can be obtained from the Liverpool workshops for the Outdoor Blind, Liverpool, where they make them."

**Rope Door Mats.**—E. P. B. (*Penge*) writes, in answer to J. A. (*Southwark*) (seo p. 590, No. 141):—"There are many varieties of mats made from old rope, but from your correspondent's statement that he has 'tried pricking a bole through canvas, and putting rope through,' I imagine he means the kind known as 'thrummed mats,' in the manufacture of which a thrum board is used. It is constructed by boring a hole through the edge of a piece of 1 in. board (size of board may be about 18 in. by 6 in.), A, and driving into it a stick about 18 in. in length of which B is a transverse section. C is plan of board complete, and *modus operandi* is as follows: Having unlaid the strands of a piece of rope—preferably coir, but alternatively bemp or manilla—and again unlaid these strands into their constituent yarns, the board is placed upon a chair—groove up—and used as a seat by the operator, with the stick projecting between bis legs. He then, taking a length of yarn about a yard from its centre, and holding it in both hands, dips the bight under the stick, as at D; one end is then taken over and down (E); the other follows in same way (F). All is hauled taut, and an assistant—who sits facing the operator—with ordinary seaming twine ties an overhand knot at each crossing, as shown by dotted lines at F, keeping same tight up under stick. This is continued until stick is full, when a sharp knife is drawn along the groove in stick, cutting each bight, and leaving a stick-length of thrum sennit, which




Diagrams for Rope Mat Making.

is sewn into mats with palm, needle, and twine. The yarns, after unlaying, should be made up into lengths of, say, about 20 yards for convenience sake, with a split overhand knot. When only very short lengths of old rope are available, they may be used by stretching two yarns parallel to each other, and then (having previously cut all yarns to exactly the same length—about 3 in. or 4 in.) taking a hitch round the stretched yarns, as at G (where H, H, are yarns and I thrum), hauling well taut, and, in progress of work, driving yarns well together. There are also paunch, sword, sennit, and canvas mats, of which I could send description, but fear it would be too lengthy for 'Shop.' The latter, however, is simply made by threading a large roping-needle with yarn (working on the bight), and, having folded canvas into a ridge, sewing yarn through it over a round stick with groove in it, along which a knife is passed to cut bights of stitches, and thus form thrumming."

**Copying Apparatus.**—C. R. (*Ealing*) writes, in reply to C. F. C. (*Oldham*) (see p. 637, No. 144):—"The address of the Auto-Copyist Copying Apparatus Company is in London Wall, E.C."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—E. A. M. (*Stockwell*); N. R. W. (*Colne*); BLUE EARTH; W. C. (*London, W.C.*); S. S. (*London, W.*); N. B. (*Wellington*); R. T. W. (*Leicester*); S. C. T. (*Knutton*); S. J. (*Stockport*); H. R. (*Colne*); N. J. N. (*Birkenhead*); MODEL S. L.; A. R. (*Scorrier*); C. T. (*Bradford*); J. J. (*Park*); W. M.; C. G. M. (*Penistone*); R. M. (*Croydon*); A YOUNG BEGINNER; R. G. (*Settle*); LEARNER; P. E. J. (*Tipton*); W. H. (*Bradford*); S. E. C. (*Warrenley*); KALLITYPE; W. H. B. (*Hastings*); D. P. (*Birstall*); J. P. (*Jubbulpore, East India*); G. H. B. (*Horsham*); S. D. (*Harmondsworth*); W. S. (*Cambridge*); A. R. R. (*Yarmouth*); W. S. A. (*London, N.W.*); F. R. (*Stapleford*); K. L. (*Leeds*); H. E. L. (*Stockton*); W. J. R. McG. (*Sale*); G. E. B. (*Ipswich*); RUBBER; E. H. (*Bethnal Green*); W. H. C. (*London, S.E.*); J. W. (*York*); G. P. O. (*Clapton*); W. W. (*Brentford*); CORKSCREW; C. B. S. (*New Wortley*).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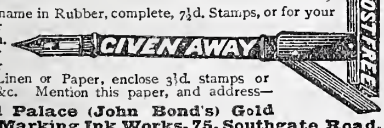


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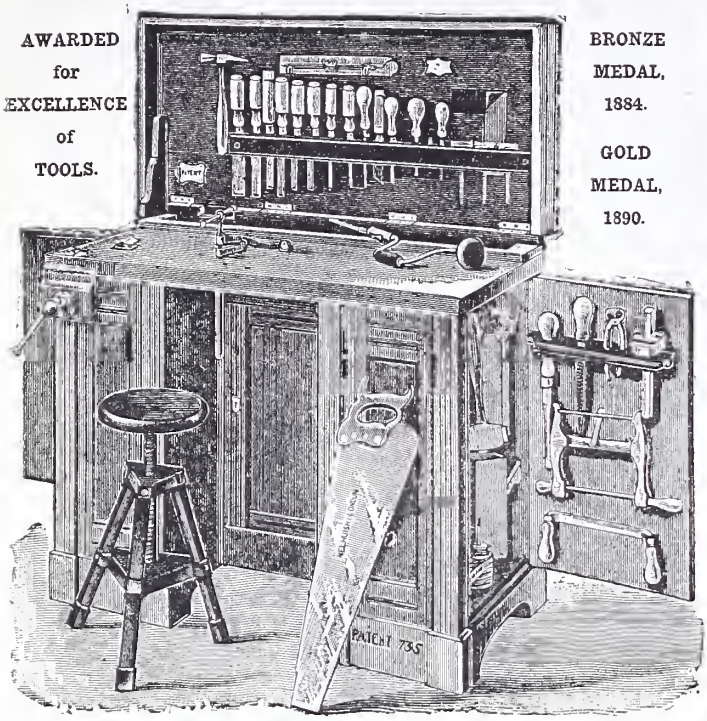


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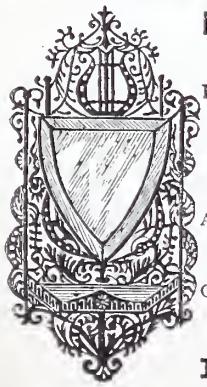

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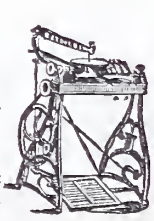

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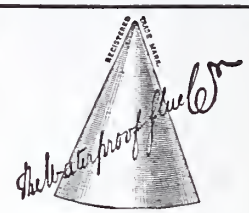


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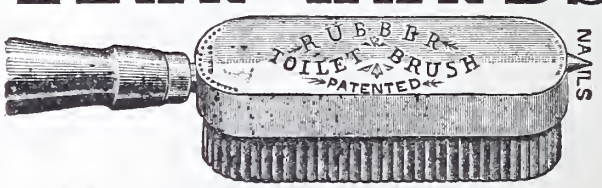


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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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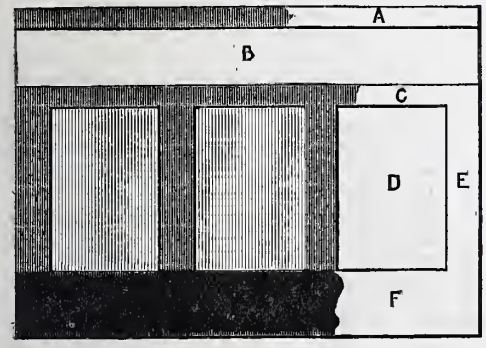
VOL. III.—No. 152.] SATURDAY, FEBRUARY 13, 1892. [PRICE ONE PENNY.

Fig. 1.

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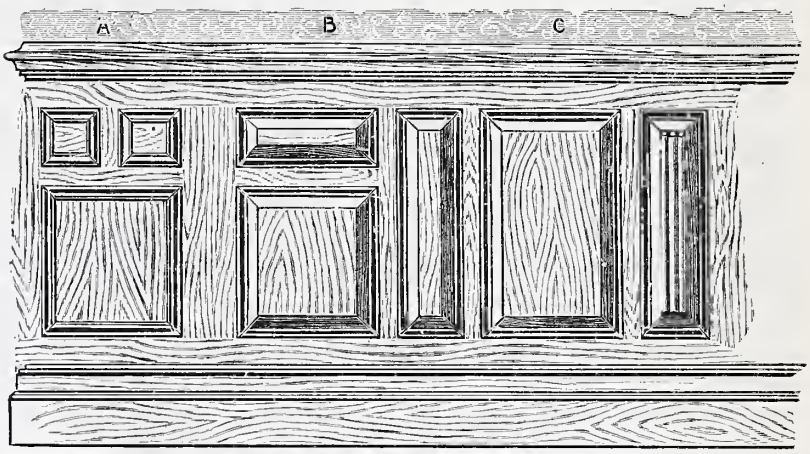


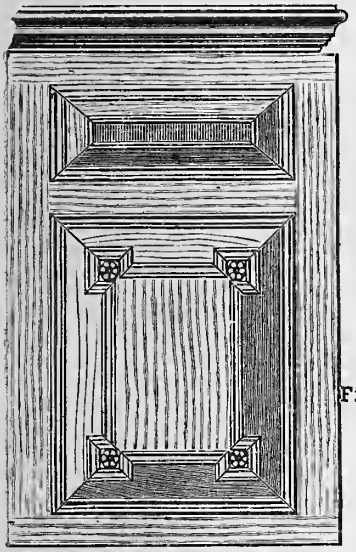

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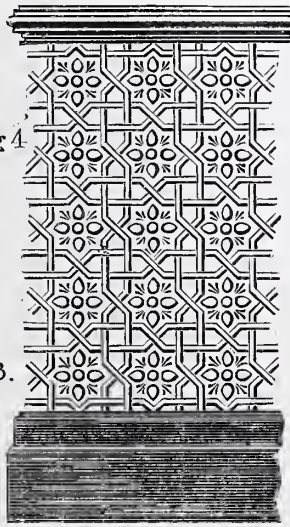

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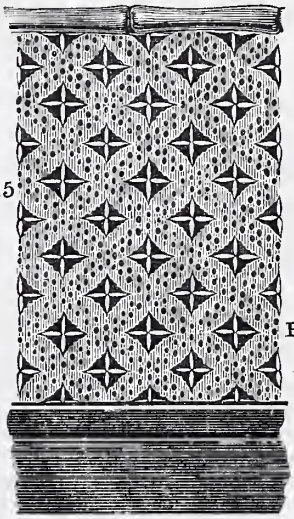

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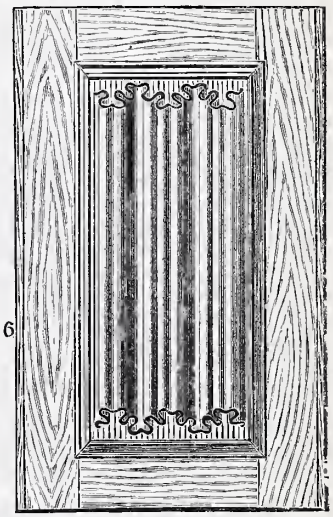

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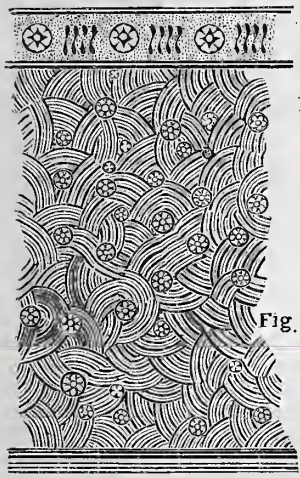

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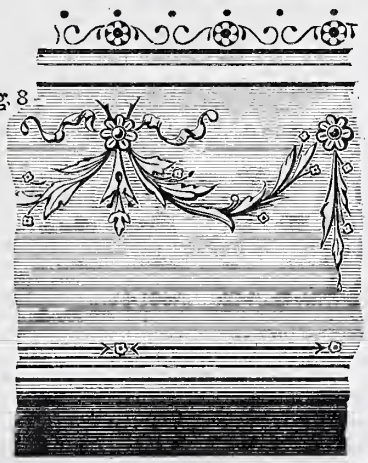

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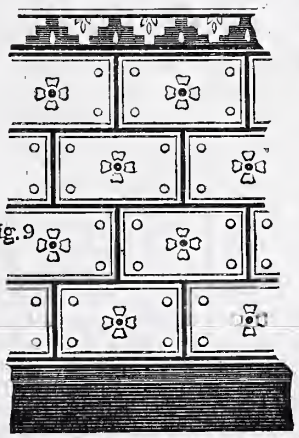

Fig. 10.

Fig. 7.

### A DISSERTATION ON WALL DADOES.

Fig. 1.—Diagram of Side of Pompeian House, after Owen Jones. Fig. 2.—Wood Dadoes: three Simple Panel Treatments, A, B, C. Fig. 3.—Anaglypta Dado. Fig. 4.—Ditto, Diaper Design. Fig. 5.—India Matting with Bamboo Dado Rail. Fig. 6.—Lincrusta: Imitation Carved Wood. Fig. 7.—Alabastine: Dado and Border, Simple Treatment. Fig. 8.—For Hand Painting. Fig. 9.—Gothic Dado and Border. Fig. 10.—Dado Borders for Stencilling over Plain Painted Dadoes. (Scale, ½ in. to 1 ft.)

## A DISSERTATION ON WALL DADOES.

BY FREDERICK PARSONS, F.S.Sc.

EXPLANATORY — RETROSPECTIVE — THE ANCIENT POMPEIAN DADO — RENAISSANCE — ELIZABETHAN — HANOVERIAN — MODERN DADOES: THEIR UTILITY — DECORATIVE VALUE — EXAMPLES OF MODERN DADOES IN VARIOUS STYLES AND MATERIALS.

IN some preceding numbers of WORK it has been my privilege to call its readers' attention to the subject of modern wall coverings, and in connection therewith to the province and value of colour. Therein we concerned ourselves with, respectively, the nature and qualities of materials, and the value of colour as a visual means of expressing and conveying sentiment. With a further view to making these fragmentary efforts a means of practical advice and assistance in their entirety, I purpose again to revert to the subject of materials, and therewith to deal, in a necessarily condensed form, with the general practice of dividing and sub-dividing wall surfaces into the divisions known as dado, filling, and frieze.

The dado, as a *common feature* of apartment and staircase walls, is an item of very modern and rapid growth. Ten years ago the technically "strongly flavoured dish" which my head-line suggests would scarcely have been considered interesting matter to such a heterogeneous mass as the intelligent readers of WORK. At that time "Lincrusta-Walton" was in its infancy; Japanese leather papers were the latest novelty amongst the high-price and West-End decorating firms; whilst "Anaglypta," "Alabastine," and many other strong claimants for attention to-day had then no commercial existence. If we are desirous to know what factor has caused the dado to become a "common hack," we have only to consult the enterprising paper-stainer's book of next spring's goods, and find therein dadoes, borders, and fillings, "made to match," at a retailing price of less than 6d. per roll of twelve yards. Well, I suppose none of us need feel personally aggrieved at this "levelling down" of an ancient and honourably connected feature. No one is materially the worse if Mrs. McCarthy, with natural envy of Widow Malony's "illigant dado," hies herself forthwith to the local glass, putty, and paper shop, and makes a like purchase. Not in the least. But very few of us can forbear making mental comparisons between "mind and matter," when, as is often the case, we find these cheap and usually pleasant wall coverings a direct antithesis to the crumbling structure, filthy and unwholesome surface, that lies beneath their bright exterior. "As we sow, so must we reap;" and therefore, if by reason of unrestrained judgment the paper-stainer makes worse than common the association of his "wall papers, with dadoes to match," the discredit, as well as commercial ill-effects, must be borne by them also.

*Retrospective.*—In order to remove from the mind such prejudice as the above-mentioned circumstance may raise, and to gather some idea of the respect that is due to our subject, we must turn back the pages of time, not merely ten or a hundred years, but to the dim past ages of the great Roman Empire—to the period when those beautiful cities, Pompeii, Stabiæ, and Herculaneum were so tragically buried beneath the streams of molten lava and showers of cinders vomited forth on the 24th of August, A.D. 79, by that monster of destruction Mount Vesuvius.

Although it is probable that were we to explore minutely the still more ancient remains and records of Egyptian, Chinese, and Grecian decoration, we might come across earlier examples of dadoes—sur-base divisions—on wall surfaces; nevertheless, it was not until the ancient Roman artists—and particularly those of Pompeii—worked out their elaborate and fanciful schemes of painted wall decoration that the dado became as definite an interior division as the pilaster and frieze.

The Pompeian treatment, as will be seen on reference to the diagram Fig. 1, did not consist only of a horizontal line, which merely divides the wall flank into two (upper and lower) divisions—now termed by us *filling* and *dado* respectively—but the latter was really the superficial and decorative sur-base of one complete effect. We may not stop here to analyse the proportion of dado to panel (or filling), of panel to pilaster, and so forth. It is, however, advisable to point out that considerations of utility had little or no place in the arrangement of the sub-divisions or their subsequent embellishment. Like as in the Japanese and the Italian Renaissance styles of design and decoration, the Pompeian artists studied to produce effects pleasant simply to the senses—the æsthetic province of decoration. Those amongst my readers who apparently, like the contributor of a certain tirade against purely ornamental beauty of design, have not yet learned to appreciate anything but *phonetic—mind-speaking*—ornament, should not fail to spend an entire day in that beautiful reproduction of a Pompeian house at the Crystal Palace.

Fifteen hundred years after these classic Roman ages, Italy was stirred throughout by a re-awakening—Renaissance—of art and architecture. Then were the sites of ancient cities and the remains of classic art fully explored, and the artistic work of those middle ages was consequently much influenced by the discoveries and studies relating thereto. It is not to be wondered at, therefore, that we find elaborate division and painting of wall surfaces a special feature of also the Italian Renaissance decorations.

*The Elizabethan style* of ornamentation was to a great extent an offshoot of the Renaissance, and in this period dadoes and high-panelled wall divisions were much in vogue. Although it might be suggested that a wooden dado notion is such as might have come naturally to the mind of the native Elizabethan architect—at a period when the English oak and a good stone wall were the chief building considerations—it is more probable, one would think, that the custom was brought over from the Lowlands—a sign as definite as the Elizabethan ornament itself of the influence of the *Flemish* phase of the great Renaissance.

*The Hanoverian period*, although anything but remarkable for its contemporaneous works of architectural or decorative excellence, brings to our minds the influence and life's work of two eminent architects—the Brothers Adams. We cannot now discuss the purely artistic merit of the interior ornamentation originated by these men of much respected memories; it is sufficient here to note that the arrangements of design alluded to are noticeable in their prominent display of panelled and sub-divided surfaces, also by a lightness and delicacy—almost to frivolousness—of the ornamental detail; and, further, in natural connection with the first characteristic, a general use of dado and frieze. From all this it is evident that the Pompeian style was a source of inspiration to the Adams Brothers in all respects—save that of the degree of conventionalism in which the detail was drawn and the substitution of ornamental *relief* form for the strong, sensuous colouring of the ancients.

With the foregoing cursory glance over the historial associations of the dado we must rest content—our work is of the present, not the bygone ages.

In dealing with the *modern dado* and its "thousand and one" variations of style, material, and treatment, one's professional experience—at all times subject to some limitations—is here the only source to be drawn upon. If the memory is taken back to the days immediately preceding the introduction of Lincrusta-Walton, now approaching twenty years, the influence of the Adams' style was still very marked. In the West-End districts of the metropolis, and encased within the ugliest of square brick-built houses, beautiful designs of the above type were repeatedly met with, and, in fact, many are still preserved. With these examples continuously before him, the modern professional decorator quickly availed himself of the dado division as a means of contrast and decorative display for the new materials—which productions, by reason of their expense or great richness and elaboration, it was not expedient to hang all over the walls. Having now defined the source of the modern dado's popularity—fashion, alas! being almost as rampant in house decoration as with ladies' clothing—it is superfluous to trace it through the various stages of rarity and generality down to the before-mentioned depths of trashy degradation and misuse. There is still one minor feature in connection with dadoes yet unmentioned. For many years past it has been an occasional plan with builders to divide a parlour wall by a "chair-rail." The fixing of these bands of more or less moulded wood-work—usually of anything but an elegant nature—for the purpose of preventing the tops of the chair-backs from knocking the plaster wall, although, no doubt, adopted as a "clever notion," is not a very commendable practice. A chair-rail proper is a piece of moulding fixed at the *base of the skirting*, where it answers the purpose equally well in keeping the chairs from the wall. Again, the height of a chair-back is scarcely a guide for the proportion of dado to filling—anything but that—whilst the notion of getting first the chairs, then the wall to suit the chairs, suggests some very absurd combinations. It is, therefore, scarcely fair, I think, to the modern dado to associate its origin with the old chair-rail.

*The utility of the modern dado* is a subject presenting a twofold aspect: viz., first in connection with "wear and tear," and secondly, that relating to its usefulness as a purely *decorative* feature. There is, however, at least *one* leading principle common to the introduction of both, and this—*that the more the lower portion of a room wall is likely to be hidden by furniture the less suited is the apartment for a dado.* Simple and common-sense enough as this principle is, one seldom finds it carried out in practice. We may often see in a modern house the dining-room dado panelled all around alike, so that when the occupier's sideboard and buffet is *in situ* many yards of expensive panelling is hidden. Had the architect used a commensurate amount of time and material for making an inexpensive fixed sideboard in character with the dado, both the artistic and commercial issues would have profited. Again, in the modern drawing-room, dadoes have been "pushed" alarmingly by the paper-stainer, whereas the expense is literally thrown away; half, or

more, of the dado is unseen, and even that latter portion, instead of serving as a foil and background to the best furniture and accessories, more often detracts from the shape and outline of such goods. It is thus patent to us that the usefulness of the dado division not only varies with different apartments and the uses to which they are put, but is further intimately concerned with the style and arrangement of the furnishing. In connection with the homes of the "masses," a dado division will prove very economical for staircase, passage, and kitchen. Nothing can compare with a light and cheap filling division of distemper, both for effect and cleanliness; and when the surbase is painted either a darker tone of the same colour or a dark contrasting colour, wear and tear is well provided for. The practice of pasting paper over paper until it forms one mass of putrefying vegetable nastiness has probably caused ten times more sickness than ever the presence of arsenic in wall papers has been responsible for. Cheap papers are more related to the percentage of interest on house property investments than to any other artistic or useful consideration. If every dwelling-house had the same attention from Government inspectors as is given to the workshop and factory, many would benefit therefrom. We should certainly have better finished walls, lighter and more cheerful interiors, and far purer air to breathe if the cheapest wall paper cost 2s. 6d. per roll, for it would then be recognised, of necessity, that plain tints of distemper formed the best cheap covering.

*The decorative value of the dado*, although a subject of less practical interest to my readers, calls for a few sentences. In the first place, the base division of a wall breaks up the monotony of the surface mass. The dado, however, has no material connection or association with the *build* of the wall. Even with costly wooden dadoes these are always attached as accessories, surface treatments, and as such must be considered part of the furnishing. One of the effects of a dado is to convey a snug, "closed-in" sentiment, and which, when carried to extremes of proportionate height, gives the impression of "sitting in a well." Therefore, by reason of the horizontal *tendency of line*, the feeling of *sur-base support*, and the *scope for contrasting colour*, the dado as a purely decorative factor is invaluable in the embellishment of our homes. In design they should never be "patch-worky," *repose* being a desideratum. Where there is full scope for display a dado of rich-looking relief material is very effective, care being taken that the form of the furniture is always helped by the contrast of pattern as well as tone. Imagine a shaped wooden chair-back placed against a dado space covered with a stiff design of something between a Chinese puzzle and a Gothic ceiling pattern, and you will understand "what not to do," my reader. With regard to *colours* combined with pattern, the fewer the better in a dado. Next to one general colour, the most suitable treatments are soft monochrome effects, whilst all strong subdivisions of line or assertive contrast in colour, and—unless in the nature of a highly raised leather paper—all gilding and metallic colours should be avoided for the dado of an *ordinary apartment*.

*The examples of modern dado* materials which are given on page 753 should serve to emphasise some of the various points I have herein drawn attention to. Their height, it will be observed, varies considerably, but in dealing with the average room the height of the top of the door lock-rail gives a useful proportion of filling and dado. The latter should never, unless with high wooden panelling, come above the mantelpiece, and the aim should always be to work in the line of rail, or top border, with some pre-existing structural feature of the room. Beyond mere consideration of colour and oil paint, the materials adaptable to dado purposes are innumerable. American oil-cloth, India matting, cretonnes, Turkey twills, brown paper (bought in continuous rolls and finished with painted decoration), plain "oil-grounded" papers, and the great variety of ordinary wall papers, Lincrusta-Walton, Willesden paper, Tectorium, leather papers, Alabastine, Anaglypta, and many more could be added to the list. Our worthy Editor will surely say, "Hold! enough!"

## THE WINTER ELECTRICAL MACHINE AND ACCESSORY APPARATUS.

BY CHAS. A. PARKER.

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THE *Gold Leaf Electroscope*, which is depicted in Fig. 56, will be found a most useful piece of apparatus to possess when studying the phenomena of induction, or for the purpose of detecting minute charges of electricity. It consists of a couple of narrow strips of gold leaf attached to a flattened piece of brass rod, to the upper end of which a flat disc of metal is affixed, the leaves thus prepared being enclosed in a glass jar mounted on a wooden stand. For the glass jar an ordinary chemical deflagrating jar will be found to answer very well; or, failing this, a "comet" pattern domestic lamp chimney may be made to serve the purpose fairly well. It will be necessary to employ the largest size of this pattern chimney, which will measure 6½ in. high and 2½ in. diameter; any oilman or ironmonger can supply these at about 3d. each.

When a suitable glass jar has been procured, the next proceeding will be to provide it with an ornamental turned wooden base, which should be furnished with a slight groove, into which the glass may fit. In the absence of anything better, the base may be made in a simple manner from a cigar-box lid by cutting out a couple of discs, one of which is made to just fit into the jar, with the other one about ¾ in. larger. These two discs may now be glued and clamped together firmly, and when dry, a disc of foil of suitable size is pasted on to the upper surface of the smaller disc. A couple of narrow strips of tinfoil—about ½ in. wide, and nearly half the height of the jar—should now be pasted inside the glass jar on opposite sides, in order to serve as a means of discharging the gold leaves if they should become overcharged at any time.

We shall now require a 5 in. length of stout brass wire, one end of which should be softened in a gas flame, and then bent to the form shown in Fig. 57, the lower portion being hammered quite flat, in order to afford an attachment for the gold leaves. A small disc of brass must now be soft-soldered to the bent portion of this wire in the manner indicated by the dotted lines in Fig. 58, and when this has been done it will be necessary to insulate the wire, and then fit it into the cap of the jar. The wire is heated in the centre, and then provided with a thick cylindrical coating of shellac, which should be made to flow evenly round the wire for about a couple of inches along its length, being rolled whilst hot between the fingers until of a uniform diameter, about the thickness of an ordinary cedar pencil. Thus prepared, the whole is inserted in a hole previously bored in good sound cork of a suitable size to fit into the opening at the top of the jar. If desired, a small turned wooden cap may be glued on to the cork, in order to form a better finish.

The wire will now be ready to receive the gold leaves, which, by the way, should be the real article, and not Dutch metal, as the latter is much too harsh for our purpose. A leaf of gold should be gently coaxed from its containing book on to a sheet of clean note-paper, which is then folded and cut into strips about 2 in. long and ½ in. wide, using a pair of sharp scissors for the purpose. Both sides of the flattened end of the brass rod should be moistened with just a trace of glue or gum, after which the two strips of gold leaf are attached to the rod with the greatest possible care. It will be necessary to hold the breath while the leaves are being manipulated, otherwise they may become crumpled and blow away. When ready, the wire should be quietly and gently introduced into the jar, with the leaves hanging perfectly parallel to the foil strips attached to the sides of the jar. It is necessary that the leaves should be just clear of the glass on either side when they are greatly diverged.

The glass should now be cemented on to the wooden base, after which the air should be sucked out of the interior by means of a glass tube inserted in a hole bored for the purpose through the cork, the aperture being closed with a dab of sealing-wax immediately afterwards. It will add considerably to the appearance of the instrument if the under-side of the disc and the top of the cork or cap is painted over with a coat of red sealing-wax varnish.

A *Proof Plane* (which is shown in Fig. 59) will be found very useful to employ when charging the electroscopes. It can be readily made by simply cementing a brass knob or thin disc of sheet brass with perfectly smooth edges into a suitable length of glass tube of small size and bore, as shown in the illustration.

The *Pith Ball Electroscope* (see Fig. 60) is another form of electroscope, which may be readily made in the following manner: One end of an 8 in. length of soft glass tubing, ¼ in. in diameter, is first drawn out to a fine point in a Bunsen flame, and is then bent in the form of a curve, with a small hook at the end, as shown in Fig. 60. Thus prepared, the larger end is cemented into a hole bored for its reception through the centre of a small ornamental turned wooden base, which is afterwards painted with enamel spirit varnish. This done, the pith ball is suspended from the hook of the supporting stem by means of a single filament of "cocoon" silk, which is drawn through the ball by means of a needle, and then knotted at the end.

The *Horizontal Electroscope* depicted in Fig. 61 is another description of electroscope, which takes the form of a straw balanced on a needle-point mounted on a short length of glass tubing, and attached to an ornamental turned wooden base. First prepare a small turned wooden base about 2½ in. in diameter, and then provide this with a hole in the centre, into which a 2 in.

length of soft glass tube is cemented. Previous to the tube being cemented into the base, draw out one end to a fine point by means of a Bunsen flame, and then, holding a small sewing-needle point outwards in a pair of pliers, proceed to fuse the thick end of this into the drawn-out end of the glass tube, being particular to see that it is quite true with the tube.

The glass stem having been cemented into the wooden base, the latter should receive a coat of spirit enamel, after which it will be ready for the straw. For this we shall need a perfectly straight 9 in. length of sound wheat straw, which will require to be mounted on a small metal pivot to act as an axis. To make this pivot, take a piece of stout brass wire, and having first filed one end to the form of a cone, cut off a $\frac{3}{16}$ in. length, and then drill a small hole longitudinally towards the apex of the cone, afterwards cementing the pivot thus formed into a hole burnt through the middle of the straw by means of a hot wire, after which a small pith ball is glued to either end of the straw. This hole in the pivot will naturally require to be drilled perfectly true, in order that the straw may balance correct, and be capable of twisting round at the slightest influence.

The *Pith Balls* above mentioned can be readily cut to the spherical form from a piece of perfectly dry elder pith, using a very keen razor for the purpose. When cut, the balls may be gently rolled beneath a flat board, in order to remove any little irregularities of surface, care being taken not to crush them. Bundles of pith, suitable for this purpose, can always be obtained from any watchmaker's tool warehouse at 2d. each.

*Henley's Quadrant Electrometer* (shown in Fig. 62) will be found a very useful instrument for ascertaining the tension or amount of electricity collected on the prime conductor. It takes the form of a graduated semi-circle of ivory or celluloid attached to a vertical rod, which can be readily mounted on the prime conductor of the machine. From the centre of the graduated disc a light pith ball is hung on a pivot, and as the latter flies up the scale as the machine is worked, it is considered to indicate the amount of electricity developed. The graduated scale may be prepared from a thin piece of mahogany, cedar, celluloid, or vulcanite, which is carefully cut to the semi-circular plan shown at A in Fig. 63, with a slight projection at either end, in order to provide for its subsequent attachment to the supporting stem.

The component parts of the electrometer are shown full size in Fig. 63, but if desired, it can be made larger or smaller, provided that the dimensions are kept proportionate.

Having got the scale roughed out, take a pair of compasses and strike out three semi-circles, about $\frac{1}{8}$ in., $\frac{1}{11}$ in., and $\frac{1}{16}$ in. distant from each other, after which all the divisions should be carefully marked in black, red, or Chinese white, according to taste. A small piece of thin sheet brass is now cut to the plan of B, Fig. 63, and afterwards bent into the form of a tubular hinge, in which one opening crosses the top of the other, as will be seen by reference to C, Fig. 63. This hinge is now pivoted in the axis of the scale by means of a short brass pin or stud riveted into a hole prepared for its reception in the scale, care being taken to see that the hinge moves with perfect freedom.

The scale is now fitted tightly into a slot of sufficient length and width, which is filed half-way through a $4\frac{1}{2}$ in. length of brass tube of small diameter (D, Fig. 63), after which a small brass ball (E, Fig. 63), provided with a hole of sufficient diameter, is made to fit over the upper end of the tube, thus securing the scale in position, an ordinary brass screw (F, Fig. 63) being finally soft-soldered to the lower end of the tube, in order to afford a means of attaching the electrometer to the prime conductor of the machine. A very thin round match (G, Fig. 63) or a sound straw is now cemented into the opening in the central hinge with a small pith ball (H, Fig. 63) affixed in a like manner to the lower end of the match. It will also be found convenient to have a small turned wooden base on which to support the electrometer when not in use.

The *Spangled Tube*, or luminous hand spiral, illustrated in Fig. 64, is a very interesting piece of apparatus for showing the effects of the discharge when passed through a series of small bodies nearly in contact. Take an 18 in. length of $\frac{1}{2}$ in. or $\frac{3}{4}$ in. soft glass tubing, and having carefully cleaned the inside by means of a piece of rag tied to the end of a string and drawn through the tube, warm the air contained within the tube in order to dry it, and then tightly fit a good sound cork into the opening at either end, afterwards cutting the ends off flush with the edges of the tube.

Now take a sheet of tinfoil, and having laid it on a metal surface (preferably zinc) cut off a few strips $\frac{1}{8}$ in. wide by the aid of a keen-edged penknife and a ruler, being careful to cut the foil perfectly clean and free from ragged edges. Thus prepared, the strips of foil are stuck round the glass tube in a spiral form by means of shoemaker's paste, care being taken to lay them on the glass perfectly true and free from creases, after which any superfluous paste is wiped off with a damp cloth, and the tube placed aside until quite dry. When thoroughly dry, the foil must be cut up into a series of hexagonal pieces by means of the penknife drawn across the strips in the manner shown in Fig. 65, in order to remove all the shaded portion shown in the above illustration.

As the glass rapidly blunts the knife, it will be necessary to frequently sharpen it on a hone. At this stage of the proceedings one end of the tube will require to be provided with a brass ball of suitable size: an ordinary ottoman ball will be found to answer the purpose admirably, as the screw stems with which these balls are provided will enable it to be screwed into the cork of the tube, care being taken to see that it is in metallic contact with the foil. The other end of the tube should have an $\frac{1}{2}$ in. strip of foil pasted round the glass, with about $\frac{1}{8}$ in. turned over on to the cork, and a small disc of foil pasted over the flat end. It will also be found convenient to have an ornamental turned wooden base on which to support the tube in a vertical position.

The *Luminous Name-Plate*, depicted in Fig. 66, is a slight modification of the spangled tube, by means of which it is possible to show illuminated names or devices, which have a very pretty effect when viewed in a darkened room. The design or word is formed by pasting a number of small hexagonal pieces of foil on to a sheet of glass of suitable size, with horizontal strips of foil pasted in lines across the glass, in the manner shown in Figs. 66 and 67. Thus prepared, the glass is mounted in a wooden frame, which is supported on a glass stem attached to an ornamental turned wooden base. A small brass knob is now affixed to one of the upper corners of the frame in contact with the top horizontal lines of foil, and a small hook is attached to the opposite lower corner in a similar manner. In use, the discharge is passed in the usual manner from the upper knob along the horizontal lines of foil, and out by means of a piece of chain suspended from the hook at the lower end of the frame.

The *Electrical Swing* and *See-saw*, shown in Figs. 68 and 69, are a couple of amusing pieces of apparatus for showing the phenomena of attraction and repulsion. Taking the swing first, a piece of sound dry mahogany, measuring 6 in. by 4 in., is carefully planed up on the face and edges, and then provided with four supporting feet in the usual manner. This done, a couple of 7 in. lengths of glass rod, $\frac{1}{2}$ in. in diameter, are cemented into a pair of turned wooden sockets furnished with short projecting pins, in order to provide for their subsequent attachment to the base. Two small hollow brass ottoman or stool balls, of a suitable size to fit over the tops of the glass rods, are then provided with small brass hooks, which are soft-soldered into holes drilled for their reception in the side of each ball, after which the latter are cemented on to the upper ends of the glass supports.

The projecting pins of the wooden sockets of the glass rod are now glued into a couple of holes prepared for their reception on opposite sides of the base, with the hooks of the brass caps facing each other on the inside. A small brass ball is next soldered to one end of a 2 in. length of stout brass rod, the other end of which is then pointed by means of a file, and afterwards pushed firmly into the wood-work at one end of the base. When this has been done, another hollow brass ball is provided with a small brass hook in the manner before described, and is then cemented to the end of a 2 in. length of glass rod, which is afterwards glued into a hole of suitable size, bored for its reception, at the other end of the base.

A small pith figure, cut and painted to form a neat little doll, about $1\frac{1}{2}$ in. in height, is now mounted on a thin flat piece of pith, which forms the seat of the swing. This figure is afterwards slung between the two insulated pillars of the stand by means of a silk thread passed underneath the seat of the swing, and up through a couple of holes on either side, the upper ends of the silk terminating in small loops, by which it is suspended from the hooks of the insulated supports.

When in use, the swing is connected with the machine by means of a short length of chain, brought from the prime conductor, and hung from the hook of the conducting rod at the back of the base, another piece of chain being suspended from the insulated ball at the front of the base, in order to provide the necessary earth contact. If properly adjusted, the figure will steadily swing backwards and forwards during the time that the machine is worked.

The *See-saw* (which is represented in Fig. 69) is but a modification of the swing just described, and is of extremely simple construction, as will be understood by reference to the above-named cut. For the base, a piece of mahogany, 10 in. by 3 in., is carefully smoothed by means of a plane, and then provided with four supporting feet as usual. This done, a couple of 3 in. lengths of in. glass rod must be cemented into suitably turned wooden sockets, each of which should have short projecting pins turned underneath, to enable them to be glued into a couple of holes bored through the base—on opposite sides—by means of a centre-bit.

When these two supporting pillars have been attached to the stand, two short brass

Fig. 56.

Fig. 57.

Fig. 58.

Fig. 59.

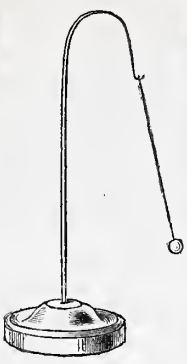


Fig. 60.

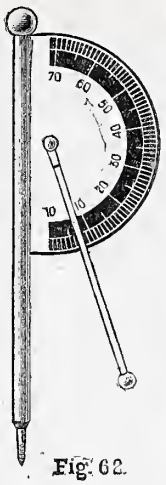


Fig. 62.

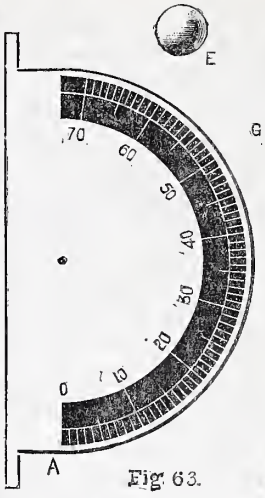


Fig. 63.

Fig. 65.

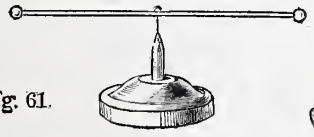


Fig. 61.

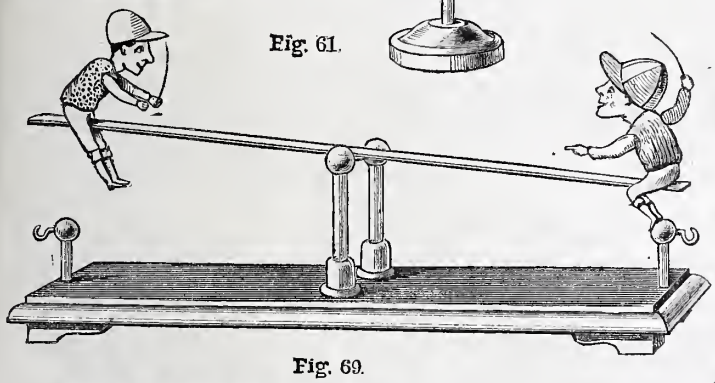


Fig. 69.

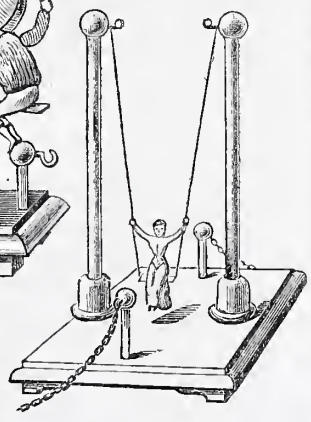


Fig. 68

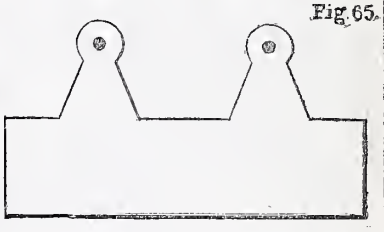


Fig. 73.

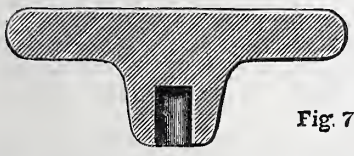


Fig. 76.

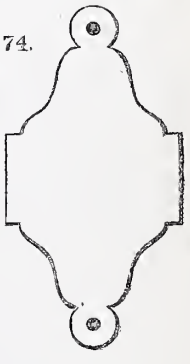


Fig. 74.

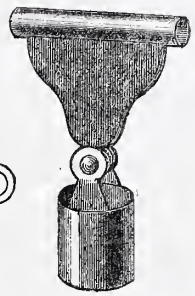


Fig. 75.

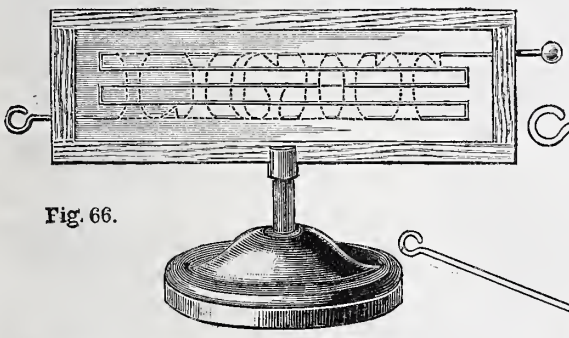


Fig. 66.

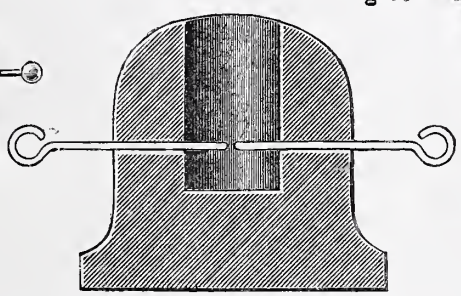


Fig. 70.

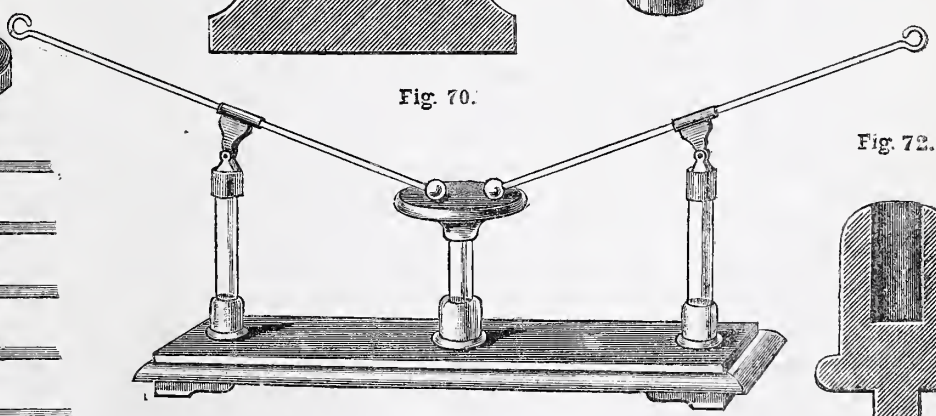


Fig. 71.

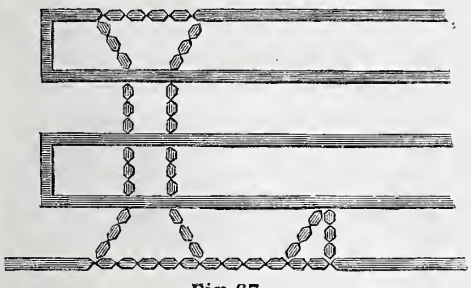


Fig. 67.

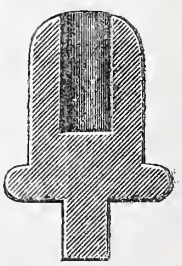


Fig. 72.

Fig. 56.—Gold Leaf Electroscope. Fig. 57.—Bent Wire Support for Leaves. Fig. 58.—Table attached to Support. Fig. 59.—Proof Plane. Fig. 60.—Pith Ball Electroscope. Fig. 61.—Horizontal Electroscope. Fig. 62.—Henley's Quadrant Electrometer. Fig. 63.—Component Parts of Electrometer—A, Graduated Scale; B, Plan of Central Hinge; C, Completed Hinge; D, Supporting Stem; E, Hollow Brass Cap; F, Screw for Stem; G, Index or Pointer; H, Pith Ball for Index. Fig. 64.—Luminous Hand Spiral. Fig. 65.—Enlarged Detail of Foil. Fig. 66.—Luminous Name-Plate. Fig. 67.—Enlarged Detail of Letter. Fig. 68.—Electrical Swing. Fig. 69.—Electrical See-saw. Fig. 70.—Electrical Mortar. Fig. 71.—Henley's Universal Discharger. Fig. 72.—Socket for Glass Pillar. Fig. 73.—Plan of Brass Cap. Fig. 74.—Plan of Brass Hinge. Fig. 75.—Cap and Hinge complete. Fig. 76.—Section of Table.

hooks should be fitted and soldered into holes drilled through the sides of a couple of hollow brass balls, which are afterwards cemented to the ends of a pair of 1½ in. lengths of glass rod, these rods in turn being cemented into holes prepared for their reception at either end of the wooden base. A very thin lath of dry wood, 10 in. in length and about 1 in. wide, must now be pivoted between the two insulated supports by means of a darning-needle thrust through the width of the wood exactly in the centre.

A couple of hollow brass balls of suitable size, to fit the supports of the plank, should now have a small hole drilled through the side of each, after which they are cemented on to the upper ends of the supports, with the strip of wood pivoted between them by inserting the ends of the needle in the holes in the brass balls. The see-saw is finally completed by gluing a suitably carved pith figure on to either end of the balanced plank, after which it may be set in motion, in a similar manner to the swing previously described, by means of a couple of short lengths of brass chain hooked on to the conducting knobs—one of the latter being placed in communication with the prime conductor, and the other with the earth.

An *Electrical Mortar* (shown in Fig. 70) is employed for the purpose of exhibiting the deflagrating powers of the discharge. It is formed from a block of hard wood, about 2 in. square, which is turned in a lathe to the form shown in the cut, and then provided with a hole ¾ in. in diameter, which is bored from the upper side through to about half the thickness of the wood. A couple of short lengths of brass wire are now bent in the form of a small ring at one end by means of a pair of pliers, and then rounded off at the other extremity by the aid of a file. Thus prepared, they are now tightly fitted into a couple of holes bored through the block on opposite sides at ¾ in. below the mouth of the mortar, as it may now be called.

When ready, the mortar may be charged with a mixture composed of equal parts of chloride of antimony and chlorate of potash, which should be separately powdered, and then mixed together carefully by means of a feather. It is important to crush these substances separately; otherwise, if they are pounded together the mass will be inflamed. A sufficient quantity of the powder is put into the mortar to just cover the two conducting wires, one of which is now attached to the outer coating of the Leyden jar or battery, and the other to the discharging rod, by means of short lengths of brass chain, and when the discharger is brought into contact with the inner coating of the jar or battery, it will cause the charge to pass and fuse the mixture.

In *Henley's Universal Discharger* (which is represented in Fig. 71) will be found an almost indispensable piece of apparatus for use with the Leyden battery. The base should be prepared from a piece of sound dry mahogany, ¾ in. thick, carefully planed to measure 10 in. by 4 in., and then furnished with three holes, which are bored through the wood by means of a ⅜ in. centre-bit, one being situated in the middle of the board, with the others at about an inch from either end. Three small ornamental wooden sockets to receive the supporting glass rods are now turned in a lathe to the form of Fig. 72, and then fitted into the holes in the base by means of the short projecting pins. The openings in the sockets should have a depth of about 1 in. and a diameter of ⅝ in., and as soon as they are ready a 2 in. length of ½ in. glass rod may be cemented into the central socket, with a couple of 4 in. lengths of the same diameter for the other two.

When this has been done, it will be necessary to prepare two hinged caps for the upper ends of the last-named glass supports. For each of these, mark out and cut a piece of moderately stout sheet brass to the plan of Fig. 73, then bend the piece of metal thus obtained round the glass rod, and afterwards solder the seam neatly together, thus forming a metal cap with two projecting leaves. The tubular portion of the hinge is now formed from another piece of sheet brass, which is marked and cut to the plan of Fig. 74, and then head round a piece of $\frac{3}{10}$ in. brass rod, after which the two leaves are soldered together, in order to make the hinge as solid as possible. The two portions of the hinge thus formed are now riveted together by means of the head, and a short portion of the stem of a brass screw, which is passed through holes bored for its reception through the outer extremity of each portion. When completed, the hinges, which will present the appearance of Fig. 75, should be cemented on to the upper ends of the two onter glass supports of the base, after which they will be ready to receive the two metal arms.

For each of these arms a 10 in. length of brass rod, about $\frac{3}{10}$ in. thick, should be bent in the form of a small ring at one end, and then pointed at the other extremity, after which the pointed end of each arm should be tapped to screw into a small ½ in. brass ball. It is necessary for these balls to be removable, as it is sometimes desirable to screw others in their place. As soon as the arms have been completed, the glass supports to which they are attached may be made a fixture to the base, and when this has been done a small mahogany table, 3 in. in diameter, should be turned in a lathe to the form of Fig. 76, with a short socket on the under-side, which is made to fit the upper end of the central glass stem of the table. A longitudinal or circular recess is now cut in the upper surface of the table, into which a piece of ebonite is carefully cemented, after which the surface must be accurately levelled, and the table finally cemented on to the upper end of the glass supporting stem.

The table should not be cemented into the central hole of the base, as it is sometimes convenient to remove the table altogether for the performance of certain experiments. It is also usual to provide a small screw press, which is capable of being attached to the base in place of the table, as may be required.

This press consists of a pair of small mahogany boards, mounted in a horizontal position on a glass stem, in a similar manner to the inlaid table above described, but provided with a couple of vertical adjusting screws and wing nuts, which are affixed to the lower board at either end. The body through which the charge is to be sent is placed in position between the press, the screws of which are then tightened and the discharge passed in the usual manner. Correctly speaking, the arms of the discharger should be mounted on the supporting stems by means of ball and socket joints, but for all ordinary purposes of the amateur experimentalist the above modification of this form of joint will be found to answer extremely well.

*Numerous experiments* may be performed by the aid of Henley's Universal Discharger and the Leyden battery before described, the charge being passed through various substances placed upon the table of the discharger. Arrange the arms of the discharger to within about a couple of inches of each other, and then slightly unscrew the ball, and insert a thin slip of tinfoil between them, afterwards screwing the balls up again. Now connect one of the arms with the outer coating of the Leyden battery by means of a short length of brass chain, and then attach another length of chain from the director to the other arm of the discharger. If the battery is now charged and the ball of the director is rapidly brought in contact with the other arm of the discharger, it will cause the entire charge of the battery to be passed through the strip of foil, which is instantly fused up with a brilliant flash.

A slip of gold leaf arranged in a like manner will also be fused, as also will other metals, silver leaf resulting in a bright green flash, and Dutch metal a purple tint. The strips of metal employed for this purpose—which should not exceed ¼ in. in width—may be readily cut by enclosing the leaf of metal between a sheet of writing-paper, and then cutting the required width by means of a pair of scissors. An ordinary visiting card or a few sheets of note-paper, supported on the table of the discharger between the knobs of the arms, can be pierced by the discharge, which will produce a slight burn on either side of the card. If the knobs are placed nearly in contact on the table of the discharger, and some tow is arranged between them, and then sprinkled with a small quantity of powdered resin, the latter will be inflamed upon the charge being passed.

When the spark is passed in the ordinary manner between the brass balls, it results in a brilliant violet flash, but if these balls are removed and a pair of ivory balls substituted, it will assume a crimson tint, or a pair of copper balls silver-plated will colour the spark green.

Various substances placed upon the table of the discharger, with the arms in contact, will assume different tints upon the charge being passed: rock crystal becoming red, sulphate of barium or lump sugar green, chalk orange, and calcined oyster-shells the prismatic colours, etc.

## ON SOME WORKSHOP APPLIANCES.

BY H. J. L. J. MASSÉ.

BENCH: IMPROVEMENTS ON AND UNDERNEATH IT—VICES—SPARE TABLE ROOM—CLAMP—FLAP FOR ADDITIONAL TABLE—TOOL CHEST—GAS SUPPLY.

A DESCRIPTION of some of the appliances I have fitted up in my workshop at different times may be of interest to some of your readers; and as some of the devices are quite inexpensive, they may, perhaps, in some cases, be adopted, or they may supply hints on which other contrivances may be fashioned.

To begin with the bench, as this is an indispensable article in any workshop. Mine is one of the smaller size of German benches, standing about 31 in. high, and measuring 50 in. by 18 in. I found this quite high enough when I began to work only occasionally at woodwork, but found it too low to work at for any length of time, so I raised it slightly from the floor by putting a piece of quartering under each of its two legs. These two legs are really rough pieces of framing, kept firmly in place by two struts, which fit into mortises and are wedged in. On the struts rests a board, on which the jack and trying planes are kept, and below them are a couple of boxes for odds and

ends of all sorts—bits of leather and bits of wood, all of which are sorted periodically into different boxes for future use. One of the first things I added to the bench was a bench-stop—known as the "Perfect"—which, as many readers of Work know, is fixed in flush with the bench top. The stop can be adjusted to any height by hand, either under the bench or from the top, and is fixed or released by a half-turn of a screw, also sunk flush with the bench.

Later on I bought and fitted to the bench a joiner's instantaneous grip-vice, a tool which, without any unscrewing, will take in anything, from a sheet of paper to a block 12 in. in thickness, and hold it "like a vice." This vice is all very well for wood-working, but it is quite unsuited for holding small pieces of metal, and it is too low down—being only 35 in. from the floor—to enable one to do much filing satisfactorily. As I had a small parallel bench-vice with 3 in. jaws, which I used to screw on to a table or bench when required, I mounted it on a piece of plane-wood (30 in. by 5 in. by 4 in.), which I had bought for turning, but which, working out rather rough, was discarded. This block, then, with the vice on the end of it, is placed in the jaws of the instantaneous grip-vice, and can be held there at any height most convenient for the job in hand. If the grip-vice is in use, the block can be fixed in the sliding end of the bench, which is in itself a vice, and held there at any height. Sometimes, too, it suits me to sit down with the block and vice held tightly between my knees, and resting on the floor.

Everyone, even the tidiest among us, has sometimes felt how nice it would be to have another table (no matter how small) to hold some small thing that has been just recently cemented or otherwise repaired, well out of reach of everything else. This end I was able to attain by making a table out of an old drawing-board, about 2 ft. by 15 in., with pieces of wood screwed to the under-side in the shape of a capital H. The cross-bar of the H is held tightly in the jaws of the small vice on the block, and the block inserted and held in the instantaneous grip-vice. In this way I have ready at hand a table which can be adjusted to any height and almost any angle I happen to want. It has been a most useful contrivance, and as I often like to stand up after a long spell of sitting, it is a real comfort and a great economiser of time: *e.g.*, suppose I am in the middle of a piece of repoussé work or chasing, and the kitchen clock is sent up to be put to rights, with a message that everybody is waiting for it; or a toy is brought in by an imperious youngster, who means to wait till it is mended, the table can be rigged up high and dry above everything else in a moment—there is no clearing away of tools, and no delay in returning to the work originally in progress. I often grip in my big vice a board 4 ft. by 11 in. by 1½ in. when I want the bench temporarily widened for mount cutting, or any large piece of work.

The back of the bench has a lath attached, between which and the bench chisels and files can be put, and to hooks on the legs of the bench two tenon saws and a small panel saw are suspended.

Another useful addition to the bench is an American bench-clamp. It is a difficult tool to describe, but it somewhat resembles an F. The top arm and the upright pillar or shaft are made of one piece of round steel, a little over an inch in diameter. In the end of the arm a screw works, and this screw raises or depresses the lower arm as required. This lower arm is 16 in. long, and moves between four spurs or studs on the shaft; it can thus be brought up close to the shaft or kept 16 in. away from it. The shaft is merely inserted into a hole in the bench—I have three holes in mine, one at each end and one in the middle—and the object to be clamped is put under the end of the movable arm; and then the more turns that are given to the screw in the top arm the tighter the article is clamped to the bench, and the tighter does the shaft hold in the hole in the bench.

This clamp is most useful for holding down a plank flat on the bench while planing or bevelling it, for pressing together two pieces of wood that have been glued, or for holding a thin sheet of metal while turning the edge down on to a wooden shape held underneath. By clamping a piece of board (about 3 ft. long) under it at right angles to the bench a convenient table for fretwork is formed, under which one can sit and move about with perfect freedom.

Another table in my workshop, which is used occasionally for picture framing, mount cutting, but chiefly for photographic and chemical work, is really nothing more than a strongly-built kitchen table, measuring 6 ft. by 3 ft., which stands against a wall. Seeing that after giving up a foot all along its width to a chest or nest of drawers, the space left is sometimes insufficient, I have a plank which, by means of loose edge hinges (*i.e.*, hinges which can be unmounted in a moment), can be fitted to or removed from the table with the greatest ease. This plank is kept in its place by a small button at the end of the table (otherwise the hinges might work loose), and is held up by two arms which, being pivoted at both ends under the table-top, need only to be pulled out at right angles to the edge of the table to make a secure support for the flap.

My tool-chest takes the form of a cupboard (4 ft. by 3 ft. by 11 in.), which I have mounted on two boxes as pedestals. The boxes are placed on their sides, and their open tops which give on to the room form most convenient receptacles for such bulky things as boot-lasts, mitre-cutters, cramps, and the like. Between the two boxes there is a space, in which I keep a box for larger oddments in brass or copper.

The gas arrangements are the outcome of much planning. The gas bracket is a straight and rigid iron pipe with a connection for flexible tubing fitted to the end. By means of this I am enabled to run three tubes, each with a separate tap, from the one tube which constitutes my gas "main." The top pipe has a "Kinnear's" patent jet attached, a most useful invention, as it enables me to turn the gas down to a tiny bead, in case I am called away from my den, and it needs no relighting on my return. It is absolutely necessary in printing on alpha or bromide papers. This burner is the chief illuminating agent in my workshop.

Tube No. 2 is carried down by red india-rubber tubing to a position just above the bench, where it is attached to a double-swing gas bracket, about 22 in. long, fitted with a Swedish burner, opal globe and shade. With this I can work very comfortably at night and on dark days, as I can regulate the shadows that fall on any work to a nicety, and it is a good light for reading purposes.

Tube No. 3 is a longer length, nearly three yards, and is fitted to my blowpipe—a tool I could not do without—worked by one of Fletcher's foot-blowers. My object in having such a long tube is that I can have my blowpipe wherever I like in the workshop, or in whatever room I have occasion to transport the whole apparatus, for soldering or what not. I can also, by removing the blowpipe, fit the tube on to a gas standard on the lathe, where a good light is indispensable for good work. I can also, when in a hurry, very easily light my fire by inserting the lighted gas tube in among the coals; in this case no laying of the fire is required.

## A CLEVER CHAIN-COUPLING LINK.

BY JOHN W. HARLAND.

In looking over my diminutive "marine stores," into which I throw all items of metal, broken tools, screw-bolts, nuts, etc., in the hope that "they may come in useful some day," I came across a link of chain which, on examination, struck me as a very valuable invention. I cannot account for its coming into my possession; it bears no mark; it may

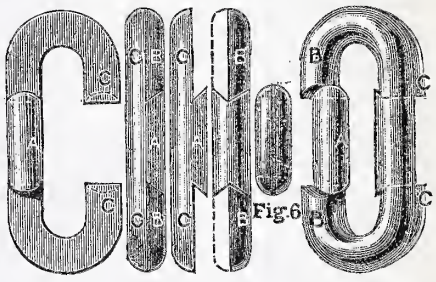



Fig. 1. Fig 4. Fig. 2. Fig 3. Fig. 5.

Chain-Coupling Link.

have been patented, for aught I know. I have shown it to several people who ought to have seen it if it had ever been in general use, but it is as new to them as to me. Perhaps someone of the hundred thousand readers of Work might know something of it. At any rate, it would be invaluable for military purposes, and as a reserve link in case of broken chains for railways, wharves, carriers, etc.

My sketches above show its beautiful simplicity. Fig. 1 is one of two exact counterparts of the form of a letter C. Between the points C, C, is a gap in each. Fig. 2 shows side view of same; it is in form (in profile) a half link with a portion of dovetail shape left on, full thickness, and round to fit the gap of the counterpart half link as shown fitted together in Fig. 4, Fig. 3 being the said counterpart. Fig. 5 shows these two half links slided almost into place. It is evident that when the neighbouring links are placed within one half link, and the other is slid into place, the stress on the chain will maintain the two half links in position so that they can never slip undone; the dovetail piece, A, being solid, supports the point, C, of the other half link, B, and, being dovetailed, all strains tend to press the two flat surfaces closer together laterally—binding them into one link, as it were. Fig. 6 is an end view of link with dotted lines showing dovetailing when in closed position.

Such pairs of half links could be cheaply made by machinery, and if made in steel would be stronger, if anything, than the links of the chain itself; at any rate, it would be a pity that so good an idea should be left to perish in obscurity. I shall be glad to know if any reader of Work has at any time met with a link similar to this.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

### The Dining-Room—The Fireplace.

*The Dining-Room.*—This room, which opened from the entrance-hall on the side opposite to the study, had, at the time when I entered upon the house, a decidedly more civilised appearance than that room. Some previous occupant had done his best to modernise, and, according to his lights, to improve it. The wide, open fireplace which it had formerly possessed (of the same kind as that in the "den," but on a somewhat larger scale) had been walled up, and instead of it had been inserted a rather handsome grate of the *delirium tremens* pattern in vogue thirty years ago. I apply this name to that particular style from the singular facility with which its cast-iron ornamentation resolves itself, when the spectator's nerves are a little out of order, into horrible monsters. By this alteration the length of the room had been diminished by some 3 or 4 ft., though it was still of fair size, viz., 18 ft. by 15 ft.

The walls had been papered. They had skirting boards, but no cornice. The doors, of which there were two, one from the hall and one opening to a passage leading to the kitchen, were panelled and fairly good. The one large window had once had handsome stone mullions, but these had been removed, probably for the sake of more light, and wooden ones of far less bulk substituted.

*The Fireplace.*—With one of the above "improvements" I would most gladly have dispensed, and that was the modern fireplace. The old open chimney, situated as it was at the end of the room and immediately opposite to the chief doorway, might have been made a highly effective feature. But restoring it to its original form was out of the question. I had to accept it as it stood and make the best of it.

The modern mantelpiece which had been put up was, if not ornamental, at least inoffensive. It was of blackened slate. On consideration, I resolved not to remove it; but if the reader will refer to Fig. 18, which represents this fireplace as it now stands, he will see that it has been pretty effectually concealed. The present mantelpiece, as there shown, is of carved oak on a background of ebonised pine; there are some old scraps in it, but the work is mostly my own. I made a frame of black wood, large enough to encase the slate jambs and lintel, and attached to it my twisted pilasters and carving. I then drilled holes into and plugged the slate, and fixed up the woodwork by screwing through the pine boards into the plugs, and thus succeeded in making my new mantelpiece perfectly firm and secure, without the trouble and mess of pulling down the old one, and without, what to me was a point of importance, the necessity of calling in the mason.

My new and larger shelf lies on the old slate one, which is hidden by a moulding fixed to the under-side of the shelf-board; a couple of strong dowels into the wall at back hold the new shelf in place. It is still further secured by the super-mantel, which is screwed to plugs in the wall, and rests upon and is dowelled into it.

I must admit that the carving about this

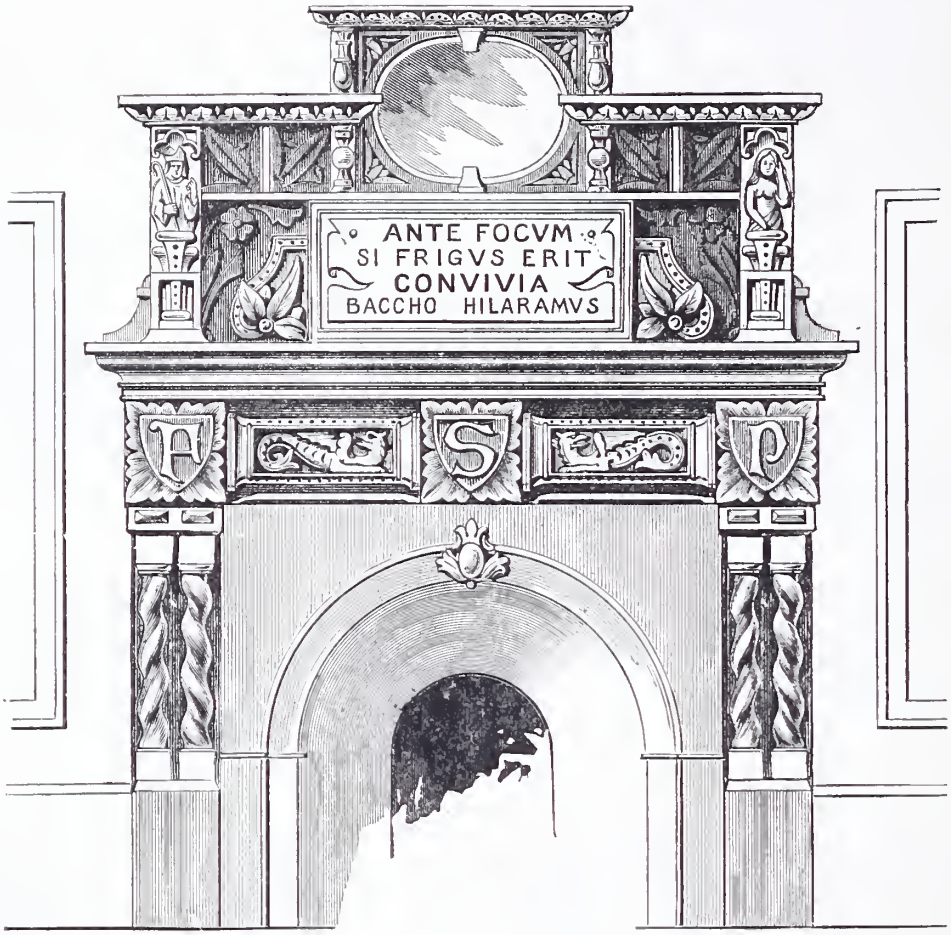



Fig. 18.—Dining-Room Fireplace in Carved Wood.

fireplace cost me considerable labour and time, perhaps more than most people would care to devote to such a purpose. But I imagine that one of its most telling features, namely, the twisted shafts, might very effectively be combined with turned and joinery work only, so as to be carried out more quickly, and by anyone who did not carve. These twists were cut by hand (not in the lathe) and they are readily made. The way to set them out is to wrap strips of paper spirally round the wood; a draft is then made with the saw up the hollows, which can afterwards be quickly worked out with the gouge, the work being finished with the file and glass-paper.

If, instead of a plain mantelshelf, one covered with velvet and edged with fringe should be preferred, such an arrangement will be found perfectly suited to the design, since a fringe 4 in. or 5 in. in depth will hide the mouldings merely, and not the carved work.

## CORK WORK.

BY J. W. W.

Old corks are generally considered useless litter, only fit to be burned, but there are few things that lend themselves more readily to the adornment of various articles; and anyone with an average amount of patience may turn out work that will, by its beauty, surprise both himself and his friends. Of course, I know there are many readers of Work who will consider themselves above this kind of work, but there are many more who, like myself, are willing to try their hands at any kind, so long as it goes toward the beautifying of their homes.

And now, having said so much in favour of old corks, I will proceed to give a few simple designs for those who should feel desirous of trying their hands at this kind of work. First, as regards cutting the cork: an old, thin-bladed table-knife, well sharpened on a rough stone, is the best tool, as far as my experience goes—and I have tried everything almost, from a small dovetail saw down to a pocket-knife—and should be used with a quick, firm pressure; it is impossible to cut cork by hitting or chopping.

Fig. 1 is a pretty design for a picture-frame. For this you will require a wood foundation, made out of $\frac{1}{2}$ in. by $\frac{3}{4}$ in. stuff, rebated out $\frac{3}{8}$ in. deep, and then half-checked together, leaving the ends 2 in. long—the broad side should be to the front; cut your corks like Figs. 7, 9, and 10, glue the three-cornered pieces on the sides close up to the front, and the half-rounds on the front close up to the edges, then glue the pyramids on down the middle; the three-cornered and half-round pieces are $\frac{1}{8}$ in. thick, and the pyramids are $\frac{1}{2}$ in. square at the base. For the corners where the frame is half-checked together, cut four flat-topped pyramids $\frac{3}{4}$ in. square at the base, and about the same height; it will greatly improve the appearance of the frame if these are blacked, but you must do it before they are glued on, as it is a difficult job to do after without smearing the others. The frame should now look like the corner shown at Fig. 1, and may be washed over with a thin coat of glue, to stop the pores; after which, it should receive two coats of shellac varnish, as that shows to more advantage than the more transparent kinds.

Fig. 2 is a design for a basket: filled with African everlasting flowers and prepared moss, this makes a very pretty ornament for a small bracket. Select a nice oval cocoanut, and cut it as shown, leaving the

handle about ⅜ in. wide (care must be exercised in extracting the nut, or you will break the handle off); this is covered with corks cut like Fig. 8, a row being glued on the top edge, another round the outside close up to the top, then four festoons, as shown. For the legs, gimp three corks, cut one end to a bevel, so that it fits the side of the nut, and glue them on equal distances apart. The handle and open spaces should be covered with cork cut very fine, or rice may be used for the same purpose—but if it is, the cork must be varnished first, as the rice looks best left as white as possible, and should be done with transparent varnish.

Fig. 3 is a cover for an ordinary flower-pot. To obtain the correct size and shape for this, wrap a piece of paper round the pot it is intended to cover, letting it overlap ½ in.; then cut it out in stiff cardboard, glue the overlapping edge, and tie it round the pot till dry. Now cut a circular piece for the bottom, with a ½ in. hole in the centre to allow the drainage to escape; a few strips of calico should be used in gluing this on, to make it more firm. The same design is used for this as for the basket, with the exception that the festoons are continued right to the bottom, one falling from the middle of the other; fine-cut cork or rice is used for filling in the spaces. If the pot is intended to stand in a saucer, the bottom may be left off, if thought well.

Fig. 4 is a very pretty design for a pair of spill-holders. The foundations for these are made out of stiff cardboard; the shape of the front is shown at Fig. 5, the dotted lines showing where it is turned up for the sides; strips of calico should be used to make the joints more firm. They are covered with corks cut like Fig. 8, a row being glued round all the edges and angles; the open parts are filled in with rice—bearing in mind to varnish the cork work first with shellac varnish, the rice being done after with transparent. A bow of ribbon is tied round the neck, and a loop attached to the top to hang them up by.

Fig 6 is a basket for ferns: any old box may be utilised for the foundation. A cigar-box does very well, if only a small one is wanted; it is covered with half-round corks, (½ in. thick) and pyramids (½ in. square at the base); a row of pyramids is glued on the top edge, then a row of half-rounds round all the sides; next a row of pyramids, and so on till there is only a small space left, which may be filled up with cork cut very fine. The feet are round pieces of wood driven into holes bored in the bottom, and then covered with fine cork; the handles are fastened to the inside of the ends with small screws, the cross-bar being fixed in place with a fine brad driven through all three sticks, then covered with fine cork, like the feet.

Of course, there is almost an endless number of things that may be ornamented with cork, but, having said so much in favour of cork work, I will leave the readers of WORK to follow their own taste, and exercise their ingenuity in finding out and fashioning articles that lend themselves conveniently to this mode of decoration. With regard to the execution of the work, or rather the cutting of the cork that is used for its decoration, the instructions given above must always be held in remembrance and acted on. Cork is in itself a material which is far more difficult to cut than harder substances, owing to its spongy and yielding nature; therefore it is imperative that a sharp tool should be used, and that the tool itself should be kept well sharpened. The cork worker should endeavour to provide himself or herself with cork of tolerably close texture, such as is used for phial-corks, and not of an open, spongy-like character.

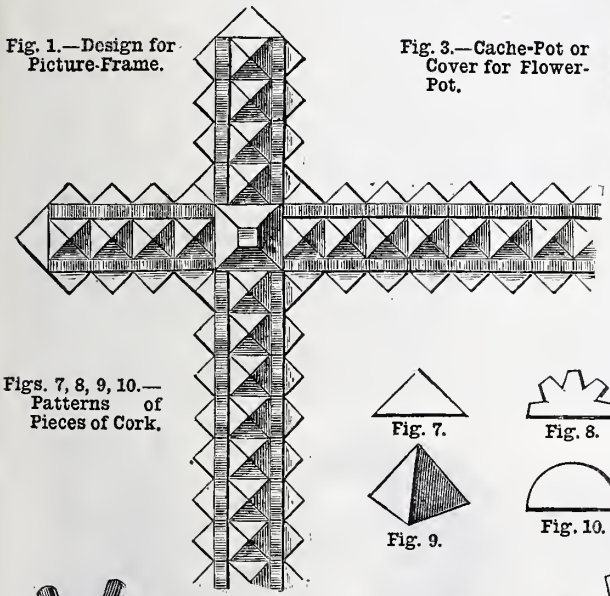


Fig. 1.—Design for Picture-Frame.

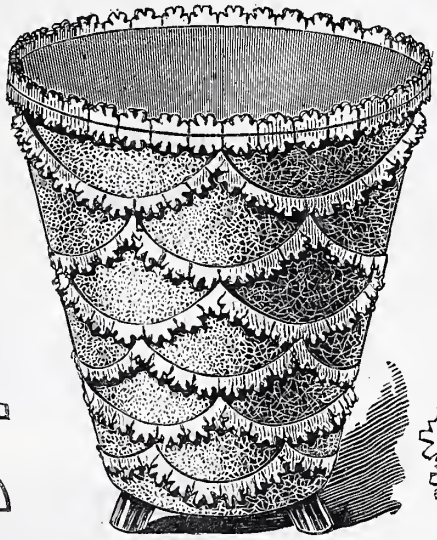


Fig. 3.—Cache-Pot or Cover for Flower-Pot.



Figs. 7, 8, 9, 10.—Patterns of Pieces of Cork.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

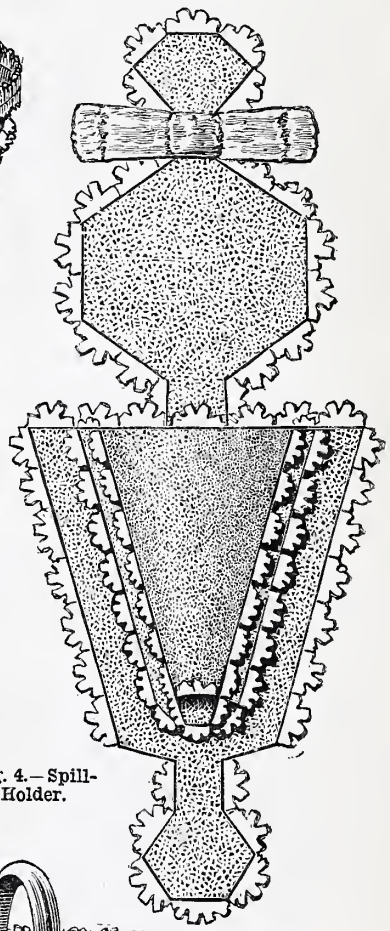


Fig. 4.—Spill-Holder.

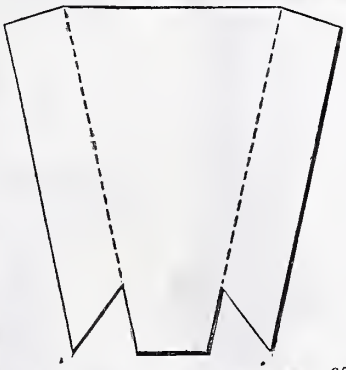


Fig. 5.—Shape of front of Spill-Holder.

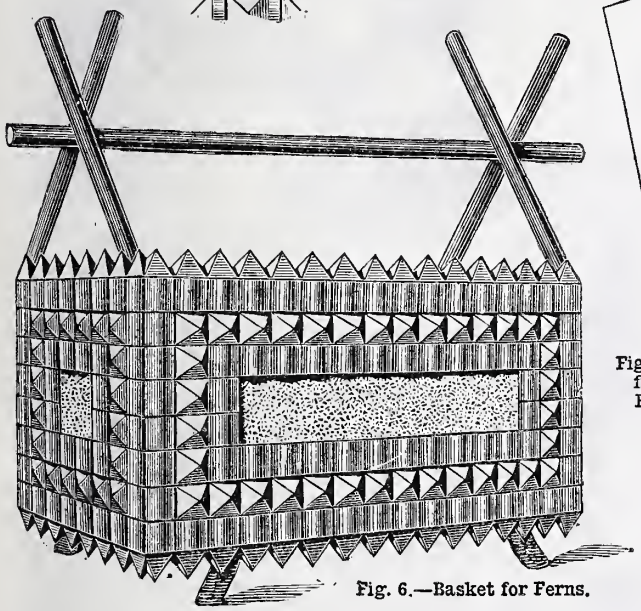


Fig. 6.—Basket for Ferns.

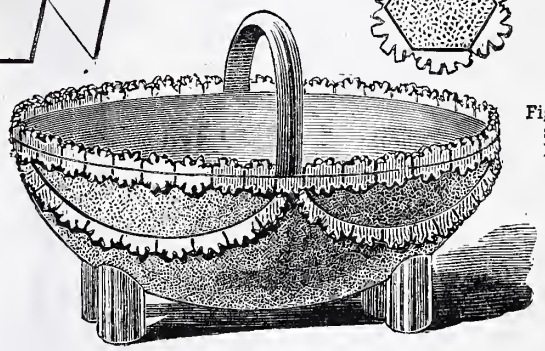


Fig. 2.—Design for Basket.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Mouldings, Beads, Ovolos, and Ogees.

A frequent use of beaded edges is where boards are brought into contact, but not glued. If a large surface is to be boarded, it would be almost impossible to get timber so dry as to remain perfect joints; so in the familiar form of matched lining we have a frequent use of beads; when the boards shrink a little it gives the appearance of another quirk, making the bead look more symmetrical.

Around sashes, beads are prepared and added to the frame, making a neat finish, yet easily removed in the event of a broken sash-line. The amateur will more often require beads to lighten the appearance of his door-frames, and to break the continuity of folding doors, etc. It is advantageous to have beads to definite sizes, and to see that when the iron is fairly set the bead works true to its name, because frequently the parts of a framing have to be so fitted that allowance for beads, rebates, or mouldings must be made on the shoulders.

Sometimes the worker is able to evade this condition, as in sashes where the moulding on the face side is exactly compensated by the rebate for the glass, it is obvious that the rebate can be made to any size, and to make it the depth that the moulding removes leaves the setting-out of the work "square."

I mention these considerations because the amateur will now be buying bead and moulding planes, and he is advised to get them true to size; if, however, he has planes in hand, he had better make a set of mouldings with them, and keep the set thus made for reference.

The mention of sashes reminds us of ovolos. A variety of shapes and sizes of mouldings are covered by this term, which is derived from ovum, egg. The special feature of all these mouldings is some resemblance to a quarter of an ellipse; some, however, are founded on the quarter circle; usually the curve is detached from the flat surfaces by narrow flats, called fillets. If these flats are large in proportion to the moulding, they are to some eyes very ugly, and the quarter ellipse as a basis for the moulding is much more graceful than the quarter circle.

Another useful moulding is the ogee. This, which has a great variety of forms, consists of a hollow and a rounded surface in close contact, and melting, as it were, one into the other.

Many of these mouldings are—and more were—worked by the use of hollows and rounds: a useful set of tools, which will not often be required by the amateur. In such cases one or two hints may be of service. Prepare the stuff truly, marking out on the ends the profile required. All straight lines on the ends should be brought to the surface and marked thereon, care being taken to mark the moulding in a true plane—*i.e.*, not "winding." Use a plough if much wood is to be removed, and with rebate planes work the straight or flat portions, then with rounds work the hollows, finally using hollows to make the round members of the moulding. In cases where the moulding—as in a cornice—is set forward, the bevels at back should be made before using the hollows and rounds, and special care should be exercised to make sure of a true surface, for upon this largely depends success in mitring the moulding when finished.

## OUR GUIDE TO GOOD THINGS.

**** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 112.—The Homacoustic.

The instrument which bears this name, and is represented in the accompanying illustrations, is a new speaking-tube instrument constructed after Cutmore's patents. It is claimed for it that when used in connection with speaking-tubes, it entirely supersedes, for indoor purposes, all existing arrangements for inter-communication, including even the telephone, over which it possesses many special advantages. Taken with reference to speaking-tubes, it completely supersedes the old-fashioned mouthpieces and whistles, and does away with all the features that render them so objectionable—the principal of which is the necessity of blowing into the pipe in order to set the air therein in motion, and so sound the whistle at the other end of the tube. This is brought about by the bottle-shaped contrivance shown in each of the accompanying figures; for when the plunger at the top is pressed down, the pressure displaces the air and causes the whistle to sound, the instrument being thus automatic. When the whistle has been sounded to call attention at the other end of the tube, the operator lifts and holds to his ear the pendent tube which is seen hanging from the appliance, and speaks, when necessary, into the funnel-shaped orifice which is opposite the mouth. This arrangement entirely does away with the necessity and inconvenience of applying first the mouth and then the ear to one and the same orifice, as in the old-fashioned whistle-fitted speaking-tube, and messages can be simultaneously transmitted and received, and conversations can be carried on as if the speakers were in the same room and speaking in the ordinary way; and there is no inhalation of the breath injected into the tube by the speakers, as must inevitably occur when the old form is used, and the whistle is always in position. The mode of using the instrument is clearly shown in Fig. 3, and the Homacoustic itself, when not in use and when attached to a wall, is exhibited in Fig. 2. Of course, it will be readily understood that, in this case, it is only possible to operate on a single tube with the instrument. The different parts are as follows: A is the whistle placed at the top of a hollow plunger, B, which, when pressed, is forced into the globular metal casing, C, in which is placed an indiarubber ball, which, by its action, restores plunger and whistle to its place when the pressure that has been applied is removed; D is the mouthpiece into which the operator speaks, and projecting from the centre of the tube is a fixed hollow cane fitted with base, which acts as a baffle when the whistle is being sounded, and prevents the escape of the air otherwise than through the whistle itself; E is the flexible tube which is applied to the ear.

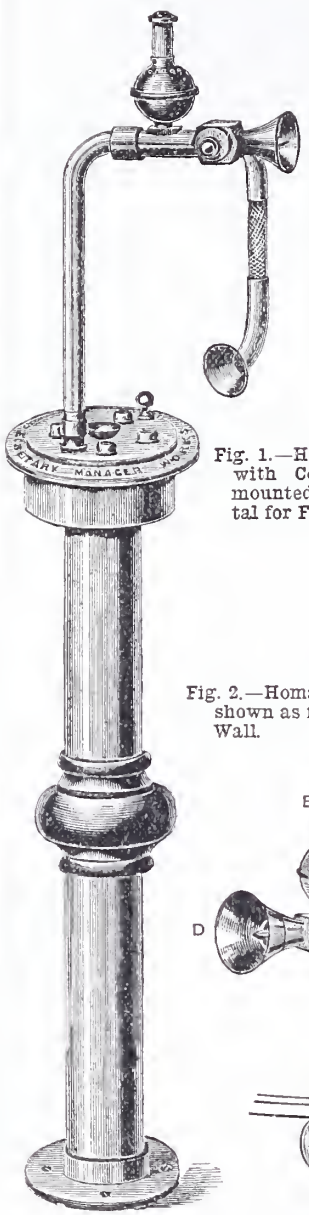



Fig. 1.—Homacoustic with Commutator mounted on Pedestal for Floors.

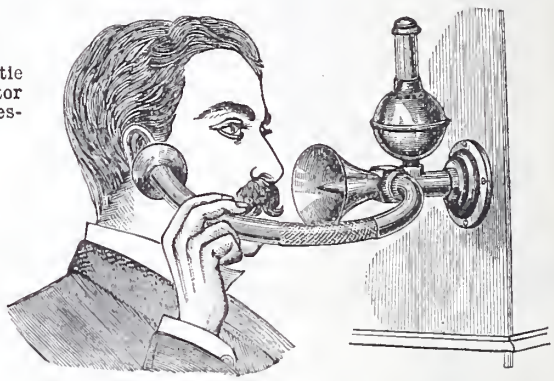
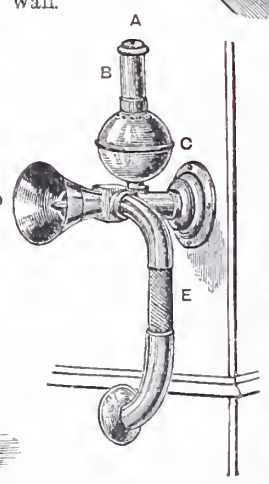


Fig. 3.—Mode of using the Homacoustic.

Fig. 2.—Homacoustic shown as fitted to Wall.




But one of the greatest advantages possessed by the Homacoustic is shown in Fig. 1, from which it may be seen that a single instrument is sufficient for operating on a number of tubes which are collected in a pedestal fixed to the floor and have their upper ends fitted into a strong metal base, the Homacoustic itself being fixed into a small circular switch-plate or commutator, which can be moved at pleasure to the right or left, thus bringing the end of the Homacoustic immediately over the orifice of the tube connected with the place or apartment with which communication is desired. It will be noticed that the room or department with which each particular tube communicates is indicated by lettering on the band in which the plate carrying the Homacoustic revolves, and the part of the building with which it must be connected by the simple act of moving the plate and bringing the instrument over the tube which is connected with it, is shown by an indicator shutter in the plate, which springs up as soon as the whistle is sounded. In a brief notice, such as this necessarily is, it is impossible to describe minutely the whole of the means by which the instrument is brought into use; but enough has been said to show its nature and its importance as an invention. It was invented and first used in Australia, and is now under the control of the Homacoustic Speaking-Tube Company, who possess patent rights in the instrument apparently in every country in the world in which such rights can be obtained. It seems to be a very meritorious instrument, and one which will find favour with the mercantile public when better known. The Editor.

## SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

### I.—LETTERS FROM CORRESPONDENTS.

**Central Foundation Schools Carpentry Class.** — A CORRESPONDENT writes:—"You may be glad to note that in the exhibition of carpentry and turnery recently held at the Central Foundation Schools, Cowper Street, London, several simple articles shown had been made from drawings which have appeared in WORK. A coal-box, a lady's table, a model kitchen table, a screen secrétaire, an easel, and two writing cabinets were among the simple articles made by members of the Carpentry Class under the direction of Mr. R. Scotter, the instructor; while others were being made during the exhibition at a bench near the stall. The other articles exhibited might be called specimens of the application of drawing to woodwork, designed to show how useful articles may be made from simple geometrical designs. Various examples of turnery were exhibited, several made at a lathe attached to the carpentry stall during the exhibition. I was glad to see the interest these boys had evidently taken in their work, and trust they may develop in after-life the taste which they have had opportunities of acquiring for making practical use of simple tools."—[We are glad to receive such satisfactory testimony as this of the successful adoption of technical training in schools, this being a matter which will always have our encouragement.—ED.]

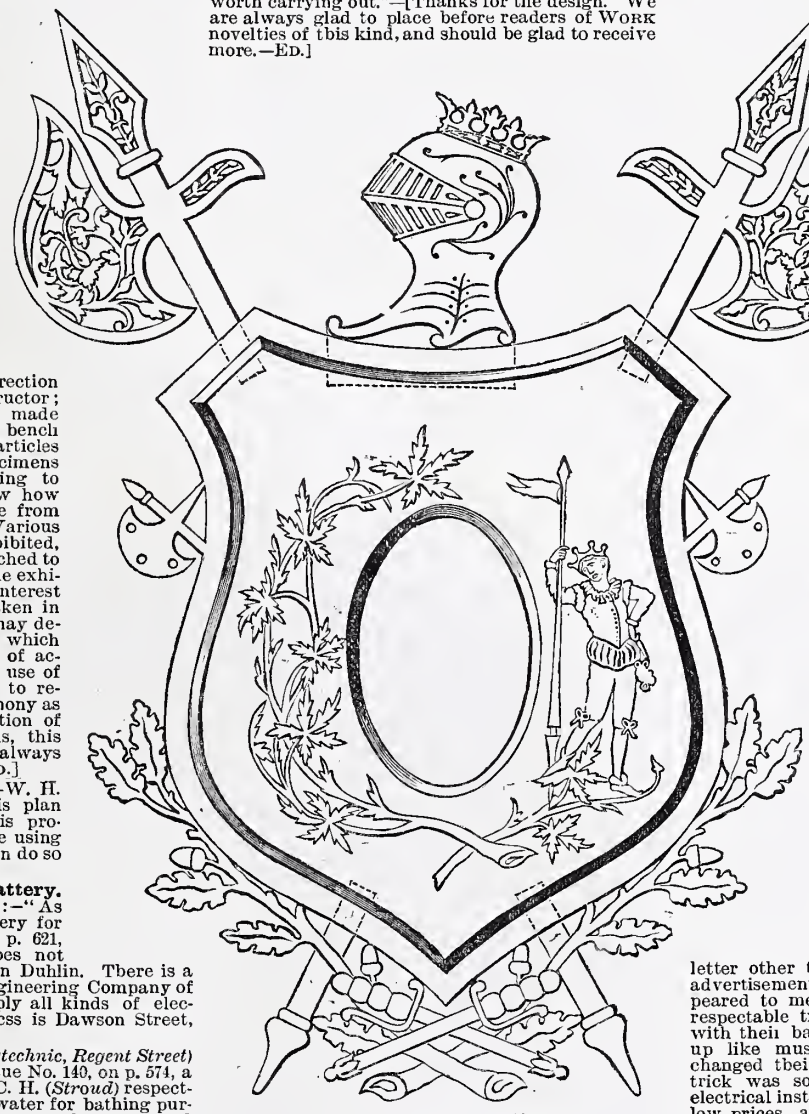
**Bicycle Anti-Vibrator.**—W. H. P. (*Tottenham*) writes:—"This plan (see WORK, p. 510, No. 136) is protected by patent, and anyone using or making the application can do so only by licence."

**Electric Night-Light Battery.** —F. G. M. (*Dublin*) writes:—"As regards the question on battery for electric night-light in WORK, p. 621, No. 143, G. E. B. says he does not know of any electrical firm in Dublin. There is a firm called the Electrical Engineering Company of Ireland, Limited, who supply all kinds of electrical appliances. The address is Dawson Street, Dublin."

**Bath-Room Air.**—B. (*Polytechnic, Regent Street*) writes:—"I notice in your issue No. 140, on p. 574, a reply to ROUND O (p. 414) by C. H. (*Stroud*) respecting a method for warming water for bathing purposes. As such a simple appliance as that suggested by C. H. is likely to be largely utilised by readers of WORK, may I, if you think the matter of sufficient interest to your readers, utter a few words of warning in connection with the ventilating of any room in which such an appliance is to be used? The bath-room is usually one of the smallest rooms in the house, and bathers, on entering a bath-room, invariably close the door and window so that they will not catch cold from draughts; then, so soon as they have stopped free access of air, they commence to strip while the water is getting hot. Now, by stopping the free entrance of air into the bath-room, it follows that the air left in the room is rapidly rendered impure by the inhalations and exhalations of air by the bather, and is made absolutely poisonous by the lighted charcoal in the stove using it for the purposes of combustion. Thus the pure air which the room had contained is rapidly replaced by the exceedingly impure products of combustion, formed by oxygen combining with the free carbon from the burning charcoal and forming carbonic acid gas, and, in smaller proportions, the very dangerous carbon monoxide. To ensure safety while bathing, it is necessary to either remove the stove out of the room altogether or else fit it with a loose cover to which a socket is attached, and this could be connected with a pipe, which should be so arranged that it would pass the products of combustion out into the open air. That there is very great danger in using these appliances when not properly ventilated is proved by the number of deaths which have occurred while using similar kinds of bath-heaters during the last few years."

**Locks.**—BRASS (*Wolverhampton*) writes:—"Two slight mistakes appear in my reply to J. G. (*Bloomsbury*) (see 'Shop,' p. 590, No. 141). In the first two addresses the letters *E.C.* should be omitted, as they are wrong and may mislead someone. The addresses are all of Wolverhampton, as stated further on, but at first sight one would think London was referred to."

**Fretworker's Photograph Frame.** —A. D. (*Monkwearmouth*) writes:—"I submit herewith an original design for a photo frame, which some of the fretwork readers of WORK may find useful and worth carrying out."—[Thanks for the design. We are always glad to place before readers of WORK novelties of this kind, and should be glad to receive more.—ED.]



Design for Fret Photo Frame.

**Hand Saws.**—CHOPSTICK writes, in reply to A. R. (*Scorrier*) (see p. 603, No. 142):—"I beg to inform him that he has read my former letter in quite a different way from what I intended it. If he looks again, he will see that I said nothing about the *rake* of the teeth, but was simply referring to the *shape:* which is quite a different matter. I was simply trying to do away with the ridiculous fancy shapes mentioned in the article. As to the proper *rake* of the teeth, that, of course, must be governed by the experience of the user, as an experienced man can work a saw with considerably more rake on than a novice; but the more the rake the faster it works, and also the more likely it is to run out of its course. A. R. mentions strength, but that is of very little use without experience, and that he will know as well as myself. He also seems to doubt my experience; but I can tell him that I have for this last twenty years sharpened all kinds of saws, from the dovetail to the pit saw in hand-working saws, and from a 4 in. to a 66 in. circular, and also band saws for steamwork. I began sawing in the pit when fourteen years of age, and had plenty of cross-cutting logs at the same time—and even younger; and if I had A. R. at one end of the cross-cut saw, and myself at the other, with an elm-tree 4 ft. in diameter between us, I could do more to convince him of my experience in cutting logs than I ever hope to by writing. However, I think he is a very good man at the job, though we do not both think alike; but I take it all in good part, and whatever he may say, I shall not write again on this subject unless the Editor wishes it. In reference to a former letter of A. R.'s, I assure him that I have written nothing, nor shall I write anything, except what I know to be true and practicable, as I certainly would not lead anyone astray. If ever I happen to be anywhere near Scorrier, I will look up A. R., and then, I have no doubt—no shadow of doubt whatever—that we should come together in some of our opinions, and part better friends than we met."—[This correspondence must now be closed."—ED.]

**Patent.**—C. E. (*London, N.W.*) writes, in reply to S. E. (*Upper Clapton*) (see p. 587, No. 141):—"Our facetious friend Artemus Ward gave a very sound piece of advice when he said, 'Don't prophesy unless you know.' I see in the first column of 'Shop' (p. 387, No. 141), S. E. says I have 'made a serious slip' in one of my communications, and therefore he hastens 'to correct it,' and says, 'If you or any of your readers rely upon this particular statement of his, they may regret it when too late;' but he may rest assured that I am *not* ready to admit my error in this case.' Now, if S. E. will just be plucky enough to invest one small sixpence in the purchase of the Patent Office 'Rules and Regulations,' which contains the fees to be paid on the various matters relating to patents, he will there find in print exactly what I have said, and I suppose he will accept this as correct. I am extremely obliged to S. E. for his kind solicitude on my behalf, and beg to thank him for it; but as he describes himself as an 'inventor,' and sets himself up as an instructor of the public, I will just modify Artemus Ward's advice to suit his case, by saying, 'Don't attempt to *teach* unless you *know*!' I must also thank him for giving a practical illustration in himself of the truth of what I have said in that part of my statement which he quotes at the commencement of his communication. Truly the race of persons ready to do what angels fear is not yet extinct."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Glazier's Diamond.** — W. T. (*Llantrisant*). — The only firm I know of is a London firm — viz., Sharratt & Newth, Percival Street, Clerkenwell, London—and you can send your diamond to them with the knowledge that you are sending it to those who thoroughly understand their business.—E. D.

**Electric Swindlers.**—G. T. (*Hollinwood*).—I do not know the firm of traders mentioned by you in your letter other than by name. I have seen their advertisements in the papers, but these have appeared to me to be too tempting to be those of respectable tradesmen, so have not been caught with their bait. A whole batch of them sprang up like mushrooms a few months since, and changed their names every few weeks, but the trick was soon detected and exposed. When electrical instruments are advertised at ridiculously low prices, attended by absurdly high claims of efficiency, you may well expect the whole to be a swindle, and the advertisers a gang of electric swindlers. Such scoundrels ruin legitimate trade by destroying public confidence, which is the very soul of trade. When men order goods and do not pay for them, or take money for goods they do not supply, or in any other way obtain goods or money under false pretences, they are thieves, and should be treated as such by all honest men. I should like to see all such swindlers well scorched by public exposure in the newspapers. I should advise you to sue them for the money at once, and in future only deal with men of standing and known character, and who have *bonâ-fide* business premises and addresses.—G. E. B.

**Wooden Mole Traps.**—J. J. (*Cumberland*).—The best plan for J. J. is to make his own traps. This is not a difficult matter to do.

**Tagging Machines.**—F. B. (*Leek*).—You wrote a second time before the information you needed could be obtained and printed.

**Photos on Metal.**—A. W. (*Parsonstown*).—Yes, plates are specially prepared for photo zinco work, but only so far as the flatness and substance of them go. Most have secret methods of working, so very much depending on skill rather than formula. A method frequently used to print an image on

bichromated gelatine: Swill it with water, ink with a greasy ink, and transfer to zinc; or transfer an image, and etch the zine with an acid solution. Either plan requires considerable practice to obtain good results.—D.

**Ironmonger's Spare Time.**—EVENING.—The best way that I can suggest for an ironmonger's assistant to utilise spare time in evenings, etc., is to study some of the practical branches of the trade. By practical, I mean the working departments. Take, for, instance, electrical work. In the present day an ironmonger who does not go in for elcctric bell work is bebind the times; and yet I venture to say that very few know anything about the practical making or fitting up. This is one thing that I am sure will well repay your time and trouble, if not immediately, in days to come, when you may perhaps be a master, and have men under you; and even if this is not to be your fortune, you will be all the more valued as an assistant. You should fit yonrself up a little work-bench, provide yourself with the necessary tools, and take for your instructions the valuable articles written in WORK by Mr. G. E. Bonney. I call them valuable becausc, being a practical man myself, I can appreciate their thoroughness and correctness; and I venture to say that if you thoroughly go into them, and carry out the details of electric bell making and fitting, you will create in yourself such an interest that you will seek to go farther into the fascinating paths of electricity. If you have any workmen on the firm in which you are employed, they would, no doubt, assist you in any technical details that you might find difficult. If you persevere, you will soon find it remunerative. I have in my mind a young man in exactly a similar position to yourself who studied tbe subject I have recommended to you, who is making a fair sum doing this kind of work for his employers: sometimes by himself, sometimes assisting the workmen. There is no reason why you should not do the same if you persevere.—R. A.

**Periscopic Glasses.**—H. G. H. (*Sheffield*).—The combination alluded to will have the qualities claimed for them. Tbc probability, however, of anyone unacquainted with the properties of lenses is that the combination would not work satisfactorily. Non-corrected lenses, such as thosc alluded to, if combined, would require very long exposures, as of neeessity the working aperture is very small. The best method is to use only two lenses, *close together*. The combined foci would be about half that of the shortest focus lens, whatever lenses were used; for instance: a 24 in. combined with a 12 in. would produce a focus of about 6 in. Of course, this is not exact, but suffieiently so for all practical purposes. Suppose another similar lens was added to this pair, the focus would be reduced to about 3 in. As spectacle lenses can be purchased of any focus, varying about two inches, as 20, 22, 24, and so on, for the camera mentioned one of 20 in. focus and one of 14 in., with the 20 in. outside, would form a good combination and give a nice-sized image. If this focal length was not approved, using a lens say 10 or 12 in. instead of the 14 in. would reduce the size of the image without the intervention of any other lens to alter the focus. The fewer the lenses the better the results. Get one of the photographie journals of about a year ago, in which a paper on the subject by Mr. Lyonel Clarke, read before the Camera Club, was published. The experiments made by him and recorded in that paper will supply very much useful information of the kind desired that the space at disposal in these columns is inadequate to give in detail. It must always be remembered that the spectacle lens, being uncorrected, cannot be treated satisfaetorily in the same manner as properly cemented and corrected ones. It is an *inexpensive* method of making a *practicable* instrument, and one that will do *really* good work; but at the same time it must not be expected to have all the good qualities of an orthodox first-class lens.—D.

**Binding WORK.**—F. C. S. (*Manchester*).—The London price for binding the yearly volume in the cloth eover is 2s. 9d., but the carriage to and from London would, of course, be additional.

**Switchback Railway.**—SIGNARF TSEW.—You do not say how long the railway is to be, nor how many passengers the carriage is to contain—in fact, you give no data at all upon whieh to work, so I can only give you a few general instructions. The difference in height between any summit and the one next after it should bc at least one-hundredth of the length of rails laid between these summits, and if your carriage does not run very easily this difference may be insufficient to carry it over. At each summit you may make the rails in a short circular arc convex upwards, and these ares are to be joined by cireular arcs convex downwards. The depth of descent does not signify so loug as the difference of summit heights is determined in proportion to the *length of rail* (not horizontal distance between summits). Your track may be carried on timbers about 4 in. square on braced trestles of the same scantling, placed about 10 ft. apart. On the horizontal timbers—which are to be cross-strutted together—are spiked down railway bars of the lightest section you can get. Vignolle's section is very eonvenient: it is single-headed, with flat bottom, and held down by hook bolts. There is nothing special about the earriage: it may be made like an ordinary open tramcar, with cross or garden seats. You must be careful that tbe rails meet accurately at the joints, and that tbeir surfaces form an even and *continuous* curve; otherwise there will be danger of the carriage running off. At the end of the track toothed racks are laid for some distance beside each rail, and into these fall hanging pawls pivoted under the carriage, to prevent its running back after coming to rest. The end of the track should for safety be carried very nearly up to the level of the starting-point, to prevent an over-run.—F. C.

**Model Ship.**—J. C. (*Bristol*).—Find, by trial, the point in the ship's length at which it balances as nearly as is practicable, and beneath this point fix a vertical bar—flat will be the most convenient—and support it upon an axis close nnder the ship. To the lower end of the vertical bar, which may be any eonvenient length, fix a weight, such as a lead disc, just sufficient to hold the ship upright. Get a clock movement—second-hand will do—take out the escapement, and fix a crank, say 1 in. throw, on the arbor of the minute hand. Connect the pin of the crank by a rod, with the vertical bar under the ship, at such a distance below the pin on which it hangs as will give the required pitch. The best way to do this will be to fit a tightly-sliding block upon the vertical rod, and on the block fix a pin to take one end of the connecting-rod from the crank, then this block can be slid up or down until the required movement is obtained. A light spring should be fixed to the case, with a screw behind to press it against the crank arbor, to regulate tbe speed of the movement. The sea may be represented by glazed green "lining" (sold by drapers), and should be glued round the sides of the ship and round those of the case, being left loose and crinkly, to represent the rise and fall of the waves. Your ship would look better if you made it to roll as well as pitch. To do this you would have to carry the vertical bar (which would then be round) in a ball and socket joint instead of on a pin, and let its lower end rest in a hole in a horizontal wheel, carried, instead of a crank, by the clock movement. The mechanism must be carried by cross-pieces to leave the bottom free, which must be put on last, after the "sea" has been glued in.—F. C.

**French and German Accents.**—W. A. (*Beckenham*).—If the dictionaries you refer to do not supply what you want, no other books oceur to our mind.

**Van Wheels.**—W. B. (*Kent*).—I am engaged at present in writing on wheel-making. In the meantime, until the subject appears, you must read carefully a former answer of mine to a queriston wheelmaking in "Shop," No. 66, Vol. II., page 225. The nave or hub of a van wheel will have to be turned "coach fashion," and not "cart fashion." The illustration in No. 66 for hand-cart wheel is turned cart fashion; it will also be better and eheaper for you to buy the spokes ready dressed and tenoned. Yes, you will have to use a templet or felloe pattern to work by. To ascertain the length of felloes for a wheel, however large or small, we describe a eircle ½ in. higher than the height of the wheel. We next describe an inner circle, 2 in. or 2½ in. (whatever the thickness of the felloes or rim may be) distant from the outer circle. If there are to be sixteen spokes in the wheel, we divide the circle into eight equal divisions or parts, each part representing a felloe. If there are fonrteen spokes, we divide into seven parts, etc., two spokes to each felloe. A piece of wood should be fixed so that one of these parts is described upon it when dividing the eircle into parts; each part must bo of equal length, or the felloe joint would have the wrong bevel: a most important point in wheeling. Whien the pattern is sawn out, the size of the wheel should be painted upon it, to show at a glance what height the wheel would be if seven or eight of these were placed in a circle. Use an ordinary carpenter's hand saw for jointing, the felloes being sawn out with the band saw.—W.P.

**Mole Traps.**—E. M. (*Rainham*).—Thanks for your answer, whieh you will have seen has been anticipated. That "star of the first magnitude" whieh you allege you saw "on the ground" at midnight might suit some scientifie paper rather than WORK. We deal with hard facts.—ED.

**Gas, Petroleum, and Wind Motor.**—C. T. A. (*London, N.*)—The question whether you can make a petroleum engine is difficult to answer. There are two in the market: Priestman's (Messrs. Priestman Bros., Holderness Foundry, Hull) and Knight's (J. H. Knight, Barfield, Farnham). A quarter horse-power petroleum engine would cost about £30, much the same as a gas engine. If you tried to make one, you would, of course, have to study the patents, so as to avoid infringing them. Another plan would be to use a gas engine, and let it draw its charge through one of Fletcher's gas generators, which is simply a box filled with cotton wicks dropping into petroleum; air drawn through the box comes out an explosive mixture. Write to Thomas Fletcher, gas engineer, Warrington, and ask if he makes gas generators for that purpose. Perhaps the Robinson hot-air engine would suit you. It will require less attention, and be more easy to manage than a petroleum engine, and have no bad smell. Now, as to the wind motor. This might be managed if you live in a windy situation, and if you employ some means to store up power for use when the wind does not blow. Here lies the difficulty. Windmills can be used to pump water, which is stored up till wanted; they are just the things for that, because they can pump a little more whenever the wind blows: but for a lathe or dynamo you must have some way to store up the wind power, since you may be a day or two without any at all; this can be done by electrical accumulators or secondary batteries, or by using the wind power to force air into a receiver for compressed air, which air you would use to drive an engine exactly like a steam engine. You see, the whole thing becomes rather complicated. No. 94, Vol. II., contains an article on "Small Dynamos for Electric Lighting." Consult the advertisements in WORK.—F. A. M.

**Steel Spike Hook.**—A SUBSCRIBER.—I should try a local gas-fitter or an ornamental smith. They would procure the castings and supply and fit up the other parts.—J.

**Wages.**—APPRENTICE.—There is no fixed rule for the rate of wages payable to a cabinet-maker's apprentice, as so much depends upon the class of trade done and the amount of premium paid. If you are properly "bound," your best way is to endeavour to make yourself master of your trade; you will then be in a much better position to estimate your proper value and ask accordingly.—E. D.

**Perpetual Motion.**—H. D. S. (*Uxbridge*).—You are probably right when you premise that your invention for securing perpetual motion may not gain the end you desire. A good many minds for a good many years have been engaged upon the same matter, but hitherto without success. This need not, however, prevent you from submitting your model to us, and most assuredly it shall be kept strictly private.—ED.

**Frosty Windows.**—SCULPTOR.—When the moisture suspended in the comparatively warm air of your shop comes in eontact with the glass, which is of much the same temperature as the freezing air outside, it is of course condensed and frozen into ice. You might generally avoid this and the other inconveniences of which you complain, as well as greatly increase the warmth and comfort of your workroom, by having double windows—two thicknesses of glass. Between these you would have a space filled with temperate air, and thus keep the frost at arm's length, so to speak, from the glass with which the air of your room comes in contact. This is the plan adopted in northern countries. Yet surely, with ordinary windows, you can place a cloth, or something else which will suck up the moisture from the melting frost flowers, at the bottom of the glass to prevent it from running down your walls.—M. M.

**Cleaning Monuments in Stone and Marble.**—SCULPTOR.—We are not aware that there is any way of removing lichen, etc., from soft stone without labour. Acids would rot the surface, and potash should be used with caution. But for preventing such growths we imagine that a solution of silica (the "water-gloss" of the mural painters) might well be employed. It would harden and protect the surface without in any way clogging or disfiguring it. We are under the impression that it has been successfully used, but have not ourselves tried it; but we are well acquainted with stones which develop a natural coat of silica by exposure and preserve their sharpness and cleanness in consequence. As regards removing stains from Sicilian marble, information on the subject will be found in Vol. II., on pp. 406, 437, 458, (Nos. 77, 78, 80), and elsewhere in WORK. If potash, salt of lemons, or soaking in wet sand fail to remove such discolorations, we cannot say what will fetch them out. Some stains are so obdurate that no ordinary remedy seems to touch them, and any reader who has had special experience in this direction would do good service by enlightening his fellow-workers.—M. M.

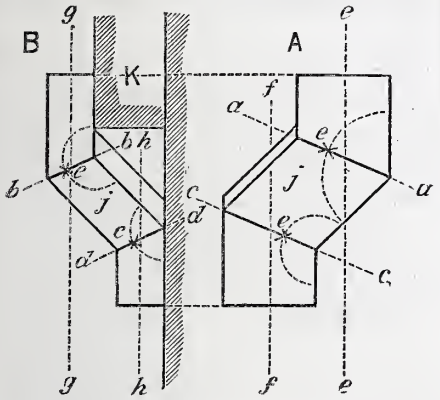
**Brazing.**—L. W. (*Islington*).—For information on brazing, see Nos. 36, 42, 48, 50, 65, 76, and 92 of WORK.

**Re-setting Glazier's Diamond.**—SPARK.—A similar query to yours is answered on p. 224, No. 67, Vol. II. of WORK. From the particulars there given, you will be able to judge if you can do it yourself. The best plan in most cases is to send it to some such firm as Sharratt & Newth, 44, Percival Street, Clerkenwell, London, E.C., or any other maker of glazier's diamonds.—H. S. G.

**Scotch Bagpipe.**—LOVER OF MUSIC.—The Scoteh bagpipe is composed of a sheepskin bag, covered with baize, tartan, or some similar material, whieh forms the wind chamber. The skin is kept soft and flexible by a piece of fat whieh is always kept inside. The chanter tube is bored with seven finger-holes in front and one behind for the thumb of the left hand, and this tube and the three drones are tied into the wind-bag in such a way that no air can escape. Then there is the mouthpiece tube. All these tubes are, of course, wood, and are mounted in silver or ivory, according to price. We should, however, advise our correspondent not to attempt the making of a set of bagpipes throughout, and we therefore give him the name of a firm of pipe-makers, who will perhaps supply him with the detached parts of proper proportion. The sounds which can be obtained from a properly made pair of bagpipes are so fearful and wonderful that one shudders at the idea of the awful possibilities of an amateur production. The name of the firm is John Center, Morrison Street, Edinburgh.—G.

**Rain-Water Pipe.**—J. G. (*Glasgow*).—A correspondent, J. G., asked some time since for information how to get the shape of a pipe coming down over a plinth. The Editor himself, in the absence of clear information on the part of the querist, supposed a plain zine pipe was intended, and gave information as to the projection of the sheets. J. G. now explained that a cast-iron pipe was meant, and the Editor, knowing this was in my line, passed the question on to me. I took a pipe of the form I thought was wanted, set it out in one plane, and showed on p. 381, Vol. III., how the bevels could

be obtained. J. G. sends at length a model of a pipe set out in *two* planes, of which the accompanying figure is a drawing, made to scale, and asks how to get at the bevels for the joints of the pattern. I sent back a reply, printed on p. 573. Now comes an impertinent letter from J. G., saying:—"Sir,—This, the commonest and simplest of jobs, has evidently baffled J. to demonstrate what was wanted. He (J.) says, 'Draw out the pipe in elevation and in front view, bisecting the angles.' Great Euclid! what does it mean? We strongly suspect the *studium inane* of Darwin. We earnestly hope you will not allow this to slip without a demonstration." As a final reply, I insert this sketch in WORK for the verdict of my pattern-making friends. J. G. has sent a model of a pipe of which he has actually got the bevel, and then asks how he is to get it! Although so ludicrously simple, I must needs go now into trivial details. Thus, at A there is a front elevation, at B a side elevation of the pipe in question. It is therefore set out in two planes—that is, in both front and side views. J. G. wants to get the angles of *a a*, *b b*, *c c*, and *d d*. I said, and say still, set out the pipe on a drawing-board, and bisect the angles formed by the pipe body, and cut the pattern accordingly. Thus, the centres, *e e*, *f f*, are the




Rain-Water Pipe.

centres of the pipe in front view; *g g*, *h h* are the centres in side view. Set these out to full size or to scale, and the outline of the pipe also. Draw in the sloping part, *j*, in any convenient diagonal position to clear the plinth, K. Then bisect the angles formed by the pipe outlines, as at *e*, *e*, *e*, *e*, and draw lines *a a*, *b b*, etc. The lines *a a*, *b b* will give one joint face, the lines *c c*, *d d* will give the other, which, if worked to with saw and plane, will ensure the pipe being of the shape required to clear the plinth. Without commenting on the insolence of J. G., to whom I shall not reply again, I ask the readers of WORK if they know of any more ready and practical way of getting at the angles in the Fig. The query was sent to me because I am familiar with pattern and foundry work. I have made, and have given instructions for making, hundreds of jobbing pipes of all kinds, and I have described just the way in which I should set about it, with the certainty of making a correct job. Even the gods must fight in vain against stupidity; and if J. G. is unable to understand this description, I cannot make it clearer; or, if he wants some more elaborate and roundabout way of doing the simplest possible job, then I ask, *cui bono?*—J.

**Writing-Desk.**—G. J. W. (*Ballymena*).—It is a pleasure to reply to such an explicitly placed query

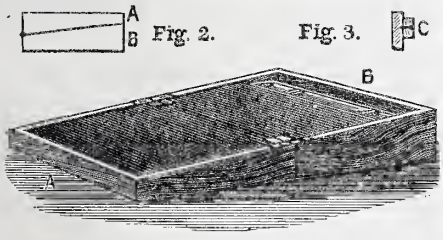



Fig. 1.

Writing-Desk. Fig. 1.—Desk open. Fig. 2.—End View of Desk when closed (drawn to a smaller scale). Fig. 3.—Section of Screwed Piece against Ink-Pot Spaces to form a Rebate for Lid.

as yours. One comprehends instantly the correct requirements. The desk, of which a sketch is here subjoined, is undoubtedly the one you are in search of. The back and front sides, respectively A and B in Fig 1, contact with each other when the desk is closed, as in Fig. 2. It is essential that the *hinged* sides each coincide exactly in depth, to permit of proper adjustment. According to an old article of the kind I have in my possession, the depth of A should be about 1 in., that of B 3 in., while the intervening divided sides (Fig. 1) should each be about 2 in., thus making a uniform depth, when the desk is closed, of 4 in. Your proposed length of 20 in. (when open of course) is suitable. A proportionate width will be 12 in. Two thin lids are bound to each other by means of the fabric covering them, a width of fabric intervening between the united edges equal to two thicknesses (about three-eighths) of the sides. The latter are rebated, where necessary, to allow the lids to lie flush, while they are held permanently in position by means of the fabric being tacked to the hinged sides of the desk. In lieu of a rebate adjacent to the shallow ink spaces, a small strip (C, Fig. 3) could be screwed. Space forbids more remarks, excepting to say that the hinges are screwed to the narrow side edges.—J. S.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Ornamental Brass Castings.**—J. P. (*Accrington*) writes:—"Will any reader of WORK give me the address of a firm where ornamental brass castings, such as horses, dogs, clowns, etc., may be had?"

**Carboline or Carbolinum.**—WICKER would be glad to be informed where this is obtainable in London.

**Lucrative Home Industry.**—W. M. Q. (*Elgin*) asks if any reader of WORK would kindly inform him of a lucrative home industry. He lives in the country, and could spare a few hours each evening.

**Colours for Diagram.**—A NEW READER writes:—"I have to make some diagrams, coloured. I have tried water-colours, but they are not brilliant, and crayons are liable to smudge. Is there any preparation to cover the crayon with to keep it from smudging, or any other colours I could use more suitable?"

**Vellum.**—F. B. (*Clapham, S.W.*) writes:—"Would anyone kindly mention the name of some firm on the Continent where I could purchase vellum in large quantities, or tell me the best plan to adopt? I am given to understand that I should have to pay double the amount for an inferior article over here."

**Vertical Furnace.**—G. W. (*Bournemouth*) writes:—"I should like some particulars of a vertical furnace (with a sketch, if possible) for heating wheel tires. Some reader, perhaps, may be able to oblige. Should the chimney or shaft be the door end, or *vice versâ?*"

**Quick Varnish.**—J. K. (*Patricroft*) writes:—"Would any reader kindly give through the 'Shop' column a recipe for varnish that will dry quick and bear out with one coat at a small cost? The above is for skipping-rope handles, spinning-tops, and wooden toys—something after the style of a Venetian blind gloss."

**Adhering Composition.**—F. W. (*South Darenth*) writes:—"Could any brother reader of WORK inform me of a composition that will make paper adhere to steel bands which revolve upon two wheels, about two inches in diameter?"

**A Hard and Fast Cement.**—A. R. (*Redcar*) writes:—"I have tried the recipe for the above, given in 'Means, Modes, and Methods' part of WORK on p. 602, and find it is a complete failure. I shall be pleased for some further particulars."

**Water-Wheel for Saw Driving.**—CELL writes:—"I should like to know, through 'Shop,' the way to make a water-wheel to work a circular saw 6 in. in diameter."

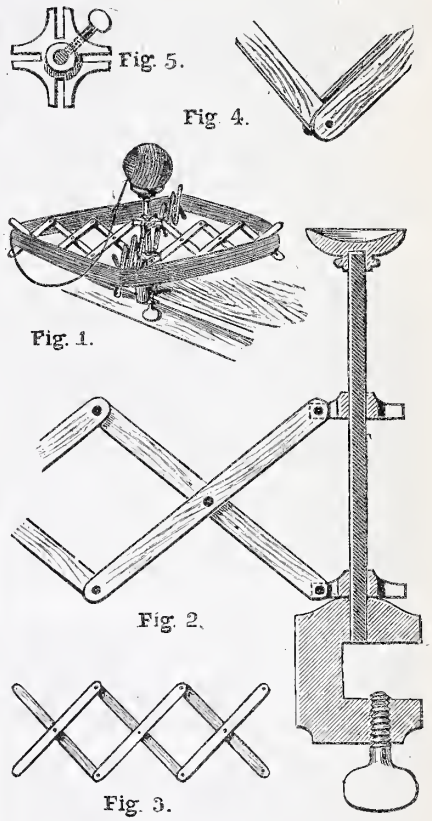
**Cameo Cutting.**—J. A. B. (*Camberwell*) writes to say that "he takes in *Cassell's Family Magazine*, and that he has read a chapter on the art stated above, wherein the writer mentions that the designs are cut out of conch-shell, and also that pieces of the shell are sold besides whole ones; also that special tools are made for carving the designs. Could some of our readers of WORK mention some of the principal firms that supply the material and the tools that are used in carrying out this art?"

**Maguay Electric Lamp.**—W. M. (*Dundee*) (see WORK, No. 142) writes:—"Would W. G. Sherborne let me know where these can be obtained, and probable cost of same?"

**Magnetism.**—BEGINNER writes:—"I want to magnetise several bars of steel, 5½ in. long, for experimental purposes. Will some reader tell me the best way to do them? I am anxious to make the necessary apparatus."

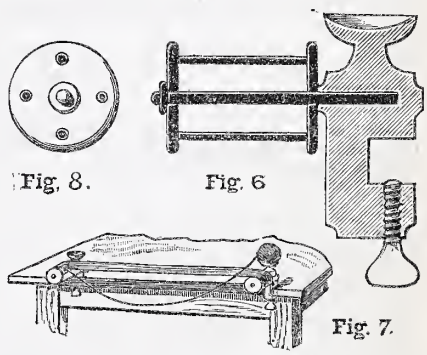
## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Wool-Winders.**—A. M. (*Glasgow*) writes, in reply to MART (see p. 621, No. 143):—"In response to the request of a correspondent for a design and some details of construction of a wool-winder, I enclose two designs of this article which I have seen in use. The first (illustrated in Figs 1, 2, 3, 4, and 5) consists of four lattice-work arms fixed to a central stand, the whole revolving while the wool is being wound. In Fig. 1 is given a general view of the article in use, the ball being for a moment placed in the cup. Fig. 2 shows a section through the centre of the article, and as it is drawn half full size, all the various sizes, etc., can be easily obtained. The lowermost portion is for fixing the apparatus to the edge of a table. It is in the form of a cramp, the screw underneath working fast against the under side of the table top. In this portion all the rest of the apparatus revolves. Notice the centre pillar entering into this part in Fig. 2; it must not be made at all tight, as it must revolve freely. This pillar carries the four expanding arms, which are connected with it by means of a pair of collars or rings, and above all is the cup for receiving the ball of wool at any time the individual winding may want both hands free. A smaller sketch of the lattice-work arm is given in Fig. 3; every alternate bar is, for the sake of strength, made double, the single bar being placed between the two portions of the double bar, and riveted as in sketch (Fig. 4). The four arms are connected by means of a pair of collars, as shown in Figs. 2 and 5, the latter Fig. being a top view of the collar. The arms are inserted in the slots prepared for them, and are fastened with a pin. The lower collar is fixed to the pillar, but the upper one is left free to slide up




Wool-Winder and Parts.

and down the pillar, as the arms are contracted or expanded, to suit the wool. To keep the arms fixed at any particular size, a screw pin is inserted in one side of the top collar to screw against the pillar (see Fig. 5). As lightness is an essential in the construction of the revolving portion of this article, the wood should be kept thin, and therefore should be made of birch or such tough stuff. The other design, of which a general view is given in Fig. 6, consists of a pair of large reels fixed to the edge of



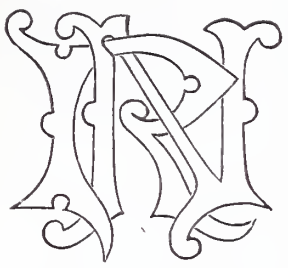

Wool-Winder and Parts.

a table, at a suitable distance apart. The wool is put over the two reels, and wound from them. An enlarged drawing of these and of their necessary fastenings to the table-edge is given in Fig. 7, drawn half full size. The recess for the table top and the screw for pinching it and keeping all tight are there shown, while further up is seen the cup in which the ball may be at any time placed. The spindle on which the reel revolves is inserted on one side and made fast, and the reel itself is shown in end view in Fig. 8. It has four bars or rods across from end to end. This design is undoubtedly a stronger one than the former, though it does not

seem so compact. Each has its own advantages, and both perform their duties in a satisfactory manner, and that is in itself no mean recommendation."

**Saw Bench.**—CHOPSTICK writes, in reply to WOOD-WORKER (see p. 622, No. 143):—"I beg to inform him and others that before these lines appear in print an article on a saw bench to work by hand will be in the Editor's hands, and he will most likely publish it at his convenience. It will be a practical tool, and will cut timber up to three inches thick, as I have done myself on a similar home-made bench."

**Monogram for Fretwork.**—R. D. T. (*Marylebone, W.*) writes (see p. 590, No. 141):—"I notice in 'Shop' that N. R. (*Yeovil*) asks for a monogram for fretwork. I have made a sketch of one which I think would perhaps do, and hope N. R. will like it."



Monogram for Fretwork.

**Photography.**—D. C. (*Marsden*) writes, in reply to C. E. H. (*Horwich*):—"I may say I know a little about the process of colouring photos by the transparleum method, that being the word our correspondent had forgotten. The address from which I obtained my outfit of material necessary to make transparleum pictures was the Continental Novelty Company, but I cannot vouch for the existence of the company now. About two years ago I wrote to the address, asking them to forward me more materials. About a week after I received my letter back from the Dead Letter Office, saying that they could not find the company with the address given; so that they must either have changed address or else have given up the business. For my part, I cannot see the slightest difference between the crystoleum and the transparleum method of painting or colouring photos. I have read the articles which have appeared in Vol. I. of WORK on the crystoleum method of colouring photos, and I think it is exactly like the transparleum process in every detail."

**Besoms.**—TRIPLE EXPANSION writes, in sequence to BESOM MAKER and J. W. H. (see WORK, p. 635, No. 144):—"Worcestershire is well stocked with gipsies, and I will try to find one that makes besoms. Besom-making is a trade carried on in Bewdley, three miles from here (Kidderminster), and Richard Ashcroft, of Bark Hill, Bewdley, is a good maker."

**Skates.**—L. L. H. (*Falmouth*) writes, in reply to JACK FROST (see p. 637, No. 144):—"I strongly advise you not to attempt to grind your own skates; you would almost surely spoil them. They should be ground across the stone, and it is a job that requires much practice."

**Photography versus Painting.**—H. E. (*S. Norwood*) writes, in reply to A. B. (*Glasgow*) (see p. 686, No. 147):—"Without seeing your painting it is impossible to say why you cannot obtain a copy. Have you tried isochromatic plates? These are the only ones to render colours correctly. Possibly your painting may be yellow with age. If so, ordinary plates would not be of much use. As you say several experienced men have had a try, I do not know what to advise. Perhaps the Mahatmas are having a game with it. If you think it worth your while to send the picture on to me, I will see what I can do. I have had some little experience in copying."

**Early Riser's Friend.**—H. E. (*S. Norwood*) writes, in reply to WILL (see p. 686, No. 147):—"If you write to Stevens & Son, of Whitecross Place, Wilson Street, E.C., sending them a copy of the article in question, they will make you all the fittings at a reasonable rate. Their workmanship is A1, and price moderate."

**Fret Saw.**—J. W. B. (*Huddersfield*) writes, in answer to W. M. (*Brixton Hill*) (see p. 651, No. 145), "that Barnes' improved fret saws are used by fret-cutters and carvers, and equal steam-power."

**Pins.**—M. (*Bishop Auckland*) writes, in reply to A. W. B. (*Bristol*) (see p. 622, No. 143):—"Send 6d. to Kirby Beard & Co., Bradford Street, Birmingham, for their sample card and description of pin-making, which will give you all particulars."

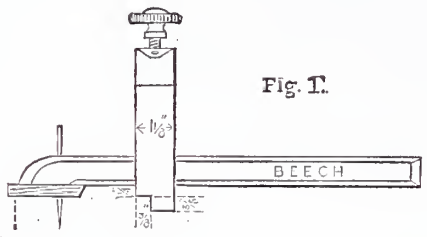
**Pottery and Porcelain.**—M. (*Bishop Auckland*) writes, in reply to T. H. L. (*Dublin*) (see p. 606, No. 142):—"One of the following will suit you: Chaffers' 'Collectors' Handbook of Marks and Monograms,' price 5s.; or Chaffers' 'Marks and Monograms,' price 32s. (Batsford, of High Holborn)."

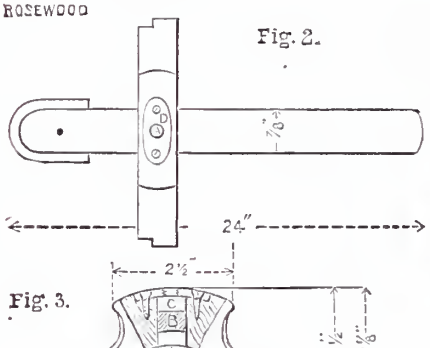
**Water Motor.**—M. (*Bishop Auckland*) writes, in reply to WATER MOTOR (see p. 606, No. 142):—"The Editor has a drawing and description of a water motor, which will be published as soon as space can be found, which I think will suit you. All particulars are given with it. Should any part not be sufficiently clear to you, if you write again I will give you any further particulars."

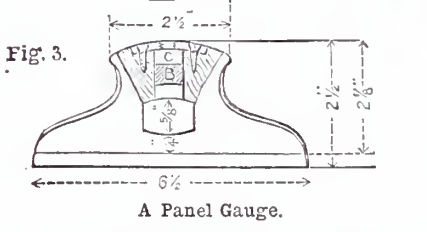
**Model Yacht Fittings.**—M. (*Bishop Auckland*) writes, in reply to T. H. L. (*Newport, Mon.*) (see p. 622, No. 142):—"You can get fittings for model yachts from Mr. Lee, who advertises in WORK; or if you want to make them, if you say what you require I will send you a sketch. I have made my own fittings for a cutter 3 ft. long."

**Fretwork.**—N. T. LEE (17, *Home Road, Battersea, London, S.W.*) writes to W. M. (*Brixton Hill*) (see p. 654, No. 145):—"If W.M. will take the trouble of calling at above address (not very far from his home), I will show him a machine (a Dexter) which I have had in constant use for the past seven years, and which looks like lasting for the next seven years. I will also show him work done by it up to one inch thick, and down to 'cigar boxes.' I have seen many machines such as he describes 'useless.' Let him write me the time he intends calling, so that I can be 'at home,' as I may be able to give him a few other 'useful hints,' which I will willingly do. I am the winner of the first prize in Group I., Division A, Class 3, and also special prize for best exhibit taken from WORK in 'Work' Exhibition.' The Dexter machine is sold in two sizes, I think, A and B, by Messrs. Churchill, Finsbury Square. I will have great pleasure in showing the machine to any reader of our valuable WORK who may give me a call."

**A Panel Gauge.**—EDDIFRA writes, in answer to APPRENTICE (see p. 606, No. 142):—"A panel gauge made to the following dimensions makes a very handy gauge for gauging up to 18 inches. It looks well made of beech, with rosewood tip; it is fixed




A Panel Gauge.

by means of a thumbscrew or milled screw, which presses a piece of boxwood, ⅜ in. square, on the shaft. In the sketch, D is a small iron plate, A is a ¼ in. tapped hole for milled-headed screw, B is the piece of boxwood, and C is the square hole in which it works."

**Dexter Fret Machine.**—M. (*Bishop Auckland*) writes, in reply to E. W. (*Cupar, Fife*) (see p. 686, No. 147):—"The makers of this machine are J. H. Skinner & Co., who advertise in WORK."

**Fretwork.**—M. (*Bishop Auckland*) writes, in reply to W. M. (*Brixton Hill*) (see p. 654, No. 145):—"If you procure the catalogues of J. H. Skinner and Co., Harger Bros., or the Britannia Co., all of whom advertise in WORK, you will find drawings of some very good treadle machines. The advantage of these is that they leave both hands at liberty; although some fretworkers prefer the hand-saw."

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. H. C. (*Homerton*); SIGNALMAN; KODAK; W. L. K. (*Rochdale*); CHUCK; H. W. (*No address*); G. E. H. (*Worcester*); TASMON; TINSMITH; YANKEE; H. H. (*Worcester*); VOLTIC; W. R. E. (*Carlisle*); CYMRO; E. E. W. (*Abergavenny*); H. H. (*Latchford*); H. H. (*Birkdale*); READER (*Knutton*); THEODOLITE; F. G. (*Gravesend*); J. W. S. (*Guernsey*); F. H. (*Battersea*); R. S. (*Stoke-on-Trent*); VIGILANTIA; W. G. A. L. (*London, W.C.*); W. H. A. (*Tamworth*); W. H. J. (*Brentwood*); MAGNET; J. E. L. (*Redcar*); J. D. D. (*Carnarvon*); W. M. (*Market Drayton*); G. A. (*Stoke-on-Trent*); B. P. (*Battle*); A NEW READER; A. T. S. (*Redford*); W. L. F. (*Dublin*); W. H. (*Chorley*); A. B. (*Oban*); W. S. W. (*Keighley*); W. W. (*Wavertree*); F. B. (*Rochdale*); PORTSMOUTH; J. H. (*Mile End*); D. C. (*Luton*); C. H. (*Clerkenwell*); RESILIENT; IGNORAMUS 2ND; TELEGRAPHIST; ELECTRO-PLATE; J. T. B. (*Biggleswade*); R. D. (*Fence Houses*); G. S. (*Fulham*); H. J.; J. B. (*New Cross*); J. K. (*Bishop Auckland*); C. E. (*Liverpool*); F. J. (*Swindon*); R. R. S. (*London, N.W.*); S. B. (*Nottingham*); STUDENT; E. H. B. (*Old Trafford*); PLASTER PARIS; C. W. T. (*Leytonstone*); G. H. B. (*Norwich*); LOVER OF "WORK"; APPRENTICE; H. B. (*Greenock*); SHAMROCK; ILFORD; W. F. L. (*Bootle*); W. L. (*Stoke-on-Trent*); C. B. (*Keighley*); CAWD HUD.

## ART WORK EXHIBITION.

THE Secretary writes:—"This will be held in connection with the Building Exhibition, 1892, to take place at the Royal Agricultural Hall, London, N., March 14th, 15th, 16th, 17th, 18th, 19th, 21st, 22nd, 23rd, 24th, 25th, and 26th.

"There will be eight Groups—viz: (1) Carpentry; (2) Carving; (3) Furniture; (4) Painting and Decorating; (5) Metal Work; (6) Building Appliances and Materials; (7) Building Facilitators; (8) Invention and Design.

"These Groups will consist of three Classes in each Group—viz: (1) Workmen; (2) Apprentices; (3) Amateurs; to be judged from their respective standpoints.

"Applications must be received by February 14th, at latest.

"The Best Exhibit in the Art Work Branch of the Exhibition will have a Gold Medal awarded. The Best Exhibit in each Group will be awarded a Silver Medal; and the Best Exhibit in each Class of each Group will obtain a Bronze Medal, all to be accompanied by First, Second, or Third Class Certificates respectively.

"The Second Best Exhibit in the whole of the Art Work Branch will receive a Silver Medal, One Guinea, and First Class Certificate; the Third Best securing a Bronze Medal and Second Class Certificate.

"The Second Best Exhibit in each of the eight Groups will receive a Bronze Medal and Second Class Certificate.

"The Second Best Exhibit in each Class of each Group will be rewarded with a Third Class Certificate."

The Secretary and Manager is Mr. John Black, 2, Newcastle Street, Strand, W.C.

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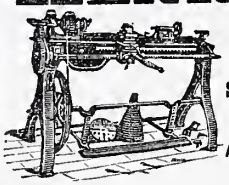

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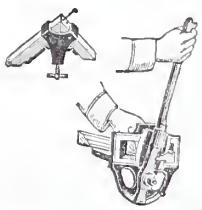

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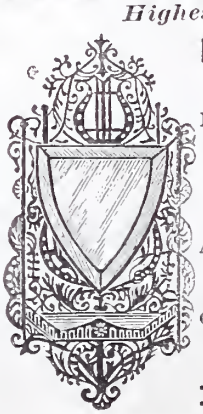

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# WORK

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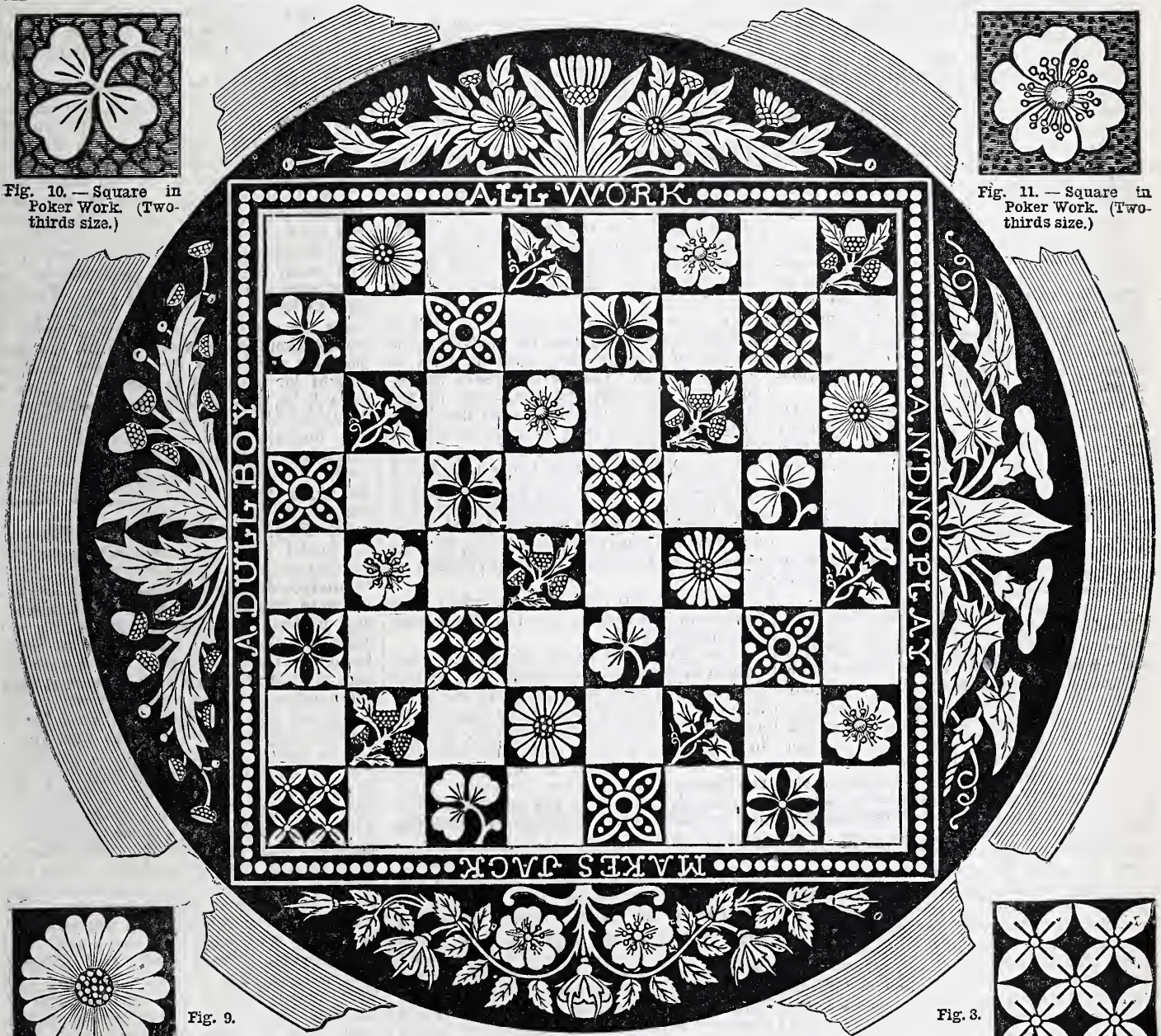
VOL. III.—No. 153.] SATURDAY, FEBRUARY 20, 1892. [PRICE ONE PENNY.



Fig. 10.—Square in Poker Work. (Two-thirds size.)



Fig. 11.—Square in Poker Work. (Two-thirds size.)



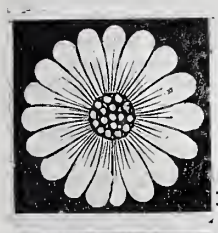



Fig. 9.

Fig. 3.

FIG. 1.—DESIGN FOR CHESS TABLE IN INLAID WORK, CARVING, OR POKER WORK. (ONE-THIRD SIZE.)

Fig. 2.

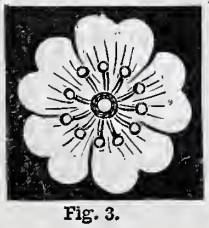


Fig. 3.

Fig. 4.

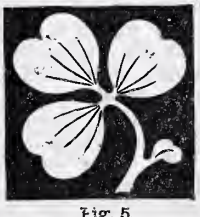


Fig. 5. (Two-thirds size.)

Fig. 6.

Fig. 7.

Figs. 2-9.—Enlarged Squares.

## DESIGN FOR A CHESS TABLE.

BY FLORENCE HUDSON.

This design may be carried out very effectively either in inlaid work, carving, or painting. The best effect would doubtless be obtained by inlaying, such as ebony and ivory, well-contrasted woods, or stone mosaic, in the style of the Torquay work.

But these methods are costly, and moreover require technical knowledge. Whitewood tables are now procurable at all stores and artist's shops, and are most tempting for decoration, and an excellent effect may be obtained by either of the following methods, without any special knowledge and at little expense.

A close-grained, smooth, white wood should be chosen, and two things must be remembered—*i.e.*, not to lose the sharp contrast of light and shade, and that any ornamentation by relief must be below the plane of the table, as represented by the white squares and pattern, otherwise the chessmen will not stand easily. Also great care must be taken in tracing or drawing the pattern, that the squares are true.

*Wood Carving.*—Having gone round outside (that is, on the dark side) all the patterns and lines with a small gouge, the dark ground can be cut down roughly, so as to leave the pattern in slight relief, and the veins in the leaves can be finely cut. The dark parts must be stained, taking care not to encroach on the light parts, and the whole subsequently polished.

*Poker Work*, or burnt-wood engraving, may be substituted very effectively for carving proper. Follow the outlines, and also the veins, with the point. Then the ground may all be dotted closely with the point. This will probably darken the wood sufficiently without staining, but if not, stain and polish as with the carved work.

*Imitation Inlaid Work.*—The following are very simple but most effective ways of producing the effect of inlaid work :—

Having well sized the white wood, and drawn the design, go over all the outlines firmly with Judson's artist's black, which is really a beautiful dark brown. Then put on a mottled brown ground with the same, diluting it with a little turps. When thoroughly dry, re-size (taking care that the brown does not smudge), and either varnish or French polish, which is by far the most lasting and effective way of finishing. Or ebony and ivory may be imitated by painting all the light parts with perfectly smooth, thick, Chinese white, and the dark with ebony black instead of artist's black. Care must be taken in subsequent sizing and varnishing that the white and black do not mingle. It is as well to size each separately. The effect is excellent if carefully done ; or if colour is desired, the colours chosen can be mixed with Chinese white and glazed with pure colour after. When all put on, outline everything with a fine black line (a little gold-size or veloutine mixed with lamp-black to prevent its running), and then size and varnish, or, better, French polish. The fine black line gives quite an inlaid effect.

This design was carried out originally with 1½ in. squares, on a table top of about 19 in. diameter.

Table tops vary so much, that the safest way is to find the largest possible square to be had out of the circle ; and then to arrange the eight squares and lettering to such a scale as will be well within that limit. In other words, when the whole design is drawn, there should be room left for a bevelled edge, or narrow white border, round the edge of the table.

In whatever way the art-worker may elect to carry out the design, the effect, provided always that the execution be good, cannot fail to be satisfactory. But I shall be understood when I add that it goes well-nigh without saying that everything depends on the way in which the work, whether it be inlaying, carving, or painting, is done.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

Case Hardening — Case Hardening at the Forge — Box Hardening — Forgings for Model Work—Differences between Model and General Work—Anvil—File—Leaving Parts Solid—Steel better than Wrought Iron for Model Work—Die Forging—Formation of Dies—Quantity of Material Important.

In the first paper of this series I mentioned several subjects on which I proposed to treat. Space is narrowing up, however, and I find that I must perforce omit two or three of these, and discuss the remainder as briefly as possible in this and in the succeeding and final paper. In this I shall touch on (1) case hardening ; (2) model work ; and (3) die forging.

(1) *Case Hardening.*—Case hardening is a method commonly used for rendering the surface of wrought-iron work as hard as tempered steel. The advantages of its employment are that the toughness of the wrought iron is combined with durability of the wearing surfaces as great as that of steel ; and that the first cost of the forgings, and of the cost of their being tooled and finished into shape, is less than the cost of steel forgings. Case hardening is adopted in link-reversing gear for engines, for the eyes and working faces of various levers, for pins or pivots, and so forth. It is performed as follows :—

There are two methods adopted in case hardening—hardening at the forge, and hardening in pots.

*Case Hardening at the Forge.*—To case harden at the forge, get a quantity of yellow prussiate of potash powdered very fine in an iron tray. Heat the work in the clear fire to a red heat. Take up the prussiate powder in a spoon, and strew it thickly over the surface of the forging. If practicable, roll the forging also in the tray of potash. Time must be given to allow the powder to fuse and run freely over the surface, and then the forging is quenched in water to harden it.

If the forging is so light that it loses its heat too quickly, and before the potash has had time to penetrate, then it must be returned to the fire and heated up to the red heat again before plunging it in water.

*Box Hardening.*—But this method is only suitable for small work, and not for articles of large and irregular form. For these, box hardening is resorted to. Boxes of various kinds are employed. For the heaviest work, cast-iron boxes of circular form with cast-iron covers are used. They are of sizes suitable for the work in hand, ranging, say, from about a foot to two feet or two feet six inches in diameter for engineers' work. For small work, tubes of wrought iron or old pulley bosses are used. The process of hardening is as follows :—The bottom of the box is covered with a thick layer of the hardening material. This consists essentially of such nitrogenous and carbonaceous substances as bone dust, leather clippings, hoofs, salt, and charcoal powder. The forgings are made to alternate with the hardening material in the box. If the forgings are heavy, care must be taken to give them good support among the material, so that they shall not become distorted by their own weight while at a red heat. When the box is filled with alternate layers of work and of material, the cover is put on, and luted with fire clay. It is essential that air be thus completely excluded from the box. Then it is placed in a fire, or, preferably, in a reverberatory furnace, for periods ranging from, say, ten to thirty-six hours. The time during which the box is exposed to the heat of the furnace mainly regulates the depth to which the case hardening will enter. The result, however, depends also partly upon the chemical activity of the hardening agents.

This is assisted by the addition of the salt just now mentioned. Finally, the forgings are turned out into cold water, and are thus hardened. The depth to which the case hardening penetrates varies with the conditions named above. It will range from $\frac{1}{64}$ in. to nearly $\frac{1}{8}$ in. But in the same forgings its depths will not be quite uniform. For light articles, of course, a mere film of surface hardening is enough ; for heavy work, the steely casing should penetrate to the maximum amount, or nearly $\frac{1}{8}$ in. There is this to be said : that since hardening distorts the work, the minimum amount of penetration that is consistent with the purpose for which the forgings are required should be imparted to them—$\frac{1}{16}$ in., or a bare $\frac{1}{16}$ in., may be taken as a good average. In almost all instances the process distorts the forgings somewhat, sometimes more, sometimes less ; and the fitter has to correct outlines, not with a file, which of course will not touch case-hardened work, but with an emery buff, or emery paper.

(2) *Forgings for Model Work.*—Forgings for model work are necessarily expensive, for two reasons. In the first place, in order to produce shapely forgings so nearly like the ultimate finished work that only moderate and uniform amounts for machining are afforded, much time must be spent upon them. In the second place, very few smiths care to undertake such work, because it pays them better to do the ordinary work of the forge, and also because a man must be an exceptionally neat workman to turn these out as perfect as they ought to be made. Yet it is work that practised amateurs, with more time than cash at their disposal, can succeed pretty well with, because there is less of high skill than patience wanted, and there are scarcely any of the really difficult operations of forging involved. There are few special tools required, most of the work being done with hammers and files. The cost of material is small, and the principal appliances are a small anvil and a vice.

*Differences between Model and General Work.*—Speaking generally, we may say that there is less of welding and more of drawing down done in forgings for model work than in those of heavy type. The difference in the dimensions of bossed-up ends or forked ends and their shanks or rods is so small relatively, that it is much easier to reduce the latter with the hammer than to weld the former on If, however, the bosses are of considerable thickness, or the forks large, then it is better to weld them on. There is no difficulty in welding small work, provided no time is lost in hammering the parts together immediately on removal from the fire, which can be done upon a small anvil or a block of iron laid upon the side of the forge.

*Anvil.*—For very light work, one of the small combined anvils and vices will be found serviceable. The work can then be transferred rapidly from one to another as occasion requires, without loss of time. One advantage of a small anvil is that the beak is very useful for turning curves, and to form a suitable bedding when fullering down curved necks and shoulders. For these the ordinary fullering tools are too large. The cross panes of the hammers are useful for this operation. With hammers of different sizes, radii of various curvatures can be formed. Neither are flatters used, but all the battering and smoothing that is done is effected with the hand hammer.

*File.*—Owing to the unsuitability of smiths' ordinary finishing tools for purposes of model work, the file has to be used much more largely in this class of work than in ordinary forgings. When the forgings are cooling down to a black heat, a good deal of material can be removed with little effort, and some kind of finish imparted, that it would be difficult to impart by the hammer alone.

*Leaving Parts Solid.*—Again, in small forged work, many parts are left solid that would be punched or fullered, or cut out in large work. The holes in bosses would seldom be punched, but left to be wholly drilled. The forked ends of eccentric rods are left to be slotted or filed out.

*Steel better than Wrought Iron for Model Work.*—When wrought iron is used for model forgings, the same regard must be had to the direction of the grain as in larger forgings. But in all respects steel is preferable as a material for model work to wrought iron. There is, practically, no grain. It does not open out and prove spilly, like the inferior kinds of wrought iron. It is hard, rigid, and strong, an important consideration when light and slender work is in question, and takes a better polish, and is more durable. For these reasons I should always give the preference to steel over iron for light model forgings.

(3) *Die Forging.*—Die forging, or stamping, is adopted in all modern firms doing repetition work. There are numerous parts in nearly all branches of smiths' work that are required precisely alike, and an enormous saving—often as much as 300 or 400 per cent.—is effected over the hand methods by stamping such work, wholly or partially, in dies. Such parts as flat links for pitch chain, flanges for steam and exhaust pipes, some portions of valve gear, ornamental bosses, railing heads, pins, small levers, and a host of similar articles more or less intricate can be readily stamped with proper appliances. Moreover, another great advantage of such stamped work is that it takes the precise form of the die, and its accuracy is such that the very minimum amount for filing, turning, machining, or polishing can be allowed, and that in a perfectly and uniformly precise amount.

*Formation of Dies.*—The dies are usually made either of cast iron or of steel, the larger dies in the former, the smaller in the latter. In the former case, the required impressions are cast out, and afterwards cleaned and smoothed a little with the file; in the latter case, they have to be cut out with drills, chisels, and files. In either case, sufficient metal must be put into the die to enable it to withstand without fracture the concussion of the blows to which it is subjected. Cast dies are, further, frequently bonded with a wrought-iron ring in order to prevent their bursting under the stress of concussion. For this kind of work the sledge is no use. In little country shops, unprovided with power, the Oliver can be used. But generally the drop hammer, steam hammer, or hydraulic press are used for work of this character; and the heavier and more powerful within reasonable limits they are, the better.

The general mode of working off die forgings is as follows:—The formation of the dies themselves must needs vary with the shapes of the forgings. In the plainest work a single bottom die will often suffice. But if the top of a forging is not plain, then the die must be divided, the upper portion being cut to the requisite outline. The top portion must also be attached to the lower in such a way that it will take its proper position in relation to the lower instantly, without any adjustment. This is usually effected by means of iron dowels, two or three dowels being driven tightly into the lower portion of the die, and standing upwards to fit into corresponding holes drilled in the top portion of the die. The dowels are well tapered, and their ends rounded off to give every facility for entering quickly into the holes in the top portion of the die. Sometimes the bottom dies are furnished with long handles for their manipulation. But as frequently, they are lifted about with the hoop tongs, and the top dies only are furnished with handles. When holes have to be punched in the forgings, corresponding holes are usually drilled in top and bottom dies. The top holes are then parallel, and of the same size as the punch which is inserted in them; but the bottom ones are only of the same size where the lower face of the forging lies, being tapered thence downwards to allow the punched discs to fall down freely.

In many cases two sets of dies are requisite to produce an article. One set will form the sides, and another set the top and bottom. Into the details of these and kindred matters I cannot enter, nor into the relative cost of die *versus* hand forging. Of course, dies are expensive, and however desirable from the point of view of accuracy the use of dies may be, there must always, from a commercial point of view, be a balance struck between the cost of a given quantity of forgings done by hand or by means of dies. As a general rule, there must be at least several dozens of an article required to pay the cost of dies.

*Quantity of Material Important.*—In stamped work, the amount of material required for any given forging must be gauged with accuracy. If there is a little excess of metal, there will be thick fins spreading over the edges, which will not only have to be laboriously cut or ground off, but will prevent the dies from meeting, and so cause the forgings to be thicker than they ought to be. If, on the other hand, the metal is short, then the forgings will not come up keen and clean, but will have edges more or less rounding and inaccurate. After two or three tentative attempts have been made, the amount of metal necessary for any given forging should be estimated accurately.

Time is passing on, and the date that brings us to the conclusion and completion of the third volume of WORK is fast approaching. I am warned, therefore, that this series of papers on the work of the forge and smithy must be brought to a close also, as I said at the commencement of this paper. So the space that yet remains at my disposal shall be devoted appropriately and, I trust, usefully, to the arrangements of the smithy.

## SCARF ORNAMENTS.

BY H. S. GOLDSMITH.

### Scarf Pins.

THE methods that jewellers employ to attach ornaments to the necktie or cravat arrange themselves in three classes, two of which are in ordinary use, while the third is nearly forgotten. One of the two is the subject of this paper, the other is the scarf ring. As these latter are still worn to a considerable extent, they deserve a paper to themselves; but for the third—*i.e.*, scarf brooches—a paragraph here will suffice.

*Scarf Brooches* are mostly of the "comet" pattern shown in Fig. 1, and surely it is about time that the beautiful designs and exquisite workmanship often found in these old-fashioned pieces of work were reproduced, or else that the ideas on which our great-grandfathers based their style of scarf—or rather, shirt-frill—ornaments were once more submitted to the public. This will doubtless depend on the fickle decrees of fashion, and if plain cross-over ties should ever be "the thing," then we may expect and hope to see a revival of the manufacture of this class of ornament.

The opportunity for varied patterns that the elongated form of a comet brooch gives, causes one to wonder why they have not reappeared long before this, if only as a contrast to the insignificant, puny, round beads and minute crescents and horseshoes that have been made by the hundred for the last year or two.

In these scarf brooches, although variety of form is one point, still there is another which we might bear in mind nowadays, and that is the attempt at producing a "jewel." This was defined for us by Carlo Guiliam—the modern Cellini, as he is called—in a lecture given at the Society of Arts on the "Art of the Jeweller." He says: "The object of a jeweller will be to produce the largest amount of beauty in the most limited space possible under the circumstances. A piece of goldsmith's work need not necessarily be expensive; it is the style, the design, the form that will give that grace and refinement which will give joy and pleasure to look at it. The very word itself is derived from the Italian word *giojello*, meaning joy, pleasure to the eye."

Such a paragraph as that applies to our trade in every branch, but with regard to scarf brooches especially, one finds that, be they even plain rounds or ovals, even then the maker has not only done the mechanical part excellently, but by the employment of various well-chosen colours both in stones and gold, as well as in contrasting plain and chased surfaces, that he has produced a real "jewel." The stones in these scarf brooches are not restricted to diamonds alone, but rubies, emeralds, and pearls are very often met with.

The one sketched here (Fig. 1) is a very usual pattern: it is intermediate between the collet with a simple bar and the much more elaborate ones that are to be found in the hands of connoisseurs.

*Pin-stems and the Principles that govern their form.*—Pin-stems and the parts that attach them to the pin-head is, then, the principal subject of this paper. But before we enter into details, let us spend a minute or two in thinking over the purposes for which they are made.

The first thing is, doubtless, to give security to the ornament. Now, the consideration of that leads us naturally to the means we ought to adopt to obtain the utmost power

of holding combined with the equally important—and opposite—quality of easy insertion. In different places different methods are used. Length only is thought sufficient by the French people, for their pin-stems average nearly 3 in. in length, and they are but plain pieces of hard gold wire, nicely pointed. We in England, in trying to "make assurance doubly sure," generally make a groove in the stem, like Fig. 3, D; or else use some of the methods to be mentioned later on, such as the addition of spikes or nuts, etc.

In old work, another sort of addition is introduced for the purpose of obtaining greater security, and that is illustrated in Fig. 5. It is, as you see, another and generally smaller pin, connected by means of a fine chain. The custom of chaining scarf pins together is one that has fallen into disuse, notwithstanding that the fine chain and small pin-head add greatly to the appearance of the chief ornament, leading up to and pointing out the larger one rather than detracting from it; just, in fact, as the frame of a picture improves the appearance of the painting.

Sometimes we find that three pins are attached to one another, each one of importance in itself, and, as one would naturally expect, the chain is occasionally made more of an ornament still by being set with stones, or else by having pearls strung along it at intervals.

This seems beyond our immediate purpose, which is the consideration of obtaining security for the ornament as now worn; so, to proceed with the technical details. One has but to call attention to Fig. 12 (A, B, C, D, E, F, G); these are, of course, the most secure of all, for by the addition of a nut or a pin, *after* the scarf pin is adjusted in the scarf, it becomes impossible for it either to ride up or drop out, or even be snatched out by any of the light-fingered fraternity.

*Details of Manufacture.*—We have glanced at the main purpose of pin-stems, now to consider the best way to carry that purpose out.

We must, in the first place, have the pin-stem pointed, for it has to be inserted in a silk scarf, and it must be strong enough to bear forcing in and out of and through several thicknesses of material. On the other hand, it should not be made thicker than is absolutely necessary, else it would make a large hole, and possibly spoil the scarf.

There is yet another consideration to bear in mind, and that is with reference to the pin-head. For the purpose of clearly indicating the last reason, we will suppose (as an extreme case) that a bead is to form the pin-head: one made, say, of delicate wire-work, and quite hollow. Now, if a piece of filigree work such as this were attached to a thick or clumsily-made stem, would not the result be that the bead would be squeezed up by the finger long before the stem could be forced in and through the hard scarves that are now worn?

The guiding principle of making stems is proper proportion—that is, of greater or less thickness, according to the strength or fragility of the head of the pin, or the use it is to be put to. This proportion, *i.e.*, suitability, is one of the points that a good workman would be sure to have in his mind.

In extreme cases it may be advisable to use a steel needle in place of a gold stem, for be the head ever so weak, it has got to act as the means to force the stem in, and we can do nothing else but use it.

Now to make an attempt at describing, as thoroughly as may be, the steps in the manufacture of a simple plain pin-stem, and then from this—the simplest type—we can show, step by step, the alterations from that which are in common use. It is to be hoped that it will be done in such a manner that an apprentice will be able to judge for himself the different advantages, defects, or improvements that such alterations bring in their train.

*French Pin-stems.*—The simplest stem of all is that illustrated in Fig. 2; it is that used in all French work. It is a quite plain piece of pointed wire, made in 18 ct. gold (alloyed all copper), which has necessarily to be drawn down very hard, to get rid of the natural pliability of that quality. This means, as you know, that for the last twenty or more holes in the draw-plate which it has been through it should not have been annealed. Even that is probably too little, and it would have been better to have twisted it and hammered it, and *not* annealed it at all. Experience will only teach that, so we will take it for granted that your wire is to the proper size, straight and hard; the length we have spoken of as being about 3 in. for smooth stems, the thickness size, 17 B.W.G., or 19 Shakespeare flat gauge.

Of the way it is to be attached to the head, more is written later on, so we now have but to consider the point you have to put to it. It should be like Figs. 2 and 3—that is, neither weak or thin, nor blunt and ugly, like Fig. 4, *b*. Pin-stems are pointed this way doubtless as a result of experience, for we find the same shape of point almost exactly in the ordinary pins sold by the drapers. If you will compare these with needles, you will see how the greater hardness, etc., of the metal, steel, permits of a much finer point to the latter.

In the metals—gold and German silver—we cannot obtain such a special hardness, therefore do not make your pin-stems with points like a needle, but condescend to follow the shape given to the humble ordinary pin, which is made of a metal resembling those we use.

This calls to mind that we have of late years had to make up small gold pins, with pearls for heads, to be used to fasten dress ties to the shirt collar. For these also no better model can be found than "short whites" of good quality. Plain stems are occasionally used for the light pins that ladies have to fasten their lace with; the length and strength of stem being made proportionate, of course, to the use they are to be put to, and to the size of the ornament they carry. They will, therefore, be several sizes thinner than the usual stem.

*Twisted Stems.*—From a length of 3 in. we drop to an average length of 2½ in. when the stem is other than plain, such as the general one with a twist, used here in England.

There are two ways to make this form of stem with a hollow, or twist, or groove in it; both ways have their advocates, or at least their users. One way is by filing the groove, the other by hammering and twisting the stem.

The first is thought to be somewhat objectionable, for this reason: that the bottom of the groove is very likely to be not round, but sharp—a continuous nick, as it were. Now, a sharp nick is always the place of greatest weakness, which you can see for yourself if you notice how small a nick, comparatively, an engineer will put in a rod of steel at the place where he wishes to break it.

As we do not want our stems to be always breaking, the second method is preferred by the writer, for he holds that the twisting of the grain of the wire tends towards retaining a good part of the strength which is liable to be lost by having these hollows in a stem.

The steps in making a pin-stem after the second process are drawing the gold wire (9-ct., usually) to a proportionate size—say, 17 B.W.G. size, or the Shakespeare flat gauge, size 19; then to cut it into lengths of about 2½ in., straightening it in the draw-plate before cutting it, of course.

We now have a piece of wire 2½ in. long, straight and hard (Fig. 3, A): this has now to be annealed in the centre, where the twist comes, and nowhere else; then flatten it out with the hammer, like Fig. 3, B, and 3 B′, not with an unequal thickness like Fig. 4, A.

Again anneal it, and proceed to twist it until it comes like Fig. 3, C. This will be done with a couple of hand vices, or in the same way as a brooch tongue is done (see p. 648, Vol. I., of WORK, Fig. 4).

If there is any soldering to be done, it will be the best time to do it now, before the stem is hardened. It may have to be soldered to the head, or a collar may be required; if it is, then let it be a small one—not anything like the great ugly thing on Fig. 4, B.

Now to harden it and finish it. It is soft all over now, except at the point, which you have not been told to anneal, and a good deal of trouble will be saved if you have not annealed it, but have kept it hard. If through inattention or carelessness you have annealed it, then proceed to hammer it first one way, then the other; but do not get it "double"—*i.e.*, split—if you can help it. A pin-stem with a double point ought to be replaced with another one, for soldering the end up means farewell to nearly all hopes of getting a firm, strong point.

If all is right, then hold the stem on a sparrow-hank, small anvil, or smooth iron, and proceed to reduce it to the same diameter all along.

The blows of the hammer are to be many in number, and not heavy, for we have to obtain a gradual and thorough hardening, and to that end the stem must be rotated all the time by the finger and thumb, so that the blows of the hammer will strike successive parts; thus the round section of the wire will be brought back again. This also straightens the stem, so we can proceed to file it up, first roughing the points down, then with a smooth file going over all of it from collar to point; the result should be something like Fig. 3, D. The point, you will notice, is of the same shape as the French one.

*Badly-made Stem.*—As contrasts help to indicate the point of one's argument, Fig. 4, B, is given to be compared in all particulars with Fig. 3. Here follows the chief fault it possesses. It is hammered too thin in the centre of the twist, the wire itself is too thick, the twist is too long and too near the point, and is of course irregular, and finishes off with a kind of gash: then the point is too blunt. That is a too general fault, and yet it could be so easily altered in this and all other cases; but unfortunately it is not. The collar at the top is too large; not that this tends to weakness, but because it is out of proportion to the work it has to do—viz., to act as a stop to tighten the screw against.

*Polishing.*—There are one or two other things that might be said, but we will get

the stem finished off; it only wants polishing. Take a bundle of threads, and charge one single one with crocus and oil; coil it round in the groove and rub away from one end to another; after that, use water of Ayr stone and buffs; don't take it to the lathe and polish off all the corners with a wheel brush: the edge of the groove should be sharp and square, and for a reason apart from the look of the thing. It is a small matter which is generally overlooked, for we know that the object of the twist is to keep the pin steady in the scarf; that being so, no individual will dispute that a hollow with rounding edges is much less likely to catch the silk than one with their square corners.

Do we not twist our stems in the wrong direction, and, in so doing, throw away a considerable amount of holding power? If we twisted our stems as a right-handed screw, and screwed them into the scarf, we should then get plenty of hold: as you can try for yourself when you come across or make a stem with that twist as suggested. I believe the original maker of this kind of pin-stem intended them to be screwed in; but of course people do the things the easiest way, and as a consequence we find that not one in one hundred has its thread to the right. I have written before this about the left-hand screws.

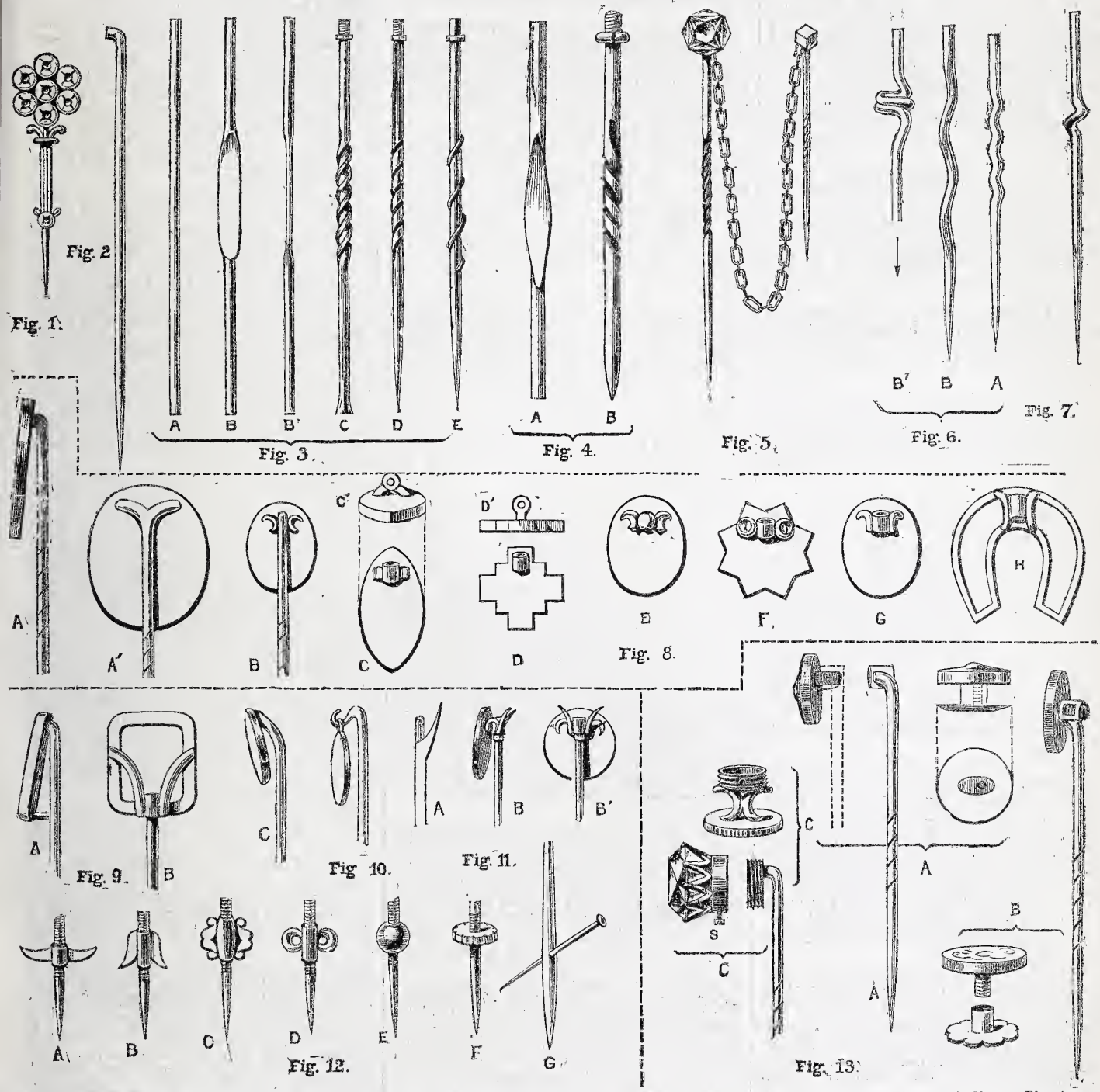



**Fig. 1.**—Comet Brooch, an Old Style of Ornament for Gentleman's Shirt Frill or Cravat. **Fig. 2.**—French Pin-stem. **Fig. 3.**—Ordinary Pin-stem—A, Plain Wire before commencing the Twist; B, the same after Hammering; B', the same after Hammering to show Thickness; C, Appearance after being twisted, and with the Collar soldered on; D, Finished Stem; E, Stem with raised Thread. **Fig. 4.**—A, Wrong way of forging the Stem for twist; B, Shows A when twisted and hammered with bad Style of Point and clumsy appearance generally. **Fig. 5.**—Square Wire Pins connected by Chain for security. **Fig. 6.**—A, Zigzag Stem for Lace Pins; B, Spiral Stem for Lace Pins; B', Mode of commencing Spiral Stem. **Fig. 7.**—Perks and Sons' Screw Stem. **Fig. 8.**—A, To show the amount of Space to be allowed between Pin-head and Stem; A', Back View of same; B, a more Ornamental Form of A, where Stem is soldered direct to the Pin-head; C, D, Back View of a Stirrup or Socket to screw Pin-stem in; C', D', Side View of same; E, F, G, H, Various Forms of Sockets. **Fig. 9.**—A, B, C, Bad Forms of fitting Stems to Pin-heads. **Fig. 10.**—Shepherd's Crook Pin-stem for Swinging Ornaments. **Fig. 11.**—A, Pin-stem with Spike, to prevent Pin riding up in the Scarf; B and B', Side and Back View of similar arrangement, but with two Spikes on the Pin-head itself. **Fig. 12.**—A, B, C, D, Forms of Butterfly Nuts; E, Bead Form of Nut; F, Disc Form of Nut; G, Stem pierced for passage of Pin. **Fig. 13.**—A, Improved Arrangement for Interchangeable Pin and Stud, with Screw soldered above the Centre; B, Pin and Stud as usually made; C, Another Method, where a small Screw (S) can be made to go through the Male Screw on either Pin or Stud to prevent the Setting coming unfastened.

in Indian ear-rings, which doubtless arises from the same cause—viz., that to produce a screw to advance by turning it to the right, it is necessary to turn the thread in the opposite direction. In place of the groove, a thin wire is sometimes coiled round and soldered, like Fig. 3, E; but this is a formation that is not much used.

*Other Kinds of Pin-stems.*—It is time that we got along with a description of other stems, presuming that the reader will fit the details already given on to those that follow.

*Old English.*—Fig. 5 is made from simple square wire, twisted. If the wire be polished before twisting, the result will be better than if it were done afterwards. You may use the hammers to this twisted stem if you want to spoil it; not otherwise. As you see by the diagram, it is this pattern we find in old work.

*Lace Pin-stems* (Fig. 6, A).—The crinkled one is an approved form for lace pins, where a sharp-edged groove might cause damage. These were formerly used for gentlemen's scarves as well.

A slightly varied form (Fig. 6, B) to this is simply made by twisting the middle of the stem wire round a small mandrel; then after removing the mandrel the wire is pulled out again, until some slightly waving form only is left.

*Corkscrew Stem.*—Fig. 7 is intended to make its way into the scarf corkscrew fashion. I have for the last few months looked in vain for an older pattern of this in shop windows. If anyone should have to make one with several turns, the easiest way I know is to take a large carpenter's screw, and coil the wire in between the threads; this will give regularity of spiral, and do away with nearly all the plier work—which is, as we know, the thing to be avoided in all wire-work. Fig. 7 has lately been introduced by Messrs. Perks & Sons, of Birmingham, and it undoubtedly deserves a fair trial.

*Screw and other Sockets for the Pin-stem.*—So much, then, for pin-stems; now for the means of attaching the stem to the ornament. It seems that there are three courses open to us. Have I not met that phrase before? The first and simplest is by soldering it direct on to the pin-head, as the French do, for the greater part; secondly, by making a female or socket mount on the pin-head, and in this to screw the stem; thirdly, instead of screwing the stem in, we can pewter-solder it into the socket.

Are there any rules or principles to bear in mind with regard to the way any or all of these are to be attached? Yes; for in the first place we have to show the ornament, whatever it is, to the best advantage. To do that, it should look well out to the front, and just a little upwards. It should remain steady in that—the best—position, neither leaning first to one side, then to the other, as the pins made from the convertible pins and studs do too frequently.

Two things are to be obtained, then: first, to show the ornament; secondly, to keep it steady. The way they are managed is shown in Fig. 8, A, where the front of the pin-head makes a good average angle with the stem; and for the second, you will notice that the space between them is about sufficient to let the scarf pass easily, and no more.

The scarf *must* be allowed to travel unimpeded as near to the top as possible—just like Fig. 8, A, in fact. It should never be stopped by either a peg like Fig. 9, A, or by having the "stirrup" as low down as Fig. 9, B, nor should the pin-head be tilted like Fig. 9, C. These three were sketched from pins I have had through my hands within a month of writing this, so it is evident that some people don't know or don't think about this.

The space left between stem and pin-head should in all cases be as shown in the side view of Fig. 8, A; perhaps it will be clearer if Fig. 8, A, and Fig. 9, C, are contrasted. Does it need any words to point out that Fig. 8, A, is right and Fig. 9, C, is wrong?

Our model for position and space between the head and stem is Fig. 8, A; something allied to that we are to obtain, be it plain soldered stem, forked stem, or socket (stirrup) and stem that we are using. If that is understood, we can get on towards a finish, for a mere row of sketches of different arrangement will give all the information required, and but little description will be called for.

Fig. 8, A to H, are a few of the different ways that the stem is attached to the work; they are various and general forms of (stirrup) sockets, which are employed when the stem is to be either screwed or pewtered in.

The centre of all of these can be made either from chenier or from a grain of gold run up on a piece of charcoal, in which a small round depression has been made with a doming-punch, or else from a coil of small rings soldered together.

There are yet two ways not spoken of. They are illustrated in Fig. 5 and Fig. 10. The first is where the stem is soldered straight into the ornament, which will be either globular or egg shape in form, such as a pearl or a lapis, gold or coral bead. The other (Fig. 10) is when the ornament (a coin or pearl pendant, may be) is to swing, then this form of stem is used; it is sometimes called the "shepherd's crook."

*Additional Means of securing the Ornament.*—Fig. 5 has already shown one direction in which attempts have been made to obtain more security for scarf pins; another class of additions for the same purpose is indicated by Fig. 11, A, B, B'. These consist of a spike or spikes, which are to be so placed that they will catch in the tie and prevent the pin riding up.

Fig. 11, A, shows the spike soldered to the stem. Now, as this cannot be screwed in the socket, it must be pewtered in to make the part that fits the socket, and the socket itself either square or oval; this is, of course, to prevent the stem turning. The pewter solder might hold it all right, but it is not worth while to trust to it more than is absolutely necessary.

Fig. 11, B, is a double spike arrangement, which you see is part of the "stirrup," consequently part of the head of the pin. To use this one will mean that great care must be exercised in getting the points hammered hard after the work is coloured—the very last thing, that is. The points themselves should be polished bright.

Another way of obtaining extra security is to form the end of the stem into a screw, and make a nut to fit on it. Any shape nut will do, providing that it is large enough for the wearer to handle conveniently; but one of butterfly shape (Fig. 12, A, B, C, D) will lay flat, and would be more comfortable to wear than one like Fig. 12, E or F. This screw and nut arrangement is the best for safety, and is consequently the one generally employed, in spite of the way which the screw catches the silk.

The stem, when used with these, requires fixing firmly, for it has to resist the nut's withdrawal. Several times have I had the pin given up to me as finished, ready to send to the customer, and on trying the nut I have had the pin-head come off instead. This sort of thing does not improve one's temper much, neither does it do much to heighten one's opinion of the workman.

The more I see of life, the stronger grows the feeling that to succeed, all that is necessary is a little common sense, conscientiousness, and industry. Ability to make articles well goes for little or nothing when such little discrepancies as the one above referred to are continually cropping up—and they do crop up almost daily. In a former paragraph, the way to keep a stem steady when pewtered is spoken of.

The last dodge for preventing loss that comes to mind is that of a perforated stem, like Fig. 12, G, where a common pin is intended to be pushed through the scarf and the stem. Many other ingenious ways have been brought out from time to time, but as they have not got into very general use, it does not appear worth while to describe them.

*Combined Pin and Stud.*—Perhaps this is the place to say a word about the ornaments now made to do duty as both pin and stud. Perhaps it is; but as nearly the whole of them make a good stud and a bad pin, it occurred to me that this matter more properly belonged to the paper yet to be written on Studs.

However, as it may be a long time before that gets printed, I have decided to allude to the matter here. It is a matter of everyday experience for me to have these studs and pins through my hands, and it is almost a universal custom, I find, to put the screw right in the centre. Now, for a stud that may be all right, but for a scarf pin it is not right; it cannot set properly in the scarf, as you can see by taking a walk where the wearers of such things most do congregate. Apart from that, you and I know that it is necessary, five times out of six, that we should be able to keep one direction of the stone—up and down, as it is called—either on account of such shapes as oblongs, drop shapes, or ovals, or to retain the proper position to show off the play of light in a cat's eye or moonstone.

To attain this fixed position of the ornament, as well as to get it to fit better on the scarf, I carry out this notion whenever the size of the ornament allows me to do so. It is simply to put the screw above the centre; this tends to keep the pin steady, and when used as a stud no inconvenience is found if the pillar of the stud be made oval: the screw, of course, fitting in one end (not the centre) of the oval pillar. Fig. 13, A, will show all the details of this, while the ordinary method is shown in Fig. 13, B. Another way is shown in Fig. 13, C. Here the screws are much larger in diameter; and as but two or three turns can only be used, it is well, where possible, to add a small screw, S, which will pass through both mounts, and so prevent the small amount of unscrewing which might result in the entire loss of the jewel.

A paper on Scarf Slides will follow this shortly.

## A WARMING PAN.

BY J. L. D.

A MOST desirable bed companion in cold weather is a jar or bottle of hot water tucked away somewhere in the region of the feet. A jar, however, possesses some disadvantages. Its capacity is limited, its shape is not often all that could be desired, and its cork sometimes does not perform its duty with becoming propriety.

To remedy these defects, I was asked to design and make a tin receptacle for hot water, which would not alone keep the feet comfortable, but act as a warming pan by being placed in the middle of the bed half an hour before its owner. I decided that in shape it should be oval, and its length one foot. For its construction I procured a sheet of best tin, 12½ in. by 17 in., and bent it over a broom handle into an approximately elliptical shape. The ends I joined together with the familiar folded joint such as is seen in almost any tin-plate vessel. I also ran a little solder along the joint. I found, on measuring, that the ellipse was 6 in. by 3½ in. I ought to mention that the sheet of tin was bent so that its greater length was round, the body of the warming pan being thus a little over 12 in. long. By means of two pins and a bit of twine I drew an ellipse, 6½ in. by 4 in., on a piece of cardboard. This I cut out with the scissors, and used as a pattern. I then procured a piece of sheet copper, 6½ in. by 8 in., and as thick as a threepenny bit, and from it cut two ellipses like the pattern. I then scribed lines ¼ in. from the edges, and flanged the ¼ in. at right angles to the body, like the top of a coffee canister. The flangeing I did over a piece of round iron, 1½ in. thick, and cut square at the end. When first I turned it over with the hammer, there were a number of puckers; but I tapped away at them, and when I thought the copper was getting hard, I annealed it by heating it to redness in the fire, and letting it cool again. I then tapped away again, and soon had the flange perfect. It also fitted the end of the body fairly, requiring only a little touch here and there to bring it into contact.

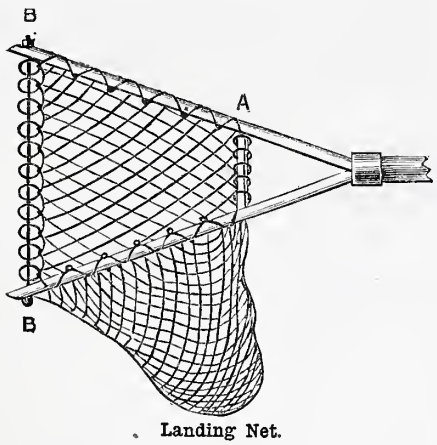
I then soldered the body and bottom firmly together, using only resin as a flux for the solder. I may here caution my readers against using spirits as a flux—at least, where tin is concerned. I have frequently seen the tin eaten through in holes from the action of the spirit. Before the other end, which we will call the top, is put in place, it would be well to furnish it with a screw-plug and handle. For the former I used a coupling, such as is used in a ½ in. brass cock, and for the latter a piece of wire, ⅛ in. thick, bent so as to fit four fingers comfortably, and fastened to the top with a strip of copper soldered all round. The top may now be put on the body and carefully soldered all round. A kettle of boiling water run in through the plug-hole will soon show whether there is a spot which requires further attention.

## ABOUT LANDING NETS.

BY LANCELOT L. HASLOPE.

THE easiest way to make a landing net is to net a sufficient number of loops on to a foundation as already described in WORK, and then to join them together into a circle by taking up the first loop that was made. If each succeeding loop is now taken up, a tubular-shaped net will be formed. When it is considered to be long enough, one end should be closed by reeving a piece of twine through the end meshes and fastening it with a reef knot. It is well to make the net deep enough, as otherwise the fish are apt to jump out of it as it is raised out of the water.

A better mode of making the net is as follows:—Net in the usual way a square piece of netting, sufficient to cover the ring to which it has to be attached: then fasten



Landing Net.

a piece of twine to the centre mesh, and attach this to the handle of a door or other suitable place. Now net round the square piece you have made, and a circular net will be formed, having a flat or nearly flat bottom, which will hold the fish more securely than one tapering to a point. In rounding the corners, the needle should be passed twice through the corner meshes, as this improves the shape of the net when finished. It is a good plan to net the last row of meshes—that is, those by which the net is secured to the ring—with double twine or twine of a coarser kind, as these meshes are apt to wear out long before the rest of the net. When the net is finished, it is laced to a ring of some kind with ordinary twine or fine copper wire.

Rings are made in a great variety of shapes. Stout iron or brass wire bent into form, with the ends turned outwards for two or three inches, so as to form a tang to go into the handle, answers very well, though it will be rather cumbersome to carry about. A great variety of collapsing rings may be purchased at the tackle shops. These usually screw into a handle, and thus take up but little room. The handle, when made of bamboo, forms a convenient receptacle for an extra top or two. On the whole, the best form of landing net with which I am acquainted is the one I have given an illustration of. The wood must be sawn down the centre for about twenty inches, and a ring or lasting passed round the end of the cut to prevent splitting. A short cross-bar is then inserted, as shown at A, and the ends secured by twine, as at B. The net is then laced on in the usual way.

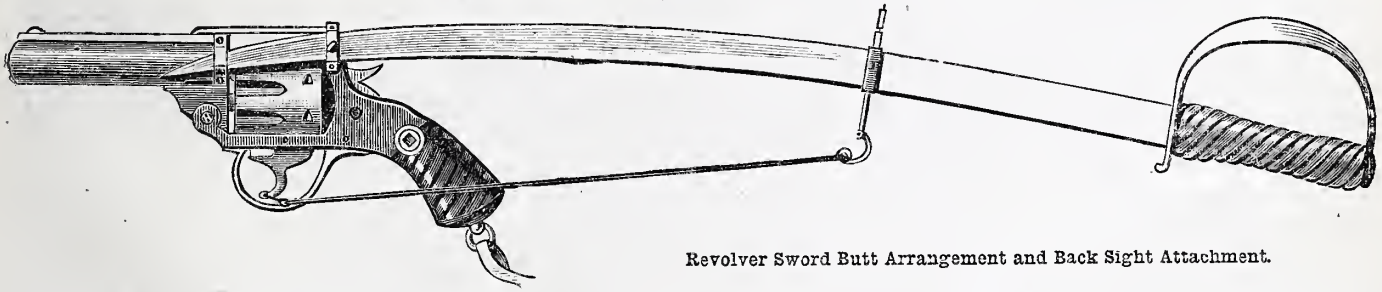
## MODE OF LENGTHENING A REVOLVER SIGHT FOR LONG-DISTANCE SHOOTING.

BY JOHN CHARLES KING.

THE revolver for military use is effective for aim only at close quarters. There are times when a dismounted cavalry-man who is without a carbine would be glad to use his revolver for a hundred yards mark, but with sights so close it is almost guess-work to attempt an aim at that distance.

His sword in this emergency might serve him well, if it were arranged for the purpose, and the revolver had staples to take the point of the sword to hold it up, the soldier using the sword-hilt as a butt to put to his shoulder, and a detached hilt-piece for sight and trigger, as shown by the annexed illustration. The revolver to have two flat staples on near side of butt, as shown, the rear staple to have a tightening nut screw to secure the sword to the revolver. The staples are lined with ebonite, to prevent abrasion of blade, sides, or edges.

*Description of Sword.*—A sliding peep-sight forms a part of the hilt, but detachable by sliding forward to a fixed limit, there to be secured by a spring stud, which engages into a recess in the side of the blade. This peep-sight has, at its lower edge of slide, a projecting piece terminating in a jointed trigger; at the point of this trigger is a small hole to take a bit of woven wire or whip-cord of suitable length to reach the revolver trigger, so that the movement of the sword trigger acts on the revolver trigger for firing. The additions proposed would not affect the ordinary service of sword or revolver.


Revolver Sword Butt Arrangement and Back Sight Attachment.

## SHORT LESSONS IN WINDOW MAKING.

BY G. LE BRUN.

### THE CONSTRUCTION OF CIRCULAR-TOPPED SASHES.

CIRCULAR and Gothic-topped sashes are two of the most difficult forms of windows that fall to the lot of the average house carpenter to construct; and as their use is confined to the more ornamental styles of architecture, they are not of common occurrence in the ordinary workshop: in fact, a man might work at the trade for years, and yet never see a window with a circular top made; therefore, a few general hints on such sashes may prove of use to the young workman, and enable him to better tackle any job of the kind that may happen to come in his way.

The general construction of the sides and lower part of these windows, whether "hung" or "deadlight," is almost identical with the forms of windows already described; but the top part is very much different in its putting together, and will tax the technical ability

of the worker who is not already versed in their making. A few special tools are necessary for the work. They are a circular-soled hand plane, which may be either an ordinary wooden hand plane cut to suit the required circle, or, preferably, one of the useful adjustable circular planes sold by Melhuish, in which the flexible sole can be bent to suit either straight, convex, or concave work by means of a screw (Fig. 1); a sash router to work the Gothic moulding with (Fig. 2); and a circular rebate plane for forming the glass rebate (Fig. 3). This last may be made by the worker himself, the iron being purchased. In using these tools, you have to fix the work

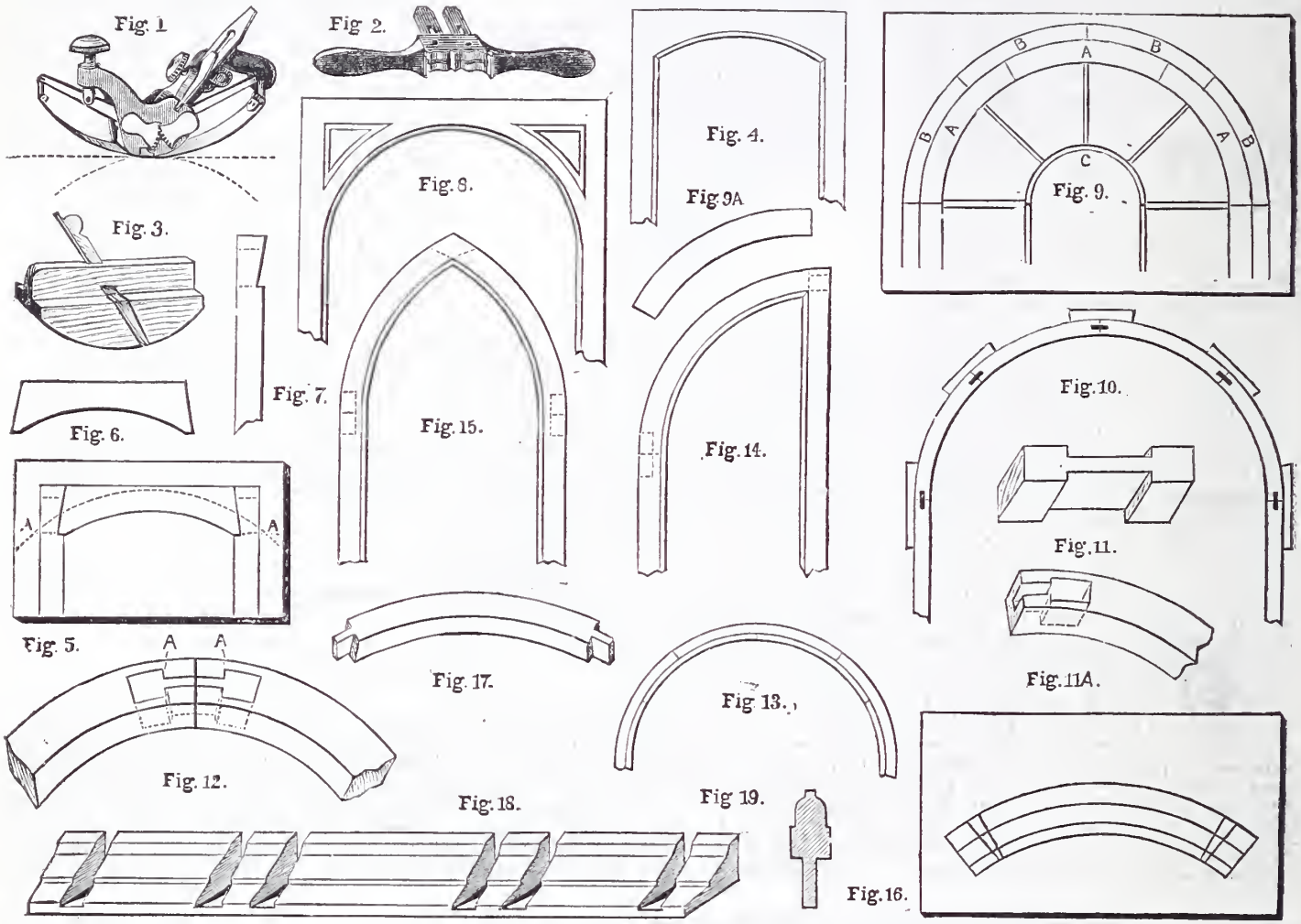



**Fig. 1.—Adjustable Circular Plane. Fig. 2.—Sash Router. Fig. 3.—Circular Rebate Plane. Fig. 4.—Top of Simple Circular Window. Fig. 5.—Board with Drawing of ditto. Fig. 6.—Mould for Sash Lintel of ditto. Fig. 7.—Top Part of Sash Tile cut in for Lintel Shoulder. Fig. 8.—Circular-topped Sash for Square Case. Fig. 9.—Drawing-board, with Drawing of Circular-topped Case and Hung Window. Fig. 9A.—Mould for Segments of Sash Top. Fig. 10.—Case Top, showing Mode of joining Segments. Fig. 11.—Shape of "Key" for joining up Sash Segments. Fig. 11A.—Mortise in Segment to receive "Key." Fig. 12.—Mode of keying Segments together. Fig. 13.—Mode of building up Sash-bar. Fig. 14.—Top Part of Gothic Window. Fig. 15.—Another Form of ditto. Fig. 16.—Board with Drawing of Circle Window for Corner or Turret. Fig. 17.—Rail of Circle Sash. Fig. 18.—Sole for Three-light Hung Window. Fig. 19.—Sash-bar for Plate Glass.**

firmly in the bench jaws, and work from both ends of the piece of curved wood towards the centre where the grain meets, as if you were to work the planes right round the circle, part of the wood would be torn up, and the job spoiled. This little matter will, however, at once make itself apparent to you when you commence the work.

One of the simplest forms of shaped window is that shown in Fig. 4, and in which the lintel of the sash, owing to the slight curve, is worked out of one piece of wood. To obtain the curve, lay a straight-edge across the wall opening, the ends just touching the spring of the arch; then measure the distance from the straight-edge (at the centre of the opening) to the top of the arch. Take a few pieces of matchboard of a sufficient length, drive them well together, nail two pieces of wood across the back to hold them together, and with a coarse hand plane level the overwood at the joints. This is to form a drawing-board. Lay it on the bench, and draw the top of the window full size on it, as in Fig. 5. Take a piece of thin wood, and make a mould the exact shape of the sash lintel between the tenons (Fig. 6). Your sash stuff having been prepared and "set out" in the usual way (so far as the lower part is concerned), take the mould and lay it on the piece for the sash lintel, which should be of a sufficient breadth to allow the same width being left at the thinnest part of the circle after it is cut as the width of the rest of the framing; mark it accurately at the ends and round the inside edge; cut out the circle with a narrow saw, make the tenons, and proceed to work out the glass rebate and mouldings. When finished, lay on one side, and mortise the stiles; after mortising, cut out the piece as shown in Fig. 7, to fit the bevelled shoulder of the lintel rail, which carefully fit into each stile, and then finish off the window in the usual manner. In a double-hung window of this description the case is made square in the ordinary way, the outside facing on the case lintel being kept wide enough to cut out to the required circle, which is denoted by the dotted line at A A in Fig. 5. A window of this kind can be made with a much deeper circle than that shown: in fact, the only limit is the width of the stuff you can procure to cut your sash lintel out of; but it presents a heavy appearance on the inside of the room, where the square side is necessarily seen. To obviate this heavy appearance, and still have the simplicity of a square case, the plan shown at Fig. 8 is sometimes adopted, two pieces of framing being inserted in the corners of the window, and the triangular opening thus formed filled in with coloured glass. This mode certainly looks much lighter than the solid wood, although entailing more labour. The size and bevels of the circled corner pieces are taken from a drawing made on a board, in the same manner as the previous example.

We now come to the real circular-topped window, where the whole of the top part, both of case and sash, must be worked out of the solid. The first thing to be done is to lay down the full-size drawing of the top of the window on the board, as in Fig. 9, in which A is the sash, B the case, and C the sash-bar. The top of the case may be in three or four pieces—more if the window is large. In this instance we will suppose it in four pieces, and the sash in three pieces: these pieces must be of an equal size, so that

one mould may do for them all. Make a mould for a segment of the case top (Fig. 9 A) and another for the sash top. Keep these moulds, say, 1½ in. longer than the exact size of the segment, as you will require a little extra length to allow for working. To get out your stuff, select a good piece of wood, of the requisite breadth and thickness. For the sash it will be 2¼ in. thick, while the case will require 6½ in. These can, by dint of much labour and an extraordinary amount of perseverance, be cut out by hand; but if at all within reach, take them to a saw-mill, and have them cut by a band-saw. Of course, in marking them off you will keep them full to the mould, so as to allow a little for loss in working.

Having the stuff cut, work it carefully to mould; lay it on the drawing-board, and mark it accurately for cutting; fit the joints together by means of a plane; try the segments together on the board while you are jointing them, so that you may keep accurately to the circle. When you have both the case and sash stuff jointed, it will be ready for putting together, which is done in the case top by grooving the ends of each segment and inserting a slip of hard wood, and by screwing pieces of wood of the same width as the case top, and curved to fit, on the outside. This method of jointing is shown in Fig. 10, and both slips and clamps should have a coat of warm glue. The same method is used to fix the ends of the circle to the pulley stiles of the case.

The sash top is put together by means of what are termed "keys" of hardwood (bolts and nuts are sometimes used). Their shape is shown in Fig. 11; the ends of the segments are mortised to receive them (Fig. 11 A), and they should be about ¾ in. less than the width of the sash stuff. Keys and mortises must be well smeared with thick white lead, and secured by driving in wedges, as at A, A, in Fig. 12. The lower parts of both case and sashes can now be put together, the tops attached, and the whole finished off. The sash-bar should be built up of two thicknesses of wood cut to circle, as in Fig. 13, the different pieces overlapping each other, and thus giving greater strength. The finished sizes must be taken from the board, and the mortises made for the reception of the straight bars, after which the moulding can be worked.

The case and sashes being ready for fitting, that operation is the same as described for hung sashes, but a little more care is necessary to fit the top sash correctly. If the window is a deadlight, little fitting into its place will be required—that is, if the sizes have been properly taken. Sometimes, as in the case of a hinged window, the sashes are made to open in two parts. Then the construction must be as in Fig. 14, where it will be seen the curved piece of the framing is secured to the long stile by the ordinary mortise and tenon, and the short stile by means of a key.

Fig. 15 shows the top of a Gothic window, which is halved at the apex, and secured by being well screwed together from both sides, keys being used to attach the top part to the stiles. In a flat-headed Gothic window this arrangement would be reversed, a key being used for the apex, and the stiles halved for the bottom.

In the construction of all the foregoing styles of window the greatest accuracy must be observed in laying down the drawing on the board, so as to get accurate sizes; and also in making the moulds, marking off the lengths of the segments, and making the joints. For without accuracy in these particulars you cannot expect to make a well-fitted window.

Another kind of circle window, and one a trifle easier to make, is that with a square top, but with a curve outwards—such as might be used at the corner of a house or in a turret. In this case we lay down on the drawing-board the curve of the window-sill (Fig. 16), from which drawing we get the curves and sizes of the case, sole, and lintel, and the sash-rails. Moulds will be required as follows:—One for the case sill, which also serves for the case lintel; one for the rails and bars of the lower sash; and one for those of the upper. The case and sashes are put together exactly as in the square form, the sash stuff being mortised and tenoned as usual, the bevels of the tenons being got from the board. Fig. 17 shows a rail with its tenons cut. The one great drawback to this form of window is the difficulty of procuring glass for it, as the panes must be bent to fit the curves, and are comparatively expensive and difficult to procure, especially in country towns, where much delay in replacing a broken pane would be found; in fact, I have oftener than once been compelled to wait for over three weeks for a piece of curved glass to replace a broken pane, to say nothing of the trouble and annoyance caused to the inmates of the house. Still, these curved windows have their uses, and must be made when occasion requires.

In all the forms of windows described in this paper the sash beads, parting beads, etc., for the curves must be worked out of the solid, the curves for them being got from the drawing-board.

It sometimes happens that two or more windows have only a thin stone mullion between them, and very often houses are built with three windows in a group—a large one, with a smaller on each side. When this takes place, the windows, if hung or hinged, generally have their cases made as one. The sill of a hung window of this sort is shown at Fig. 18, with the cuts for the pulley stiles (the case lintel is cut in the same way), and should clearly explain the construction, which otherwise is the same in all details as an ordinary case.

If plate glass is to be put in sashes, the glass rebate should be at least $\frac{5}{16}$ in. deep, and this remark will apply to all the forms described in these papers. Where there are sash-bars, they must be kept heavier than those in a window that is glazed with sheet glass, and usually are about ⅞ in. or 1 in. thick. When the moulding and rebate have been run, they show a section like Fig. 19.

To fully enter into all the details and intricacies of circular and kindred sashes would fill many complete numbers of WORK, and is far beyond the scope of a necessarily short paper like this; but the intelligent workman, having his wits about him, may gather from these few hints some idea of "how the thing is done."

## MANDOLINE MATTERS.

BY MADRILENA.

THERE are probably other readers of WORK besides the writer who intend to follow the admirable instructions given by "J. G. W." on p. 229, Vol. II., as to how to make a Mandoline, therefore the present article is likely to be of service. Although it may, as a rule, be true that whatever is now made is superior to what was constructed centuries ago, it is by no means so certain that this applies to "shell" instruments—of which large family the mandoline is a member. In fact, the most cursory glance at a number of ancient models will convince the reader that the latter embody elegances which are wanting in modern examples, and which appear to have lapsed into desuetude for no sufficient reason. As an example, take the modern neck, which has the section shown in Fig. 1. Contrast with this the ancient form, of which Fig. 2 shows a section. The groove running the entire length of the latter *must* be a great convenience, and must necessarily facilitate good stopping or fingering. In this groove the thumb travels. Here, then, is tip number one for such as are contemplating the construction of a mandoline. The form of back shown in Fig. 3, and which was copied from a Chiterna of the seventeenth century (Italian), is also one which might be revived to

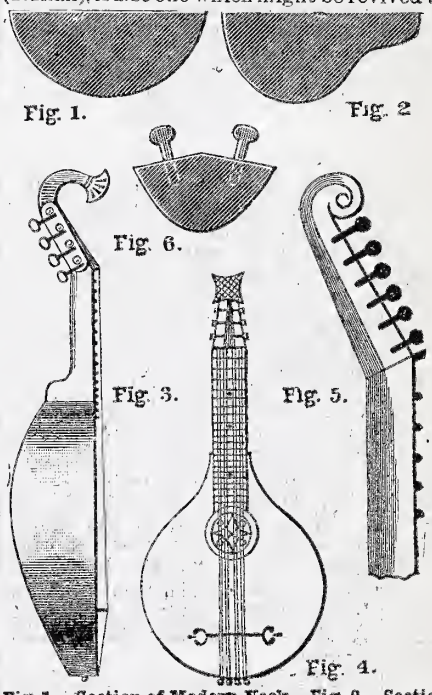



**Fig. 1.—Section of Modern Neck. Fig. 2.—Section of Sixteenth and Seventeenth Century Neck. Fig. 3.—Side Elevation, showing Shaping of Back and Head. Fig. 4.—Front Elevation, showing English Cithern Model with closed Rosette. Fig. 5.—Rough Sketch of Ancient Solid Head. Fig. 6.—Section of Solid Head, showing method of fixing Pegs.**

advantage, especially as it involves no difficulties in the making, while the model for the belly may well be copied from our old English "Cithern," as in Fig. 4. This figure also shows the "rosette," or sound-hole, *pierced* instead of cut out. In some of the old instruments which the writer has recently inspected these saw-pierced rosettes are marvels of beauty, whether perforated through the belly direct or inserted in thin brass or gilded wood. Such ornaments have only fallen into disuse since makers have ceased to consider themselves artists, and, as tradesmen, have wanted to display a label. The graceful finish to the head in Fig. 3 is also easy of accomplishment, and offers great scope for ornament in the way of carving, etc. The machine there shown is, of course, a modern innovation. For such intending makers as are not skilful workers, or who do not care to go to much trouble, the old solid head, with the pegs on the front, will also prove a welcome "tip." This is shown in Fig. 5, where, however, only one of the two rows of pegs is given.

Its construction will be seen from the section, Fig. 6. Another "wrinkle" is to make the finger-board slightly rounded on the face, the frets, of course, following the same contour as do the nut and the bridge. This is the rule with Portuguese instruments, and is a help in fingering.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Hard Wood.

In the foregoing chapters it has been assumed that the amateur has dealt with wood presenting no special difficulties. The mastery of the simplest tools, and understanding how to mark out in a proper manner the various joints already treated, have, we may be sure, offered sufficient difficulty to the persevering student. But when wood of special beauty of appearance, rather hard, or still worse for the beginner, of various degrees of hardness, is used, the trial of the amateur's patience is severe.

Oak, mahogany, walnut, sycamore, and ebony, all more or less used by amateurs, have this in common; they all require well-kept planes, with the irons not ground too thin or sharpened too rounding, and set in the planes so that only thin shavings are to be removed. Care must be taken to plane the right way of the grain, although it is sometimes very puzzling to decide which is the most favourable direction to plane. As to the saws—better abandon the rip-saw, and in its place use the hand-saw, and for cross-cutting the panel-saw. It will be found that hard woods have a very different appearance, according to the relation of the plane of the surface to the diameter of the tree. Thus, when, as in the centre boards, the surface nearly coincides with the diameter, not only are the boards of greater value because of their greater width, but also because they contain, in the fullest extent, the beauty and character of each variety of wood.

Therefore, to obtain the best effect from the harder woods, it is needful to make the cut across the centre of the tree. The surface of the board is then parallel, or nearly parallel, with those radial lines which run from the centre to the outer surface of most of the hard woods. If the end grain of a piece of oak, beech, or sycamore is examined, my meaning will become clear. In cases where a pair or a set of panels are to be made, and the grain of the wood is not obscured by paint, it is best to have all the panels alike in appearance; or, if that is impossible, arrange them so that the eye is not offended by the beautiful appearance of one panel and the poverty of grain exhibited by the next. Oak, in the form of staves (6 in. wide, 3 in. thick), always has the grain in a favourable way for panels. In every case obtain boards long enough for all the panels required, or by two consecutive boards.

A tool is needed to clean off the harder woods which I have not mentioned. It is at once the simplest tool and the most difficult to use—merely a piece of sheet-steel or a piece of saw-blade—but the sharpening is the rub. Try to do it thus: With a little water grind the edge on the paving-stone, holding the scraper upright and aiming at getting a square edge. With a hard steel tool, as a strong bradawl or a gouge having a polished surface, you burnish the edge as if you tried to bring the metal from the edge of the scraper *towards* the angle formed by the edge and the flat surface. Do this to each edge of the tool, and when well done, you have four sharp edges, which will remove a portion of the surface of the wood in a state between dust and shaving, not tearing pieces out of the work as sometimes a plane will do. This tool is a most valuable one, if good, but if too hard, it cannot be sharpened; and if too soft, it will not retain its edge.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 113.—Set of Castings of the Quarter Horse-Power Steam Engine.

It will be within the remembrance of every reader of this, the third volume of Work, whether they take interest in the subject or not, that a series of papers has appeared on "The Construction of a Quarter Horse-power Steam Engine," comprehensively worked out and carefully written by "F. A. M.," whose initials are well known as being those of a contributor to most, if not all, of the mechanical and engineering serials of the day.

I have had the pleasure of a personal acquaintance with "F. A. M." for many years, and I can speak of him from the experience of these years as an able, practical workman and conscientious writer, who never attempts to handle any subject that he does not thoroughly understand, and who endeavours to the utmost to place any subject that he does take up before the reader in such a way that few can fail to understand all that he says and describes, and who never shrinks from any personal trouble to arrive practically and experimentally at such knowledge as may be needful to enable him to do full justice, first to the matter under consideration; secondly, to his readers; and lastly, to himself.

Such is "F. A. M.," who has described in these pages the making of a Quarter Horse-power Engine from commencement to finish, and I am glad to take advantage of this opportunity to bear testimony to his skill and conceptive power as a practical workman and to his worth as a writer.

Doubtless it will have occurred to many that the utility of the papers to which reference has just been made was somewhat marred by the fact that, in making the steam-engine described, it would be necessary for the workman to make patterns first of all, and secondly, to get castings of the patterns before he could enter on the work of fitting and putting the parts together to make the steam-engine itself. It appeared most necessary, both to "F. A. M." and myself, that every would-be engine maker should be able to avail himself of a set of castings of all the parts ready to hand, and with this view the needful patterns were made under the personal superintendence of "J. H.," another valued contributor to Work.

I mention these facts because I think it desirable that every reader of Work should know something of what I may call the secret history of these matters, and that they may gather, from a knowledge of that which has been done in this case, that all who are concerned in the preparation and production of Work do all that lies in their power to benefit its readers, and are taking thought for them even while it may seem to those who are not behind the scenes that they are careless and indifferent to the appeals and expressions of those who seek their aid.

Well, the castings of this engine are now in existence, and may be easily obtained by anyone who may wish to have them. Further, a complete set has been sent to me for examination, and I am happy to be able to testify to their excellence. Forty-four castings and forgings are required for the engine alone, and these may be purchased for £1 9s. 6d.—no very great sum when their number is taken into account, and the value and power of the machine that they unite to form. Beyond these, twelve more castings are required for the feed-pump, costing 5s., and ten more for the governor, costing 3s. The necessary lubricators, stop-valve, etc., can also be obtained, and all the screws and nuts.

Everyone, I think, who purchases the castings should order the cylinder bored, and the fly-wheel bored and turned. This work will be carried out by the maker of the castings and forgings for 15s. 6d. It is machine work not usually done by the fitter, who will have plenty of work to do, which if he accomplishes successfully, may think himself fairly entitled to say that he "made the engine."

The reason that there are such a large number of parts is because everything has been done that can be done by the pattern-maker and moulder to help the amateur workman; for every little brass nut a pattern has been made, and some of the castings are very small. Amongst such a multiplicity of small etceteras, it is very easy to make a mistake, and I was very anxious that a conscientious person should be persuaded what may even now prove to be an unprofitable task—I mean to the man who makes and sells the castings, and not to any individual buyer, who, at any rate, gets excellent value for his money, and who, if he be possessed of skill and patience enough to put the parts together in a workmanlike manner, cannot fail to find himself on the right side of the hedge.

Mr. Henry Milnes, of Bradford, whose advertisement appears in our "Sale and Exchange Column," is the man who has laid hold of it, and he is determined to do the thing properly, whether it pays or not. Anyone who wishes for a set of castings to work up during the fag end of this ungenial and trying winter, from which those who are left of us will soon emerge, and tho coming spring, may send him their money in perfect confidence that they will not be disappointed.

### 114.—Calvert's "Mechanics' Almanack."

All workmen, whether amateur or professional, will find Calvert's "Mechanics' Almanack and Workshop Companion," published by Mr. John Heywood, of London and Manchester, a useful addition to the practical *vade mecums* with which they provide themselves year by year. Of the usual almanack matter that is found in this, in common with other year-books of this class, I need say nothing: it is, indeed, in the incidental brief papers, tables, and special information on matters of interest to workmen of all trades and callings involving manual labour that its main value consists. It contains a useful Wages Table, for example, for a week of fifty-three hours; a short article on "The Art of Doing our Best," which most of us may read and act on with profit; hints on "Human Life and Brain Wear," showing what may best be done to prolong the one and lessen the other; some desirable papers on "The Cost of Maintaining Patents" and "Patent Agents;" and a "Table of the Size, Weight, Length, and Strength of Iron Wire," showing for each number its diameter in inches and millimetres, its weight per 100 yds. and statute mile, the length of a bundle of 63 lbs. and of 1 cwt., the area of section in decimal fractions of a square inch, and the direct strain for wire annealed and bright. Woodworkers will find the notes and remarks on the timbers chiefly used in carpentry in the United States both interesting and useful, and the same may be said of the brief paragraph on the "Strength of Fir and Oak." In point of fact, it may be fairly said that it contains something for everybody, and that no one who takes it up can put it down again without finding some paper or paragraph calculated to instruct and interest the reader.

The Editor.

# SHOP:

## A Corner for Those who Want to Talk It.

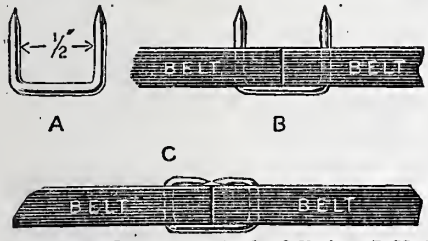
*** In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

### I.—Letters from Correspondents.

**How to Frost Cardboard.**—Reader writes:—"Hold clear glass in a gas flame until red-hot, then plunge suddenly into cold water, when it will powder itself. Go over the cardboard with a brush dipped in clear gum. Then sift the glass powder on it with a fine hair sieve."

**Leather Belting Joints.**—E. A. P. (*Tullow*) writes:—"The following is a good way to join round leather belting. Round leather belts are universally used on lathes from 2½ in. to 5 in. centres, and have many advantages over a flat belt but for one drawback—viz., the impossibility of joining them securely. Hooks and eyes of a special make are generally employed, but often fly off and get lost, thereby causing much annoyance. The plan which I have adopted is similar to that by which sewing-machine belts are joined, and is very simple and secure; its only fault is its firmness, as it is impossible to take it asunder without opening




**Leather Belt Joints—A, Staple, full size; B, Mode of joining; C, Join complete.**

the join. It consists of a U-shaped piece of wire about ½ in. broad, the two upper ends of which are sharpened with a file, and which can be easily made with pliers. Two holes are made in the belt, one in each end; one side of the wire staple slipped through each, the projecting ends turned in and well clinched; then you have a good reliable join, which makes little or no jump over the pulley, and costs practically nothing except a little time and care. Be sure, however, there is no twist in the belt before joining, as it would interfere materially with its working. The annexed sketches will explain my description more thoroughly. A is the staple; B shows mode of joining; C is the join complete."

**A Good Furniture Reviver.**—E. A. P. (*Tullow*) writes:—"Now that spring is coming round once again, all the gentle sex will be busy with the annual 'spring cleaning,' and, of course, the good man of the house will be expected to provide some suitable mixture with which willing hands and arms will make the chairs and tables shine over and over again. The following is an excellent recipe, all the materials of which can be very easily obtained, even in the most out-of-the-way places. Besides thoroughly cleansing the furniture, it leaves a splendid polish, which has the further advantage of not being easily soiled by finger-marks. Spirits of wine, 1 pint; vinegar, ½ pint; boiled linseed oil, ¼ pint; turps, ¼ pint. Mix the spirits and vinegar first, shaking well till of a creamy colour; then add the other ingredients, and mix all well together, keeping tightly corked. Apply with a clean, dry cloth, rubbing well in, and polish off with a dry flannel. The cloths used must be perfectly dry, as the least moisture is fatal to a good polish."

**Gold Lace.**—G. E. B. (*Lewisham, S.E.*) writes:—"As I am daily engaged in preparing the material employed in the manufacture of gold lace, perhaps you will kindly allow me to add a few words to the closing paragraph of the reply to L. N. (*Oldham*) by H. S. G. in 'Shop,' p. 667, Vol. III. H. S. G. says, 'Gold lace (so-called) is, I believe, never of gold, but either silver or copper wire electro-gilt.' Some so-called gold lace may be made of such material, but the real gold lace worn on officers' uniforms is not made of electro-gilt silver and copper wire. Lace wire is not made of solid gold, but of silver coated with gold by the fire process. By repeated annealings, the coat of gold becomes embedded in the surface of the silver wire. The durability of this gold coat is determined by its thickness, and this by the price customers are willing to pay for the gold lace. With the price of pure gold at 85s. per oz., only a thin coat of it can be expected on gold lace wire sold at 8s. per oz., and yet this is deemed a fair price to pay for a fairly good material. We are often pressed by competition to quote even lower prices than this. Only a few days ago we were asked to supply a good gold lace thread to sample at 2s. 6d. per oz., the pure gold in the sample itself assaying to the value of 2s. 5d. per oz.! Whilst customers demand skilled labour at such a low price, they cannot reasonably expect manufacturers to sell gold at a loss. If customers are willing to pay a fair price for gold lace, it can be made to wear well and will bear cleaning; but the low-priced lace forced into the market by foreign competition cannot be cleaned. The only way to restore it is to renew the lace."

**Hints for Fellow-Amateurs.**—H. P. (*Bracknell*) writes:—"A great saving of time and trouble may be obtained by buying common articles instead of the raw material. A rolling-pin of beech may be had for about 3d., and many articles turned out of it without all the roughing-down process, and as cheap as the amateur would buy the rough wood. Boxwood roller-skate wheels, at one penny each, will make a great variety of useful lathe adjuncts without much trouble. Napkin rings also can be made in a few minutes from them. Hard-wood draughtsmen, to be bought at 6d. a box, are useful. A halfpenny, or other bronze coin, makes a good metal washer when wanted in a hurry. A paraffin cask is a mine of wealth for dog kennels, wash-tubs with handles, chicken coops, cupboards, tubs to plant trees in, or as a stand for the greenhouse, using the inside to fumigate plants in; the wood can be straightened, and will make nice oak boxes or frames—in fact, a multitude of articles, according to the inventive genius of the worker. Amateurs generally have to pay heavily for materials, as they do not know where to get things at trade price. The most valuable find for me was Cotton & Johnson's, in Gerrard Street, Soho, where I can get any little piece of metal (silver included) of any dimensions; also any tool under the sun. Another handy place is Allen's, in High Street, Bloomsbury, for castings in brass, gun- or hell-metal. I make my own patterns in wood, and get them cast there at trade price; he has a lot of useful castings in stock, which saves the trouble of making patterns. For those who have no overhead motion on their lathes I would suggest that they buy a spindle, used by jewellers, with a hand wheel; this can be fastened to the slide-rest, and with a few ornamental and cranked drills a lot of useful work can be done. I hope other amateurs will give any little wrinkles they possess to their brethren."—[Yes, it is to be hoped other readers will give wrinkles now that you have set so good an example; but while on the subject of "handy shops" you should have mentioned Mr. Caplatzi's veritable museum, which we have seen, at 3, Chenies Street, Tottenham Court Road, London, as advertised in Work.—Ed.]

### II.—Questions Answered by Editor and Staff.

**Photographic Expedients.**—G. T. (*Liverpool*).—If G. T. will carefully read the article in question, he will find most of his questions already answered. The two pieces of tube are to allow the combinations to be changed. The one attached to the camera by the flange is merely a receptacle for the other pieces containing the lenses. Each piece may contain two lenses of different foci. Only two lenses are used at a time, although more may be. In combining two, the focus will be found to be about half that of the shortest focus, and the stop is to be placed close to the lens in front; but all this was told in the article in question. Read it again. Ask for lenses whose combined foci will be the length required. If you want 12 in., ask for two 24 in., and so on.—D.

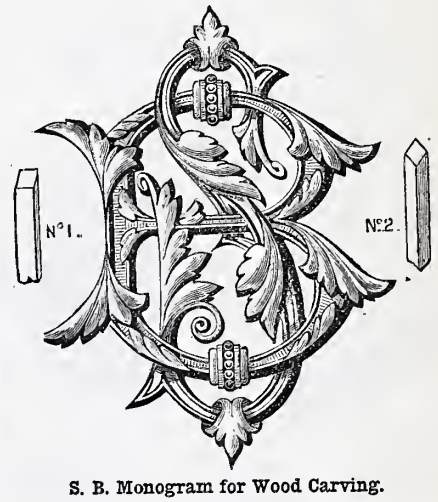
**Stereo Metal.**—J. H. M. (*Southborough*).—If you will stir your melted metal with a red-hot bar of iron, the zinc will cling to it. Repeat the operation till the whole he removed, keeping the surface skimmed for dross during the operation. The metal containing zinc is of no use either for stereotype or electrotyping. Another plan is to tie up in a rag a piece of borax about the size of a walnut and plunge it to the bottom of the melting-pot, then let it remain till the surface of the metal ceases to bubble. The zinc will rise to the surface and can be skimmed off.—J. F. W.

**Wood-Carver's Composition.**—J. W. (*Kendal*).—You can very well mix emery powder with oil, so that it makes a sort of paste, and when put on a piece of thick leather, it can he used for the purpose you mention; but it may he considered rather a rough treatment, and fine tools can, at all events, never stand it. The best remedy I know of is the one used by professionals: simply to sharpen the tools by rubbing them slightly over a small oilstone, moistened with some good oil. It may sometimes he rather difficult to obtain these stones, because few shops keep them, but I know by experience that you can get them at the ironmonger's, 379, Oxford Street. I am sorry I have forgotten the name of the firm. The price of them is from 1s.—T. N.

**Electro-Gilding with Alloyed Gold.**—E. L. (*Wednesbury*).—Alloyed gold may he deposited from an alloyed solution of the double cyanide of gold and potassium, but the process is not easily managed, and the deposit not always certain. The following process is recommended by Elkington and Co., who supply anodes for the purpose from their London works—Myddelton Street, E.C.:—Dissolve 8 dwts. of the alloy in each gallon of solution containing 4 oz. of commercially pure cyanide hy the usual battery process. Work the solution at a temperature of from 160° to 170° Fabr., using the alloyed anodes. If the colour is too dark, reduce the density of the current. The anodes for 18-carat gold gilding are advertised at £3 5s. per oz. In my experience with this alloyed gilding I find that the colour varies with each slight variation in current density, which may be brought about by a different size of anode, or size of article being gilded, or size of slinging wire employed, or change in temperature of the solution. I think, therefore, that it would be impracticable to obtain solid articles in this alloy hy the electro process. Your question respecting the electro deposition of iron is similar to that of H. C. (*Surbiton*). I fear you would not get "a deposit of iron strong enough to stamp copper." The iron would be very brittle. If you have any useful novelty in electrical appliances, proved by you, send it along on approval to the Editor. If it is worth anything it will appear in "Shop."—G. E. B.

**Organ Building.**—G. (*Sydenham*).—This subject is under consideration for future numbers. Meanwhile, many details have been explained in "Shop." Purchase the indexes to Vols. I. and II. of Work, price one penny each.

**Book-Cover Monogram for Carving.**—Amateur Wood-Carver.—Should this design he of use to any of our readers who are not advanced enough to execute it in carving, they could reproduce it, either in wood or metal, by the more simple method of piercing; then, to "relief" the scroll-work a little, the surface of the letters immediately around the ornament should he slightly sunk and boldly lined or "threaded" with a square graver. When sinking and threading, nearly all the cutting




**S. B. Monogram for Wood Carving.**

should be sloped towards the ornament, the object of so doing heing ohvious. To finish the ornament, all that is needed will he a few broad, decided graver cuts to indicate the sweep of the scrolls. With regard to the gravers technically termed "squares," two, including handles, can be purchased for ahout 6d., which should he prepared in the manner indicated above: No. 1 to be used for the sinking, or for even hevelling the edges of the letters, and No. 2 for the lining.—A. C.

**Lathe Appliance.**—J. R. (*Burnbank*).—Yours is a good and simple way of doing the work, and no doubt was quite effective. It is a kind of spherical slide-rest, except that it can only do hollow curves. A spherical slide-rest is a very old and well-known appliance, and you have not quite attained to it; yet your contrivance is all you wanted for the work you had to do. To make your appliance available for balls as well as hollow curves, the worm-wheel must be down close to the main plate and secured hy a loose collar on the pin underneath plate, the top of worm-wheel to have a T slot right across it to take the tool-holder. Then, with a larger and stronger worm-wheel, you could work round the outside of a ball.—F. A. M.

**Where to get Tinfoil.**—Gas-lighter.—The best firm to supply you with tinfoil suitahle for repairing an electric gas-lighter is one supplying materials for the repair of electrical instruments. There should be several such firms advertising in Work, but, unfortunately, there are only a few known to me who care to supply amateurs with small quantities of material. Among the few may be mentioned Mr. Caplatzi, 3, Chenies Street, Tottenham Court Road, who advertises in Work.—G. E. B.

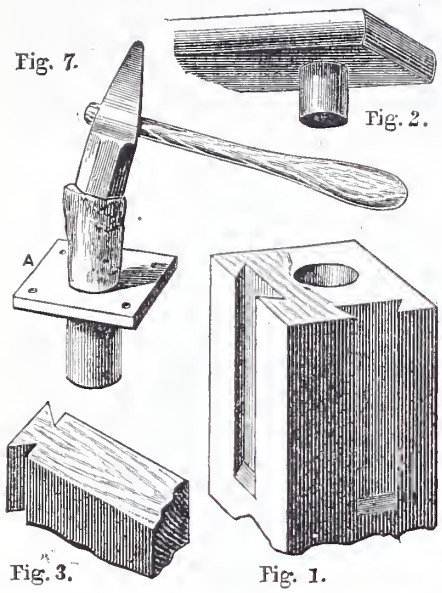
**Besoms.**—J. S. H. (*Cheetham*).—You should send this information through "Shop," addressed to the Editor of Work.

**Boot and Shoe Repairing.**—Rex.—Articles have appeared in Work, Nos. 112, 117, 122, 126, 130, and 137.

**Waste Products.**—Crede Signo.—No such paper as you allude to has appeared in Work.

**Capitaine Petroleum Engine.**—S. (*Stourbridge*).—No further information can be given respecting this engine than was accorded in the notice in Work to which you refer. We cannot give addresses in these notices.

**Table.**—W. S. (*Shipley*).—I will deal with your second query first. You can decide upon the table yourself. You do not say whether you require flaps to it; but by the absence of these particulars I presume that you want an article, the top of which shall be in one entire piece. The height of it should be about 28 in.; the legs (for a large table) turned from, at least, 2½ in. stuff; the length of their blocks depending upon the size of the table. The thickness of the top should be ⅝ in. or even 1 in., and the side-framing ¾ in. or ⅞ in. The method I am going to describe may not coincide with the views of all, but you can make a strong table by following it, with comparatively easy labour. Fig. 2 shows the under-side of one corner of the table. A hole should be there drilled to receive a stout dowel-pin (more than one dowel-pin can, of course, be used to each corner). The lower half of this dowel-pin will enter a hole down the leg-block, as shown in Fig. 1. This diagram also shows how to dovetail-mortise the sides of each block in order that the framing (Fig. 3) may be joined to them. To further strengthen the table, drive a number of screws through the inner side of the framing into the table-top, as in Fig. 6; or by driving them through small blocks as



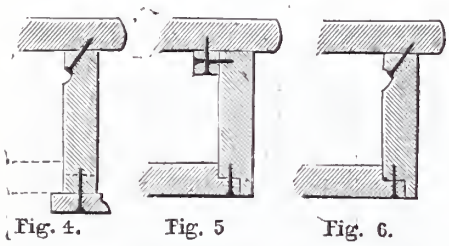




**Table. Fig. 1.—Leg-Block. Fig. 2.—Dowel fixed. Fig. 3.—Dovetail Tenon. Figs. 4, 5, and 6.—Various Sections of Sides. Fig. 7.—Dowel being formed—A, Dowel-Plate.**

in Fig. 5. For appearance' sake, you might screw moulded rails to the bottom of framing (Fig. 4). Across the table, connecting the framing, might be screwed stout rails, as shown by Figs. 5 and 6. If drawers are required, allowance must be made for their passage through the framing; and bearers should consist of rails screwed against the framing inside between the bottom rails. For drawer making, etc., read up your back numbers of WORK. Touching upon your first question, I must say you have done more than most do, when they ask two or more questions on different topics, by numbering your queries; but still it is a very essential matter, to ensure a satisfactory reply, that *each question* bearing on a different branch of trade or different trade *should be written on a separate sheet of paper*. How to sole a boot is rather out of my line of knowledge; but there is a member of our staff who gives instructions upon this trade; and to him would have been forwarded the boot query at the same time that the table question was placed in my hands if it had been on a separate sheet. You will not be surprised, therefore, at not seeing it replied to here; but our Editor, no doubt, will have forwarded it to our brother contributor, whose reply will appear in due course.—J. S.

**Bending Bamboo.**—E. McH. (*Hebburn-on-Tyne*).—Bamboo can be softened and bent either by dry heat, as over a lamp, or by heated steam. The subject is one which has often been brought forward in WORK. E. McH. is specially referred to Vol. I., p. 519, No. 33, and Vol. III., p. 252, No. 120. At the latter place may be seen a diagram of steaming apparatus. In Vol. I. is a series of articles on bamboo work.—M. M.

**Microphone Transmitter.**—G. C. H. (*New Kent Road*).—Write again, giving full particulars of microphone battery and receiver.—W. D.

**Bell Telephone.**—J. N. (*Perth*).—I have received your postcard. At present I am away from home, and cannot look up the answer to which you refer. I have not yet seen it, not having had the *pleasure* of reading WORK for the last few weeks.—W. D.

**Phonograph.**—PATIENCE.—I am sorry to say that I cannot give instructions for making a phonograph in "Shop" column, for the simple reason that space could not be spared for every detail. There is, however, an article in the Editor's hands upon this subject, which he will publish at his own convenience. Till then PATIENCE will have to wait.—W. D.

**Telephone.**—NO NAME.—The instructions from which you made your transmitter were doubtless all right, and the cause of the failure I am unable to fathom, inasmuch as you do not give sufficient particulars to help me. If you write again, explaining your instrument and the method which you have used for testing, I may be able to help you over your difficulty.—W. D.

**French Polishing.**—W. L. (*Oldham*).—Damp, rather than cold, was the cause of your polish peeling off; besides, you were very unwise in giving the handrails a coat of thick brush polish in the presence of so much damp. Paper it down again, putting a little linseed oil on the face of the glass-paper, and be content to work it up with the rubber. For this purpose, if possible, choose a bright, dry day; dissolve your shellac in naphtha instead of methylated spirits, and leave the work, if it looks well, in "dry shine"—*i.e.*, from the polish rubber; if, however, it must be spirited out, use naphtha. This may perchance make it necessary to use a little more oil, but be as sparing as possible with it. Do not overcharge your rubber with polish: in such a case as yours it would be best to use a little at a time, and work each rubber out fairly dry before re-charging, bearing in mind that friction, or, more properly speaking, "elbow grease," is a most important factor in gaining satisfactory results.—LIFEBOAT.

**Green Stain and Inlays.**—C. L. (*Beverley*).—I have several times in "Shop" advised the use of Tomlinson's aniline dyes, as sold at most druggists' in penny packets and threepenny tubes; also verdigris dissolved in hot vinegar. I can still recommend them, though since those replies were penned, I have received from Mr. H. C. Stephens, Aldersgate Street, London (a stain maker of high renown), specimens of a new green stain that appears to me to be very good, and is sold in sixpenny and shilling bottles. The coloured wood stringings and inlays are sold at most places where veneers and carvings are sold for cabinet makers (not saw-mills). I cannot give the addresses of any in your neighbourhood; but if you care to send a shilling postal order to Mr. Kingstone, veneer merchant, Pershore Street, Birmingham, or Mr. Harriss, veneer merchant, Bromsgrove Street, Birmingham, I have no doubt they will send you a variety you would be well satisfied with. Kingstone will undertake inlays to your own designs, if necessary. For the pearls (not shells) you might try Thomas Padmore, Edmund Street, Birmingham. But why not look in your local directory, and find dealers nearer home, where you could go and personally select what you require? I give you a wrinkle that may be of service to you: that well-selected and well-marked bird's-eye maple dyed green makes a capital imitation pearl inlay when well polished.—LIFEBOAT.

**Machine for Advertising.**—A. H. (*No Address*).—You say that the box has slots in it, so I suppose a card appears through each slot. If the cards appear and disappear at the same time, an arrangement similar to skeleton drawing, Fig. 1, might be used. I am assuming that the box in each case has four slots, and in Fig. 1 that the cards, A, rise and fall together, being fixed to a frame, *a*, fitted with two long bosses, *a'*, *a'*, through which holes are drilled vertically to fit guides, *b*, and with projections at side for links, *c*, *c*. The guides, *b*, can be fitted either to the top of the box or the bottom, as is most convenient. Two bell-crank levers, *d*, *d*, are pivoted at *e*, *e*, the upper end of each being fitted to link *c*, the other ends being connected together by coupling-rod *f*. The reciprocating motion is communicated to them by rod *g*, worked by crank *h*, which latter is fixed to shaft *i*, which is driven, in turn, by small cord-pulley, *j*, on outside of box, through cross-shaft, *k*, and bevel-wheels, *l*, *l*. If the pulley, *j*, is kept turning at a uniform speed, the cards, A, will remain slightly longer at the top and bottom of their travel than in the centre when rising or falling. The full lines show the positions of the levers, frame, etc., when the cards are raised, and the dotted lines when the cards are lowered. Another plan of obtaining the same motion would be to continue shaft *k*, Fig. 1, but now placed centrally under frame *a*, and provided with two cranks exactly under links, *c*, *c*, which links, in this case, must be turned into connecting-rods to grip the crank-pins, and as the cranks turn the frame, *a*, will rise and fall as before. As an alternative plan, suppose you want the two right-hand cards, Fig. 1, to rise together while the two left-hand ones fall: by dividing frame *a*, Fig. 1, in the centre, and reversing the left-hand bell-crank lever to position shown in Fig. 2, keeping the other gearing as it was, this will be secured. By conveying a reciprocating motion to the lower ends of bell-cranks, the upper end of one, together with the two cards, will rise, while the other one will fall. Thus the two pairs rise and fall alternately. The pairs need not be next each other; the first and third and second and fourth, or first and fourth and second and third, might be worked together by a slight variation in the mechanism. Still another method is shown in Figs. 3 and 3A, which illustrate a skeleton longitudinal section and an end elevation of crank-shaft, cranks, and connecting-rods. In this case the cards move alternatively, A being completely out of the box, A', A'' half out, and A''' hidden in box. In this case each card must be carried and worked separately, and have a separate guide and connecting-rod, the crank-shaft, *k*, in this case having four cranks at right angles. Thus you get each card rising and falling one after the other, no two cards being at the top or bottom at the same time. By means of cams instead of cranks, these cards might be made to rise and fall quickly, and remain still at the top of the stroke considerably longer than by the crank arrangement. The style of cam, Fig. 4, I have drawn to a larger scale than the others; *c* is the cam carried on shaft, *k*, and revolving with it; *a*, *a* are the guides for the cards; *d* is the rod to the top of which the card is fixed; while below, in contact with the cam, is a small wheel, *w*, to reduce the friction between the rod

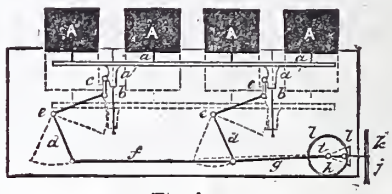



Fig. 1.

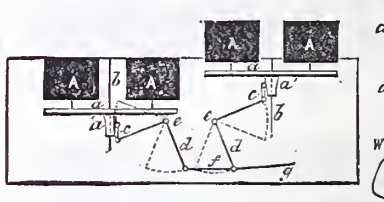



Fig. 2.

Fig. 4.

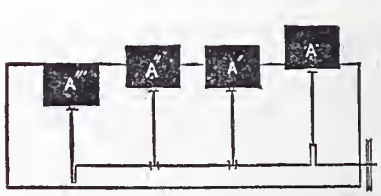



Fig 3.

Fig 3A.

**Machine for Advertising.**

and cam to a minimum. This shape of cam allows the card to remain stationary in its highest position for one-fifth of a revolution of shaft *k*, thus giving people a better chance of reading what there is on it than in the preceding cases. So if you arranged to have four cards, by setting the four cams at right angles to one another you would nearly always have one of the cards stationary for a short time. There are various methods of driving the mechanism shown in these drawings besides the outside pulley, which, however, if you have a shaft running near, is as convenient as any, and might easily be arranged out of sight of the public; there might also be used a small model steam or water engine. Inside the box you might use electricity or clock-work: which, I think, will prove the best. But the design of the mechanism and power to be used all depend on the size and number of the cards, so I cannot help you any more till these are given.—P. B. H.

**Saddlery.**—ANXIOUS.—J. Dixon & Sons' address is 24, Hall Lane, Walsall. *Saddlers' Gazette*, 46, Cannon Street, E.C. Monthly, 4d. The saddlers' and harness-makers' trade price list may help you to the lengths of parts. It gives the lengths of the stitching, and stitches to the inch, of every part of harness and saddlery, and trade prices; it costs 7d. J. Barlow & Co., Sedley Place, Oxford Street, W. Doubtless they can supply "Cutters' Lengths" publications, as they are a leading firm in London for all relating to harness and carriage furnishing, wholesale and retail.

**Measurements.**—DOBRA.—There is not the least doubt but that you would gather a vast deal of information from Cassell's "Technical Educator." It is published in monthly parts, but I should advise you to make inquiries, through your local bookseller, as to whether there is an edition being published now, etc. etc. You would also find Beaton's "Pocket Technical Guide, Measurer, and Estimator," published by Crosby Lockwood & Sons, 7, Stationers' Hall Court, London, E.C., very useful,

and, as the price is only 1s. 6d., I should certainly try it.—E. D.

**Model Horizontal Engine.**—F. C. (*Cardiff*) writes:—"I feel thankful for the answer *re* Model Horizontal Engine (see p. 572, No. 141), but what I should like to see is a dimensioned sketch of a model. I may say to F. C., who promised to further help me, that the cylinder I have hasn't got the ports cut in it yet."—[In reply, you do not give me the size of the port face on your casting, but I think I can supply information which will enable you to complete your work. Fig. 1 shows a side elevation of the proposed engine, with the cylinder in section; also a plan view of the connecting-rod, F. Fig. 2 is a longitudinal section of the steam and exhaust passages and the slide-valve. The block is too small to be clearly dimensioned, so I give you the measurements in letterpress. Make the piston, A, ¼ in. thick, and turn it to fit the cylinder truly; then no packing need be used. Face off the insides of the covers until the distance between them is increased from 2$\frac{1}{16}$ in. to 2¼ in.; you can then have a stroke of 1¾ in., with $\frac{1}{16}$ in. clearance at each end. The piston-rod, B, should be ¼ in. diameter, screwed at one end into the guide-block, D, and at the other into the piston, where its end may be lightly rivcted over, to prevent the piston from working loose. The gland, C, should be made to screw into the stuffing-box, which is to be lightly packed with cotton-yarn. The length of piston-rod you must find from your cylinder casting; it must be of such length that when the piston is against the bottom of the cylinder, and the gland, C, just free from the stuffing-box, the guide-block, D, clears easily from the gland. The guide-rods, E, E, should be of wire about $\frac{3}{32}$ in. (No. 13, B.W.G.) in diameter, screwed at one end into the cylinder cover as shown, the other ends to form a light driving fit to holes in a plate, T, fixed to the bedplate, M, and slotted out for the passage of the connecting-rod, F. Thickness of plate, T, $\frac{1}{16}$ in.; of bedplate, M, ¼ in. The connecting-rod, F, to be ¼ in. thick in the body, 3½ in. long between centres, and made with a forked end, R, to ride at one end on a pin, $\frac{1}{16}$ in. diameter, fixed in the guide-block, D, and at the other on a crank-pin, G, $\frac{3}{32}$ in. diameter.

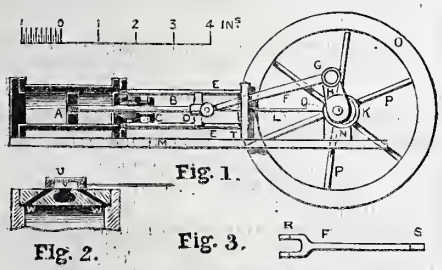


Fig. 1.

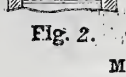


Fig. 2.

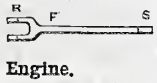


Fig. 3.

Model Horizontal Engine.

This pin is made with a head, and screwed into the crank, H, through the eye, S, of the connecting-rod. The crank, H, has a throw of $\frac{5}{8}$ in., is ⅜ in. thick, and is fixed on a main-shaft, I, ½ in. in diameter. This shaft is carried in ordinary bearings on pedestals, N, cast with or fixed on the bed-plate. The shaft carries a fly-wheel, O, 5½ in. outside diameter, with a rim ⅝ in. square in section, a boss, Q, ⅝ in. diameter by ⅜ in. thick, and six wire arms, P, ⅛ in. diameter (No. 11, B.W.G.). You may have a wheel cast complete, but the arms should then be wider; brass is the material to be used. On the shaft, I, is fixed an eccentric, K, with a throw of $\frac{5}{32}$ in., which, by a rod, L, drives the short slide-valve, U. The exhaust port, V, should be $\frac{3}{16}$ in. wide; space between exhaust and steam port, ½ in; steam ports, ½ in. wide each; edge of valve, $\frac{1}{16}$ in.; inside length of valve, ⅝ in.; the cylinder ends, W, of the steam ports, ½ in. wide. The length of the ports across the cylinder should be as great as the width of port face will allow. The depth of connecting-rod to be ⅛ in. at the forked end, and $\frac{3}{16}$ in. at the crank-pin end. The valve, U, to be covered by a steam chest, made to fit the port face. You may have to modify the valve sizes to fit your casting, but there should not be any difficulty in that. The rod L and the valve-rod may be made of wire, No. 16, B.W.G. It is preferable to use steel wire throughout. The crank, eccentric, and fly-wheels may be made driving fits to the main shaft.—F. C.]

**Designs for Work.**—J. A. (*Parsonstown*).—Your friend may send in his sofa design on approval. Indeed, I should be glad at all times to receive MSS. and designs from any reader of WORK who cares to submit to me, on approval, particulars of novelties or ideas which are his own work or idea.

**Incubator.**—W. B. (*Ramsey, Isle of Man*).—As several correspondents wish to know where to get fittings, I will try and arrange with someone to supply the whole. Watch advertisements in sale and exchange columns of WORK.—LEGHORN.

**Incubator.**—W. H. E. (*Crewe*).—See reply to W. B. above. Replies by post are against the rules.—LEGHORN.

**Thermometer.**—W. C. (*Wandsworth Road, S.W.*).—See reply to W. B. above.—LEGHORN.

**Incubator.**—F. W. M. (*Child's Hill*).—The "flower-pot" incubator was described and illustrated on p. 557, No. 35, Vol I. You may, however, as well try to hatch eggs on the hot-plate of a kitchen range as in such a contrivance. Why not make one as recently described in No. 143? If expense is an object, you might reduce size and make fittings of tin—tin canisters, for instance—although I am hound to say they will always be a trouble, rusting through in a very short time. I merely throw this out as a suggestion, because in building apparatus for actual work, it is better left alone altogether if it cannot be built properly.—LEGHORN.

**Incubator.**—H. H. (*Egham*).—Yours is a very good idea, but more applicable to a larger machine. The glass panels in lid are not very large, so that if you introduce two more rails, you will about do away with them altogether. You need not fear disturbing the regulator by opening and closing lid. Of course, on opening the lid, you disengage the regulator rod with the damper, but as the temperature then falls quickly, it is most probable that when the lid is closed again the regulator rod will be below the top of machine. The taper hole in lid allows a little play in this respect. If you prefer to follow your idea, you might make the centre rail narrower, cutting an oblong hole for ventilation, making the inner rails of lids narrower and hingeing them to the centre rail, screwing a small stop on to prevent them going back too far. If you adopt this plan, you will of course require to adapt the damper to suit the shape of the hole.—LEGHORN.

**Photos on Zinc.**—A SUBSCRIBER.—It is quite possible for anyone with the necessary skill to produce the work, but like many other things, it requires experience. We are not aware of any work published specially devoted to this subject. It is mostly in the hands of firms who make somewhat a secret of their processes. The zinc plates may be obtained of Dellagana & Co., Stereotypers, Shoe Lane, E.C.—D.

**Harmonium.**—G. E. L. (*Battersea*).—There is no useful purpose to be gained by adding stops to a portable harmonium. Probably there is only one set of reeds, or the makers would have adopted the very proper and obvious course of adding some way to control the various sets of reeds. If, as I surmise, only one set is present, the only useful stop would be that marked "expression," and the needful alteration to the instrument to add this stop would be greater than its value, and would render the instrument less portable. Fittings of every kind for musical instruments may be had of Messrs. Dawkins & Co., Charterhouse Street, Holborn Viaduct, or from advertisements in WORK.—B. A. B.

**Grip Lock Nut.**—A. D. (*Sheffield*).—Any stamped letter can be forwarded to the maker, but a free advertisement of his address cannot certainly be given in WORK.

**Water Engine.**—YOUNG ENGINEER.—Consult Glynn's "Water Power" in Weale's Rudimentary Series.

**Draught Screen.**—M. T. (*Pilrig, Edinburgh*).—For this, refer to No. 136 of WORK.

**Lathe Crank-Shaft on Points.**—J. H. (*Keighley*).—Surely you must have seen that this is the usual way of mounting the crank-shaft of a lathe. When you ask how they are lubricated you raise a smile. Put a drop of oil on the centre, just where it goes into the revolving shaft, and it will work its way in; don't pour half a pint, for that will only lubricate the floor. Some workmen seem to use as much as they can; and a nasty mess they make. Cranks for lathes are run usually on points, and I doubt whether any of the new plans are better: they are run on or between three friction rollers, and in bearings, but this requires a special bearing which can adjust itself to the shaft as it bends with the pressure of the foot on the treadle.—F. A. M.

**Hot-Air Engine.**—J. W. R. JR. (*Liverpool*).—I think you will get the information you need from my reply to another querist. I will only add to that, that as you wish to use yours for working a little pump, you can pass some of the water through the cooling cistern on the top of the heater. I should use a 2 in. or 3 in. working piston, and have a heater of twice the diameter, and the displacer same stroke as the piston; I think that would work a 1½ in. pump. I would not use any packing, but grind out the working cylinder and pump cylinder, and make the working piston of the same metal and same thickness as cylinder, so that heat may not interfere with fit.—F. A. M.

**Rocking-Horse.**—W. H. C. (*Leeds*).—This subject has not yet been treated; but the Editor has requested me to attend to it, and I will do my best to endeavour to place a page of designs and accompanying descriptive matter in the hands of the readers as soon as possible.—J. S.

**Etching.**—PROFESSIONAL.—I am hardly sure if I understand just what it is you wish to know; from the wording of your letter I take it you desire to know how to etch letters on glass, although I cannot understand why you have used a stencil. However, if this should not be what you want, write again. Cover the piece of flashed ruby with brunswick black; when dry, scrape away all of it from the parts of the glass you wish the acid to act upon. In your case it seems you wish the ground around the letters to be removed; you will therefore leave all the letters covered with the brunswick black. You ought to have no difficulty in getting the edges of the letters straight this way; you can use a square or straight-edge and a sharp point; if the other way (*i.e.*, the letters etched away), remove from the letters in the same way, and you can afterwards, if you wish, fill up with black. By acting upon the flashed side you can have white letters upon a ruby ground, or ruby letters upon a white ground, at pleasure.—W. E. D., JR.

**Silver Chloride Cell.**—ELECTRA.—The positive element in a silver chloride cell is zinc; the negative element is silver. The negative element is enclosed in some porous or bibulous material enveloping a paste made of silver chloride. This envelope may be blotting-paper or fine-mesh muslin. The positive element may be enveloped in a similar material charged with zinc chloride or with ammonia chloride, or may be suspended in a solution of either of these chlorides. The zinc should be in the form of a thick plate, as this element wears away. The silver may be in the form of sheet, foil, or wire. The electrolytic action of the cell reduces the silver chloride to pure silver, which is deposited on the negative element. You may use platinum foil as a substitute for silver foil if you choose to do so, but I do not see what advantage will be attained by the change, since the foil is soon coated with pure silver, and the electro-motive force of the cell is then that of the difference in potential between silver and zinc in an electrolyte of chlorine, not that of zinc and platinum.—G. E. B.

**Oak Work-Box.**—J. H. T. (*Earlsheaton*).—Without knowing the abilities of J. H. T., or what tools he possesses, it is difficult to advise, but such work-boxes as he can buy at the shops are made in pine, just like a packing-case (see Fig. 1). A rebate is made on all the angles except the bottom; this rebate is filled with hard wood like the box is to be

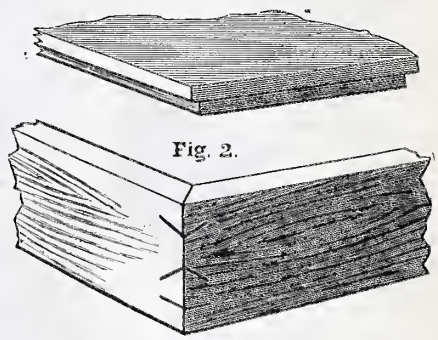


Fig. 2.

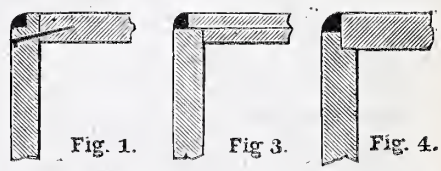


Fig. 1. Fig 3. Fig. 4.

**Oak Work-Box. Fig. 1.—Section of Corner of veneered Work-Box; the black quarter circle is hard Wood let in before the Veneer is laid. Fig. 2.—Box with mitred Angles, keyed, Top rebated, and end grain hidden by insertion. Fig. 3.—Section of Fig. 2 when completed. Fig. 4.—Section, if the Sides and Ends are rebated instead of Top. (Not drawn to scale.)**

veneered with. The ends, back and front, and top are then veneered, and the inserted hard wood just mentioned becomes available to make a nicely rounded corner. The box is then cut, thereby forming a lid, having its dimensions and figure of grain corresponding with the box itself. The edges of the cut surfaces are then veneered; hingeing, cleaning off, and the fixture of lock, escutcheon, etc., complete the box. This is the simplest way to make a work-box, but it is only available for veneered work. For solid wood, dovetailing is the best way, but if that is too difficult, I should mitre the sides and ends together, keying the joint with hard wood (see Fig. 2). In that case I should prepare a rebate for the top and bottom to rest in, and round the top insert a piece of hard wood as a finish, and to hide the end grain (see Fig. 4). Fig. 3 shows rebate on top.—B. A. B.

## III.—QUESTIONS SUBMITTED TO READERS.

*** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Upholstery.**—V. L. (*Bayswater*) writes:—"I should be obliged for some hints on upholstery, a branch of industry which I hope will soon be treated by your exceedingly useful journal. Should space not allow of an extensive article being devoted to the subject, I should be glad of the names of any good works on the subject."

**Address Wanted.**—TRANSPARLEUM writes:—"Will some reader of WORK please give me the present address of the Continental Novelty Company, late of 50, Leicester Square, London? The above was the address about four years ago."

**Saw.**—E. J. (*Borough, S.E.*) writes:—"Would W. W. (*Caverton*) oblige a brother reader by stating in 'Shop' what number or numbers in WORK I can find how to make a saw same as that of which parts are described in 'Shop,' No. 144, p. 637, Vol. III., in answer to TOP SAWYER?"

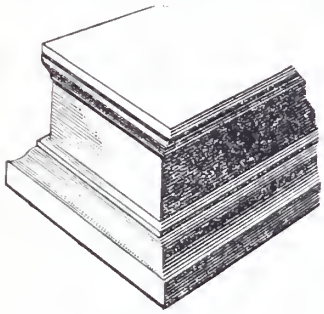
**Antique Furniture Designs.**—H. R. (*Kidderminster*) writes:—"I would be very glad to learn the price of, and where I could get, a book of patterns for carving antique furniture, such as old chests, wardrobes, cupboards, clock-cases, bookcases, and panels in other odd furniture—not necessarily in their full size, but large enough to sketch from to any size needed."

**Millboard Boxes.**—J. W. (*Upper Norwood*) writes:—"I shall be obliged if any reader would give me a description for making a hand machine or appliances for making small millboard boxes (5 in. × 1½ in. × 1 in.) in quantity—similar to those photo plates are packed in—in the columns of 'Shop.'"

**Wood.**—J. B. (*Birmingham*) writes:—"I wish to make a set of pigeon-holes with fifty-four compartments, but have a difficulty in obtaining the necessary wood. Could any reader of 'Shop' inform me where (close to Birmingham or West Bromwich preferred) I could get the wood, in pine or deal, planed and cut to the sizes I require, ready for putting together?"

**Tailoring.**—ANXIOUS writes:—"Can any reader of WORK inform me of a good teacher of cutting? Frock coats are my real difficulty."

**Lead Weights.**—W. W. W. (*Nottingham*) writes:—"Will some kind reader give me practical information as to the best way to mould lead weights such as a draughtsman uses, say ¾ in. long by 1¾ in. wide by 1¼ in. deep, having a mould on top and bottom, as per sketch? What metals, and in what proportion, should be added to the lead to have a hard and clean casting? Is it best to have a mould made in metal or in moulders, and to ensure a clear and perfect casting to prevent the use of the file? How to make the mould advised, if the weight is as per sketch?"



Lead Weight.

**Haag's Water Motor.**—B. J. (*King's Lynn*) writes:—"Can any reader of WORK give me a description of these motors?"

**Measuring Up.**—CEYLONESE (*Colombo*) writes:—"I would thank your readers for their views as to the best methods for me to measure up photographs and other perspective views of buildings, cylindrical figures, furniture, machinery, etc., each having one known dimension, and convert the same as far as practicable into working drawings."

**Working Drawings.**—CEYLONESE writes:—"I should be glad to learn, through 'Shop,' from whom I can obtain working drawings of bridges, cranes, furniture, etc."

**Octagonal Moorish Stool.** — ANGLO-DANE writes:—"Will some kind correspondent amongst the readers submit to the Editor a design for above, with colours, etc.? It is a very effective piece of furniture in a drawing-room, and quite within the scope of an amateur, I should say."

**Launch.**—E. G. (*Hereford*) writes:—"I have a flat-bottomed boat, built with pine and oak: it is 20 ft. long, 6 ft. wide, and 2 ft. 6 in. deep, and I wish to have it fitted up with steam engines and propellers—two ordinary slide-valve engines and two screw propellers. Would some kind reader let me know the size of engines and propellers? also whether two or three-blade propellers are best, as I wish the boat to travel as fast as possible, as I have some very rapid streams to pass over?"

**Wood for Carving.**—L. B. (*Hitchin*) asks for "the best shop in London to get lime-wood for carving on."

**Candle Making.**—G. N. (*Manchester*) writes:—"Could any reader tell me how to produce composite candles cheaply?—that is to say, could any reader describe to me through your columns which are the cheapest ingredients to use in composite candle making? I would, indeed, feel very thankful if you could do this for me, as I wish to try something in that line. I possess, of course, the proper moulds and wicks, only I should like to ascertain what best I could use so as to bring the article cheap and saleable."

## IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

**Besom Makers.**—J. W. W. (*Renshaw*) writes to L. S. D. (see p. 635, No. 144) that Joseph Jervis, Whaley, Clown, Chesterfield, is a besom maker.

**Mole Traps.**—T. J. (*Preston*) writes to J. J. (*Cumberland*) (see p. 492, No. 135):—"Respecting wooden mole trap with steel springs, I can recommend Mr. Joseph Cross, Tangier Street, Whitehaven, for a good article in that line."

**Flower-Pot Cases.**—F. H. (*Battersea*) writes, in reply to INQUIRER (see p. 621, No. 143):—"I do not know any firm where expansible flower-pot cases can be had. Eighteen years ago I supplied most of the West-End houses with them; but since the fashion for jars and Doulton ware, there has been no call for them. If INQUIRER thinks there is a sale for them, I should be pleased to be in communication with him."

**Wool-Winder.**—R. T. T. (*Frome*) writes, in reply to MART (see p. 621, No. 143):—"These are not hard to make; appended design explains itself. The base is made of wood, with a recess turned in it for lead to give stability; the pin is ¼ in. iron or steel wire 9 in. long, 1 in. screwing into wood stand, turned up smooth, with a shoulder at the foot shrunk on, or a piece of ⅜ in. rod can be turned down to ¼ in., leaving the shoulder. The shell is a piece of ¼ in. brass tubing, 6 in. long, with a knob screw in at the top to give a finished appearance. This tube must have its bottom edge turned true, as it runs on the shoulder mentioned above. A and B are two brass collars, 1 in. diameter; A is fixed, while B slides up and down, and is fixed by a set screw, C, in any desired position; the nearer it is brought to A, the larger the skein that can be held. The laths are wood, ⅜ in. wide, ⅛ in. thick, and 7 in. long, riveted

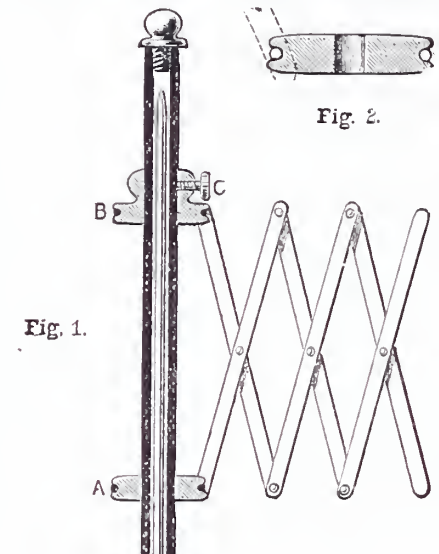



Fig. 1.



Fig. 2.

Wool-Winder and Parts.

to each other at the centres and ends. There are four sets, at right angles to each other, one only being shown in the sketch. The simplest way to fasten the laths to the collars is to turn a groove in the collar, as Fig. 2; cut four slots at right angles to each other, ⅛ in. wide by ¼ in. deep, into each of which one lath fits, as dotted line, Fig. 2, and a copper wire running in the groove, and passing through a hole in each lath, as shown, holds all tight, and yet allows the laths to turn as on a pivot. This size winder will hold any skein from 12 in. to 8 feet. As these make exceedingly popular Christmas presents to ladies, and can be easily made in numbers by anyone possessed of a lathe, I shall be pleased to write an article, giving detailed instructions and drawings, during next year, if the Editor wishes it."—[By all means submit this article on approval.—ED.]

## V.—LETTERS RECEIVED.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. R. S. (*Camberwell*); TELEPHONE; G. C. (*Woolwich*); A. S. M. (*Highgate*); F. S. (*Exeter*); W. T. C. (*Watford*); EBONY; RECTILINEAR; J. B. (*Lincoln*); BIMSHIRE; LOST MOTION; C. A. B. (*Swansea*); C. G. M. (*Penistone*); T. R. H. (*Birmingham*); C. F. B. (*Darlington*); N. S. S. (*Monkwearmouth*); MAC; NOVICE; F. W. L. (*Harling*); A SUBSCRIBER FROM THE FIRST; C. H. L. (*Falmouth*); H. W. (*Nunhead*); G. M. (*Swaffham*); J. S. (*Bedford Leigh*); H. Y. (*Poplar*); J. H. T. (*Dublin*); BOY SORTER; PERPETUUM MOBILE; W. J. H. (*Penzance*); J. S. (*Elswick*); H. R. K. (*Liverpool*); A. B. (*Leytonstone*); W. E. C. (*Wakefield*); F. S. (*Harrow Road*); H. H. (*Burton-on-Trent*); S. W. (*Ashton-under-Lyne*); C. H. O. (*East Dulwich*); F. S. (*Amsterdam*); WIRE WORKER; J. P. (*Menai Bridge*); J. M. (*New North Road*); W. T. K. (*Darwen*); J. A. (*Glasgow*); E. L. (*Woolwich*); W. J. G. (*Hastings*); J. H. (*Leeds*); J. H. L. (*Kensington*); R. K. (*Low Fell*); J. B. (*Carrick-on-Suir*); A. E. C. (*Tipton*); CONSTANT READER; ENGINEER; ONE WHO WANTS TO KNOW; CONSTANT READER (*Bradford*); AMATEUR MODELLER; CHICK; J. G. (*No Address*); J. MCJ. (*Cape Town, South Africa*).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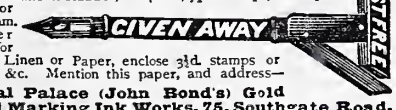


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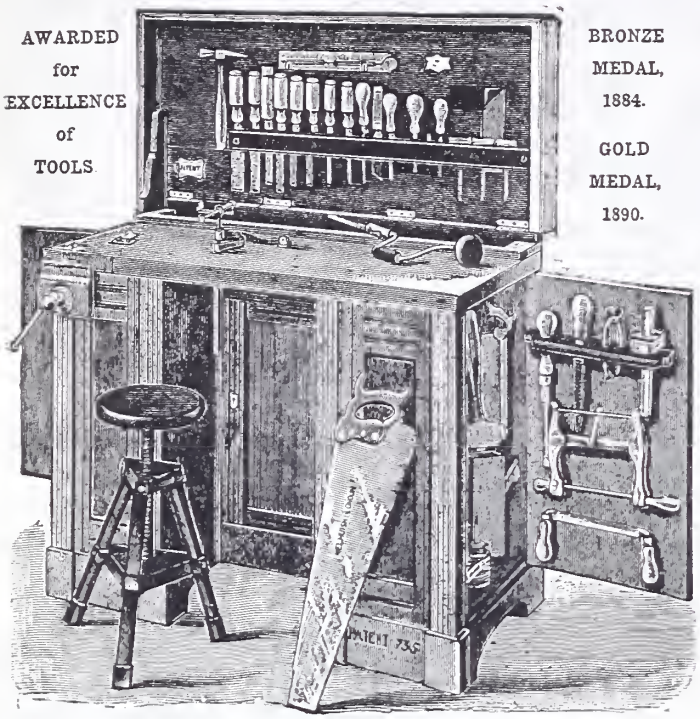

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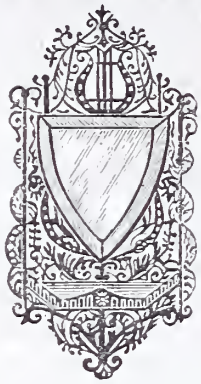

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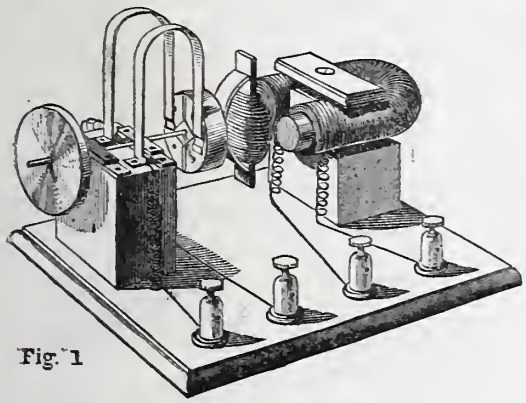

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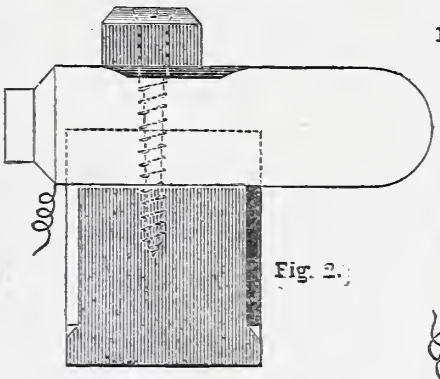

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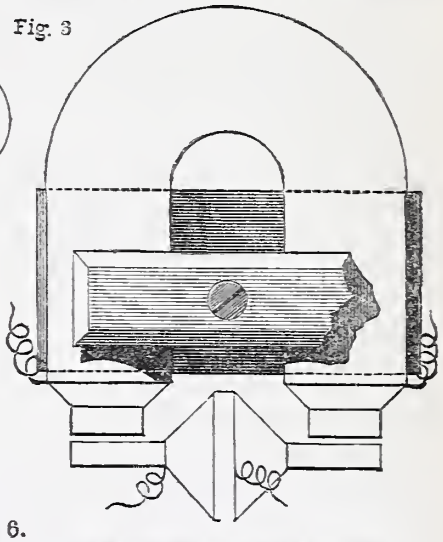

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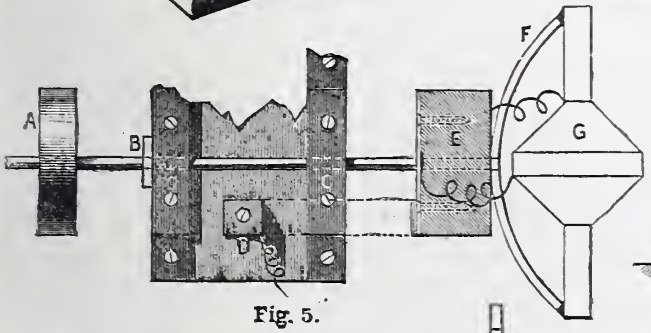


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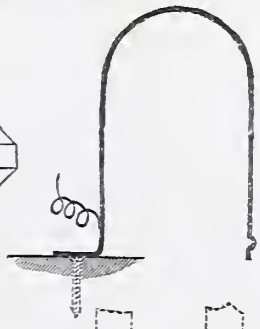

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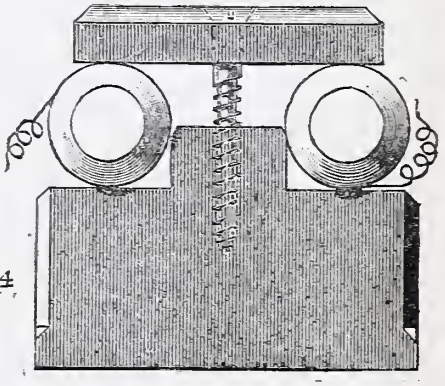

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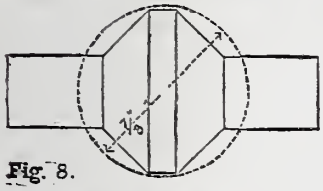

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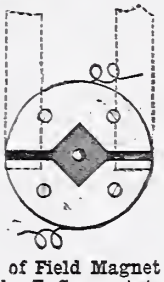

Fig. 7.

Fig. 1.—Sketch of Small Model Electro-Motor complete. Figs. 2, 3, 4.—Details of Field Magnet and Block. Fig. 5.—Armature Shaft complete—A, Fly-Wheel; B, Bush or Washer; C, Brass Bearings; D, Position of One Brush; E, Commutator; F, Yoke; G, Armature and Coils. Fig. 6.—Shape of Brush. Fig. 7.—Face of Commutator. Fig. 8.—Armature showing $\frac{1}{8}$ in. limit. Fig. 9.—Brass Bearing. (Scale for Details, full size.)

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*Introduction.*—There are many who like to say, after they have made a model, "I made this all myself." This little model, it is hoped, will fulfil this remark as far as possible; there are no castings to be made, and for those who have no lathe, the whole can be made without any turning at all.

It is also within the reach of the younger branch who read this paper, who have any idea of using a few tools, and have a little ingenuity and patience about them. The little thing, when complete and judiciously picked out with such simple things as red sealing-wax varnish and brunswick black, looks a very presentable little article, to say nothing of its use in illustrating the laws of electro-magnetism. Last, but not least, it will go, and go well; this can be vouched for, as I have made one the exact counterpart of this. It can be driven by two small bichromate double carbon cells, or more, if you should be so disposed.

To dispense with any lathe work, the commutator is a little bit novel—at least, I don't remember having ever seen one like it; but that matters not as long as it works, and the words "no lathe" are fulfilled. I trust no one will think that I am against the use of a lathe, but there are so many who have not got one, that I think it may be a help to describe a motor where the use of one is not needed.

*Field Magnet.*—Get a piece of $\frac{3}{8}$ in. round wrought iron $4\frac{1}{2}$ in. long, as soft as possible, and bend it into the form of a horseshoe, with the ends $\frac{1}{2}$ in. apart on the inside; go over it with a file to take the rough off it, and then file up the two ends true and square one with the other. Cut a long strip of paper—newspaper does very well—$\frac{1}{4}$ in. wide, and paste it well, and wind it round the horse-shoe until there are three or so thicknesses on all over, except within $\frac{1}{2}$ in. from the ends; paste the outside all over, and go over it with your fingers to get it as even as you can; when this is dry give it a coat of brunswick black.

*Winding.*—As this magnet does not require any bobbins, we can go straight on with the winding. With some No. 28 silk-covered copper wire—don't use larger—begin winding, just short of the edge of the paper cover, with a half hitch, eaving about 6 in. tag; wind the wire on close and even until you come to the other end, just within the edge of the paper, then begin to go back—still winding the same way, of course—over the first coils, but mind it does not slip, or

that the second row does not sink down between the first.

When you have gone back about ¼ in. or so, hold the end tight, either by giving two or three turns on the opposite end or any other way you can think of, and give the whole magnet another coat of brunswick black; let this get dry (which does not take long), and go ahead again, doing the same when you get to the ends always, which you should turn one coil short each time; if you are careful in turning, and repeat the brunswick black, you will find that there is no slipping.

When you have made the winding, ⅝ in. about, more or less, in diameter all over, you can stop, finishing off the other end from which you began by tying a piece of thread close up to the finish, leaving another tag, 6 in. or so, and, winding the thread in different directions, and knotting, see that the flat ends are nice and bright, and put it away. (See Figs. 2, 3, and 4.)

*Armature.*—Take a small piece of soft wrought iron, 1⅝ in. long, ½ in., or a little more if you like, thick, and ⅜ in. wide; file it nice and smooth all over, and take off the edges on the sides; then get a short strip of paper, ⅜ in. wide, and paste it round the exact middle of the iron until you have three or four thicknesses on. Give the paper a coat of brunswick black, and let it dry.

Now begin to wind with fine wire: I used No. 36 silk-covered copper wire; take as much care as you can in winding the armature, turning backwards and forwards as with the field magnet, giving each layer a coat of brunswick black, and wind on as much as ever you can get; the more neatly you do it the more you will get on, and the better the results; finish off the same as the other magnet, which in this case will be in the middle, and don't forget the tags: each about 2 in. will do. You must see that your coils are not more than ¾ in. across in front, or the magnet will cut the armature coils. Fig. 8 will show what is meant. You can also, while you are winding the armature, try it in different positions against the magnet, and see that the armature coils are quite clear of everything, for if they touch nothing while the armature is against the magnet, you are quite safe after.

*Commutator.*—This part of the model is really nothing more than a two-part commutator, the only difference being that the brushes work on one face, and not on the rim. The reason this plan has been adopted is that you are supposed to have no lathe, and that to true up an even face on the flat is easier than on a round surface; in fact, the latter is next door to impossible without a lathe.

For the body of the commutator take any piece of hard wood about ¾ in. diameter (not less), and cut off, quite square, ⅝ in. of it. A piece of an old round ruler does very well indeed; true up both faces, and carefully drill a hole in the exact centre large enough to take tightly a good thick knitting-needle, 2½ in. of which will make you a very good steel shaft.

Out of a piece of sheet copper cut a disc, the size of the wooden body, and screw it on with four small wood screws, and countersink them (see Fig. 7). Cut the copper right through the centre with a file, and saw down through the wood for about ⅜ in.; the thickness of a saw cut (small) will be quite wide enough for the slits.

There is a proper angle at which to set out the slits, but in such a small model this is not necessary; but if you like to go so far, you will find the angles set out for you in Mr. Bonney's paper in WORK, Vol. II., No. 92, pages 643 and 644; you can apply the same rule for a flat surface as well as a round one.

Having gone so far, take off the two pieces of copper, mark them so that you can put them on again in the same way, and cut a nick out of the middle of each, as in Fig. 7, to prevent any chance of contact with the shaft; screw them on again, and glue into each side of the slot two neat little pieces of boxwood or bone, so that they stand just above the copper; then file up the whole face, bone strips, screw-heads, and all, to a true and even face as smooth as you can, and square to the shaft hole.

*Brushes.*—These are simply two thin copper strips, 3 in. long and $\frac{3}{16}$ in. wide, bent to the required shape, with a short piece of silk-covered copper wire about 6 in. long soldered to each, and having a small hole drilled at one end of each to take a small wood screw, as shown in Fig. 6.

*Yoke for Armature.*—Out of some brass sheet, $\frac{1}{16}$ in. thick or so, cut a piece 1⅝ in. long and ¼ in. wide, and bend it into the shape shown in Fig. 5, so that it will touch the ends of the armature and enclose the coils on that side; perhaps you may have to cut it a little longer: it all depends how much wire you managed to get on.

In the exact centre of this yoke drill a hole to fit the end of the steel shaft (your bit of knitting-needle), then carefully place the yoke on one side of the armature so that the hole for the shaft comes *exactly* in the centre of the armature and coils; tie this there with a bit of twine to prevent any chance of its loosing its position, and solder the two ends of the yoke to the two ends of the armature.

Now place your steel shaft into the hole in the yoke. see that it is perfectly perpendicular to the face of the armature, and solder it in, taking care not to drop any hot solder on to the armature coils. Don't forget that in fixing the shaft in there is not much chance of truing up afterwards, so try and get it plumb.

*Shaft Bearings.*—These are four pieces of brass cut from the same piece as the yoke, or a little thicker if you like; two about 1¼ in. by $\frac{3}{16}$ in., and two about ¾ in. by $\frac{3}{16}$ in., drilled, as shown in Figs. 5 and 9, to take four small wood screws each, and drilled to take the shaft. The best way to drill the shaft hole is to fix both pair of brasses on to any spare piece of wood just as they are to go on to the frame, only close together, side by side, and carefully drill right through both at once, square and true; then before you take them off mark them all, so that you may be sure of getting them to fit in their places when they are fixed.

*Stand, Blocks, etc.*—The stand and blocks you can make of any wood you like, and the form does not so much matter, except the top of the field magnet one, which should be made as shown in Figs. 2, 3, and 4.

The block for the shaft can be a simple square if you like; the only thing is, they must both be of such a height that the centre of the shaft is on a level with the centre line of the field magnet ends. You can glue them on the stand after you have set out their positions, or you can screw them on through the bottom of the stand, or you can do both. You will want four little binding screws for the stand, as in Fig. 1, which is a sketch of the model complete in its simplest form, but to no scale.

*Fixing.*—You can now slip the commutator on the shaft right up to the yoke, with its copper face away from it, and the line of the slits parallel with the length of the armature; if you drop a little strong glue in on each side, between the yoke and the wooden back of the commutator, you will find that it will hold it quite tight enough, especially if the shaft hole was not too large.

Now bring the ends of the coil, one on one side of the yoke, and the other on the other; cut them just long enough to reach the edge of the copper face of the commutator, but don't let them press against the yoke; bare the ends, and solder them to the rim, one to each segment, taking care that no solder runs on to the copper face.

Having fixed the field magnet in its seat, and screwed it tight by means of the button on top—previously having wound a little silk ribbon round the coils, to prevent the wood cutting them—you can then put the brass bearings on the other block in their proper places, the one farthest away from the magnets being flush with the side of the block, so that a little brass bush or washer can work against it. This is shown at B in Fig. 5, which must be soldered on to the shaft.

Then cut a small disc of stout lead, which you can easily do with a strong pair of steel compasses, solder this on the end of the shaft in such a place that it balances the armature, commutator, etc., and put it on true to prevent any "wobble." This little disc has two uses: it makes the model run easier by means of its balancing power, and also helps the armature over the two dead points.

Put your shaft, etc., on, and screw up the bearings; now unscrew the button of the field magnet, and adjust it so that the armature will run free, as near as you can get it, without any chance of touching. Then screw on the brushes, one on each side of the shaft, and between the bearings; mind they touch nothing but the wood; set the armature opposite the ends of the magnet, and bend the brushes so that the little bends at the other ends each press very gently on the wooden or bone strips of the commutator. The dotted lines in Fig. 7 show the position of the brushes, but you will find their best place when you set the model going.

You now bring the ends of the wires from the brushes to the two first binding screws, and the two ends of the field magnet coil to the other two. With four binding screws you can make all sorts of combinations with your battery: you can drive the model backwards or forwards, connect it in series or parallel, or any other combination you can think of.

*Final Remarks.*—I am sure, now, that if anyone follows these instructions with a little care, they will have a small model electro-motor, the only expense being the copper wire, four small binding screws, and some small wood screws; you can use almost any kind of wood for the stand, but, of course, a good close-grained wood makes the best job, and you can put into the work any degree of finish you like. All the rest of the stuff you could almost get out of an old scrap heap, such as the iron, odd bits of copper, brass, etc.

I have also endeavoured to use the least number of tools that I should think could turn out a small motor, and have kept my word about the lathe. I have also dispensed with any screwing tackle. Of course, there is the expense of your battery to drive your motor; but if I am allowed to do so, I will at some future time add a short paper to this showing how you can make your own battery, carbons and all, in the easiest and simplest way. But this will depend very much on the desire of readers of WORK to have such a paper as I have mentioned.

## WIRE-WORK IN ALL ITS BRANCHES.

BY JAMES SCOTT.

HEN-AND-CHICKENS' COOPS: THE FRAMING—PUTTING TOGETHER—FOLDING MERIT—COMPANION BOARD—THE ENTRANCE—DOOR SUPPORT—PEA GUARDS: STAY-WIRES—THE ENDS—PEA HURDLES: THE MESH.

**Hen Coops.**—The manufacture of hen-and-chickens' coops is, in several wire-working establishments, a source of large profit; and this is hardly a truth to create wonder when it is remembered that the possession of fowls is a fact with so many householders and others.

The pattern shown in Fig. 185 represents the commonest kind of this class of goods, and it is my impression that it is one of the most useful for its special purpose. My amateur aspirants will find their progress a comparatively simple matter if anyone among them should decide to try his hand at making one of these articles—provided, of course, that he is fully acquainted with the practical details of "putting together," "turning over," etc., described in former numbers of WORK.

Why they are constructed of a greater width at the bottom than at the top I am not in a position to reply to satisfactorily; it certainly cannot be to allow the rain to escape when a shower envelops the articles, as is the reason for building sloping roofs to houses; for the most unintelligent of my readers will at once perceive that no resistance would be offered to the rain. The shape of the fowl, too, cannot be tendered as a reason, as I have always understood a fowl to be as wide at the top of its body as at its under part. Perhaps this is the reason: supposing that the articles were made of the same width at the bottom as at the top, the bird would have much less room to pick off the ground than it would, as in the present case, if the bottom were increased in width. If the coops were tall, then I should give it as my opinion that the bottoms were wider than the tops in order that there might exist less chance of them being toppled over. However, let it remain; but it is certainly true that as they are made now they demand the exercise of more troublesome labour than would otherwise be the case.

*The Framing.*—The top and two sides are usually of exactly the same size as each other in every respect, but the ends are generally an inch or so narrower at the tops than at the bottoms, as before remarked upon. The frames forming the top and the sides are of ordinary construction; each having two stay-bars secured to it, with knuckles inwards. The ends require some touching upon: thus, there are five separate frames.

It will be understood that the width of each side will exceed the depth of the ends, as the latter being wider at the bottom, the side rods thus formed are longer than they would be were they quite vertical; therefore the sides will each be in width equal to the length of a side rod in the ends.

*Putting Together.*—The top and sides are fastened together first, either by tying or binding. The latter operation consists of twisting a piece of thin wire several times around the bars of the frame where they come in contact with each other, thus embracing two bars or rods, as in Fig. 191. The binding wire must not encircle these bars too loosely, as in this event there would be a liability of a rickety job being constructed. Two or three bindings only will be necessary to keep all frames firmly together. Wherever one touches another, there it might be bound; although, as will be seen, it is really not necessary that more than four pairs of connections be used—or, more properly speaking, two at each of the four sides of the top frame, securing respectively the sides and ends of the article.

*Folding Merit.*—Wire-workers are in the habit of sending these coops home in a folded state, for obvious reasons; and it is sometimes bombastically claimed by dealers that these articles possess the advantage of being folded: from which customers might be led to suppose that they had been specially designed for the purpose of enabling the owners to stow them away in a small compass; whereas the truth is that the "obvious reasons" are the cause of them being so constructed. As a first reason, they are more conveniently made thus than they could be were the framework in one complete piece; and a second reason to adduce is that the makers themselves prefer that they shall fold, irrespective of this merit being advantageous to anyone else, in order that they may occupy less space while in transit to their buyers' warehouses.

When once rigged up, little necessity will arise for one of them to be folded, for in the event of an owner of many fowls possessing one or more, he will find continual use for one or all; and if a person owns but a few of these creatures, and requires only the occasional use of the coop, he can as well stow it away in its complete condition in the fowls' run or elsewhere, where it will be none the less liable to rust or spoil, or be a source of inconvenience, than would be the case were it in a folded state.

*Companion Board.*—These are sometimes secured to a board by means of staples driven over the bottom rods, and often they are merely stapled to the ground. Fig. 190 shows a board with staples for use in the former case. It is plainly apparent that a hen which chanced to occupy a coop which was merely stapled to the ground would run an extremely greater risk of catching some complaint from the damp of the space within which it were confined than would be the case if the coop were stapled to a board, when the dangers would be lessened, if not wholly avoided.

*The Entrance.*—At one end there will be a flap door. This is attached to a small frame, the latter of which is fitted on to the meshes, and the wires with which it comes in contact turned over on to it. The end of the coop in which the door is to be placed is at first in all respects the same as the opposite end, but the wires enclosed within the space to be occupied by the frame over which will hang the door must not be turned over, but left free, as in Fig. 186. When the remainder are turned over, the shears must be brought into action by cutting the necessary opening; the result being as in Fig. 187.

There it will be noticed that portion of those wires whose ends are shown protruding in the front of Fig. 186 are severed. It must be borne in mind that the area of the vacant space in Fig. 187 must be rather smaller than the area of the framing which will receive the door. This is in order to give allowance for sufficient length on the ends of the wires around the space to be turned over on to the frame. The frame to fit over this opening is made by bending a piece of wire, as shown in Fig. 188, and forming the ends into small hooks. The knuckles of these wires should be towards the inside of the work.

*The Door.*—The door is made by bending a wire in a similar manner to the small frame (Fig. 188), of a size large enough to hang conveniently over the latter. Fig. 189 shows the door. When it is fully completed it is fastened at the top of the small frame by having the hooks, which are shown, properly squeezed down.

*Door Support.*—The door can be kept open by numerous methods, one being that shown in Fig. 185. This is but the simple device of a short chain, with a hook attached to one end. The chain can be permanently fastened to either the door or the end proper of the coop, the hook being at the loose end—whichever may be the course adopted. If thought necessary, the door, when down, could be safely secured with a padlock, or for ordinary purposes a wire button would answer.

**Pea Guards.**—The articles which are made to protect those delicacies—peas—which are usually associated with other delicacies in the shape of lamb and young ducks, are called pea guards. In Fig. 192 one (or what some would term a portion of one) is shown. As most people may be aware, they are driven into the ground end to end, to cover that particular portion in which are the peas or their seeds, thereby being a preventative against the natural onslaughts of birds and other kinds of life. It is needless in such cases for the hideous scarecrow to despoil the view of human ken, when their eyes travel in that direction, under the plea, useless or otherwise, of frightening the timid but mischievous "dickies." The ends of the combined lengths are then enclosed with end frames (Fig. 193).

The original appearance of each guard is shown in Fig. 194. These frames contain two end rods, each projecting on either side to a distance of a few inches from the main portion of the work; and two side rods turned over on to the latter. The pieces of work secured to these frames are usually of the mesh represented in my diagrams, of which I speak more fully at the beginning of my papers on "Wire-Work"; but it must be obvious that there is no compulsion enacted as regards the particular pattern of the mesh used, as it may with equal efficiency be of the diamond class.

*Stay-Wires.*—The next operation is the fixing of stay-wires, which tend to strengthen a job, across a guard, as in Fig. 194, turning them over on to the frame, and tying them at their junctions in addition to at short intervals on the under wires. It will be noticed that there are four wires used in relation to my last remarks, each couple of which crosses each other, and have their ends either in direct contact with the end bars of the frame or with the opposite pair of stay-bars. They are then bent around a cylindrical surface.

*The Ends.*—One end of a pea guard is represented in Fig. 193. It is simply a rod bent half-circular in shape, fastened to a straight one, the latter of which extends at each side beyond the ends of the former, with a piece of work turned over on to them. When they are joined to the main part of the guard, one projection is passed through the guard at one corner from the inside, and the other end through the opposite corner, when they are then bent round towards the front of the end, and finally squeezed flat up against it, the straight rod thus being in reality doubled upon itself, and all superfluous material clipped off. For further security they are tied here and there round the bent portion to the guard frame.

It is not such a difficult task as it may at first sight appear to fasten an end to the

adjacent portions of a guard, and no illustrations nor further written details will be in any way helpful.

The projections at the ends of the rods on the main frame are, as lately told, for the purpose of enabling the guard to be fixed to the earth. It must be apparent that when the article is bent these points are protruding downwards.

It is usual to supply two ends with every dozen of the individual guards, but, of course, personal requirements may demand even more ends to such a number, or may be less.

Pea Hurdles.—Pea hurdles, as perhaps all are aware, are used as guides and supports for the plants when they show above ground. One is shown in Fig. 195. It is usual, I believe, to drive stakes deeply into the ground, at distances apart equal to the separate lengths of the hurdles, allowing a sufficiently long portion of each to protrude to nearly the height of a hurdle, and to attach to them the ends of the various couples of hurdles which meet at those points when placed in a row consecutively. The side rods of these articles might be carried in length to an extent of several inches beyond the bottom bar of each; but so secure and firm a hold is not to be obtained by these means as by driving stakes into the soil at various points, as is customarily done. Again, if merely the extended side rods are adopted, each hurdle will have to be bound to the next one at the end which touches it, thereby necessitating equally as

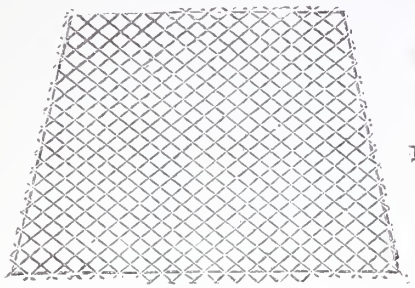


Fig. 186.

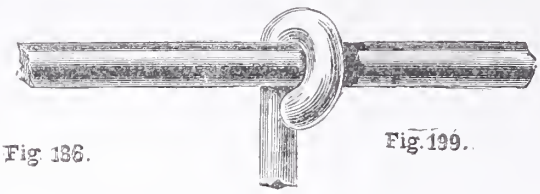


Fig. 199.

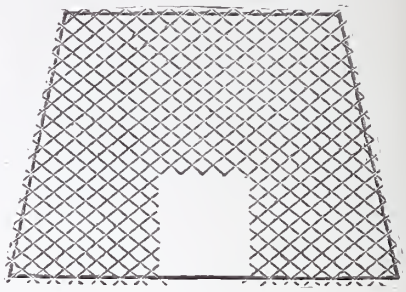


Fig. 187.

Fig. 188.

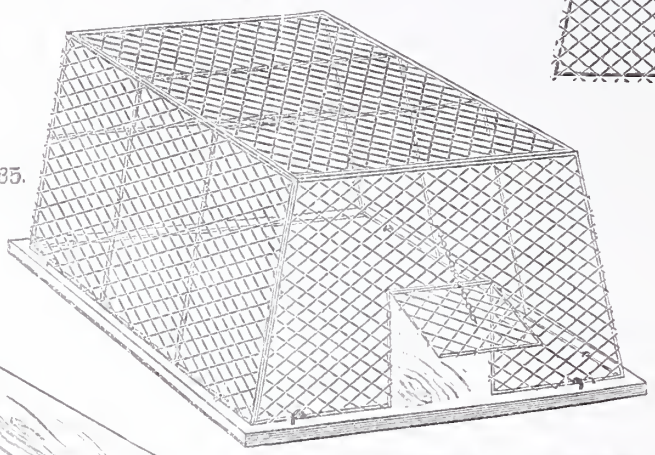


Fig. 185.

Fig. 189.

Fig. 196.

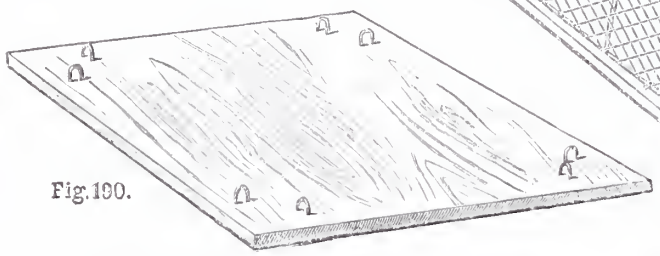


Fig. 190.

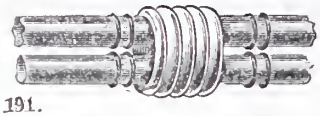


Fig. 191.

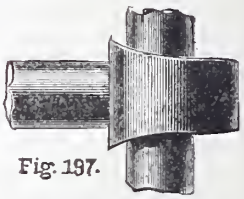


Fig. 197.

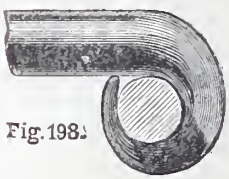


Fig. 198.

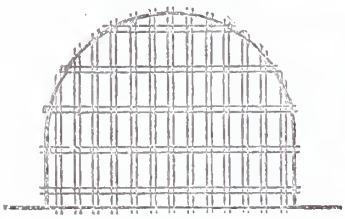


Fig. 193.

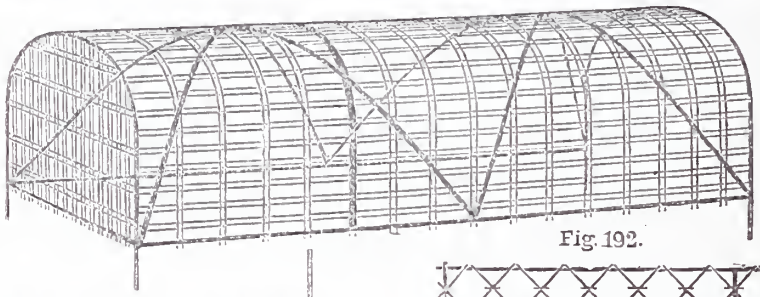


Fig. 192.

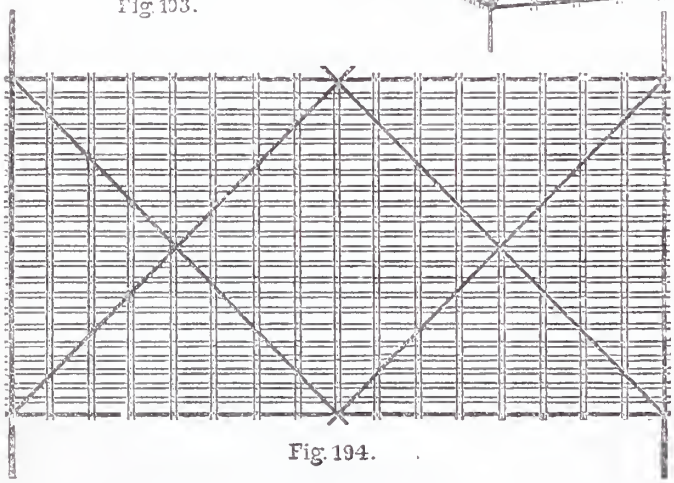


Fig. 194.

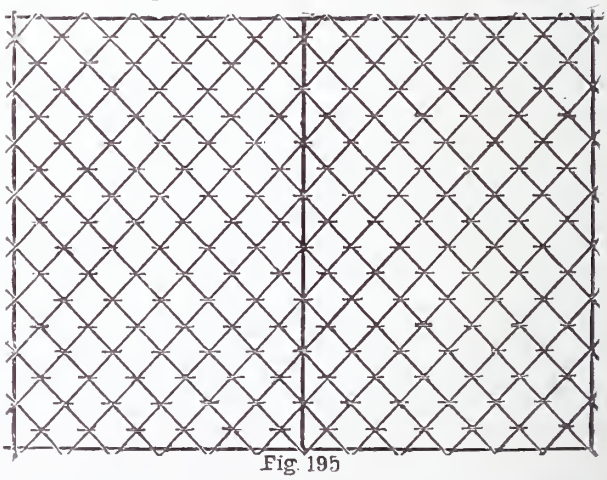


Fig. 195.

**Fig. 185.—Hen-and-Chickens' Coop. Fig. 186.—Door End with some Wires left free. Fig. 187.—Door with aforesaid Wires cut free for admission of Frame, shown in Fig. 188. Fig. 188.—Frame for Door. Fig. 189.—Door. Fig. 190.—Companion Board for Coop. Fig. 191.—Coop Hinge. Fig. 192.—Pea Guard. Fig. 193.—Pea Guard End. Fig. 194.—Original appearance of Pea Guard. Fig. 195.—Pea Hurdle. Fig. 196.—Plan of Bottom Wire in Fig. 193 when turned round upon Guard, when fitted as in Fig. 192, superfluous Material to be clipped off, allowing but sufficient to hold fast. Figs. 197, 198.—Plan and Elevation of Shorter Rod Ends, Fig. 195, which are drawn to smaller scale than other Diagrams, except Figs. 197, 198, and 199. Fig. 199.—Diagram showing Mode of turning End of Vertical Rod over Horizontal Rod.**

much labour as would be entailed by fastening them to stakes.

*The Mesh.*—A small mesh is not required for such articles as are receiving attention; therefore it is needless to use more material than is essential to obtaining the necessary strength. As this is the case, crimped or corrugated wire may or may not be used, although it is far preferable, on many accounts, to use perfectly straight stuff, and tie it at its various junctions, as in the manner shown in my introductory remarks in my first paper on Wire-work (Vol. III., No. 105, page 8).

For the frame five rods will be required. It is preferable to have the shorter (*i.e.*, the end and middle) ones with forged or flattened ends. This can be understood from Figs. 197 and 198. The longer rods are severed at points flush with the outsides of the ends of the work when completed, over which ends are squeezed the flattened parts of the end rods, while the ends of the middle rods are also turned over them in a similar manner, in contrast to the method shown in Fig. 199 in relation to hen-and-chickens' coops.

The wires in this instance will be turned over on to the frame in precisely the same way as they are in any and every other case.

With this I must bring my instructions on Wire-work to a close. I am obliged to leave much unsaid that might be said, but I have no more space at my command, and I am therefore reluctantly compelled to take leave of my readers at this point.

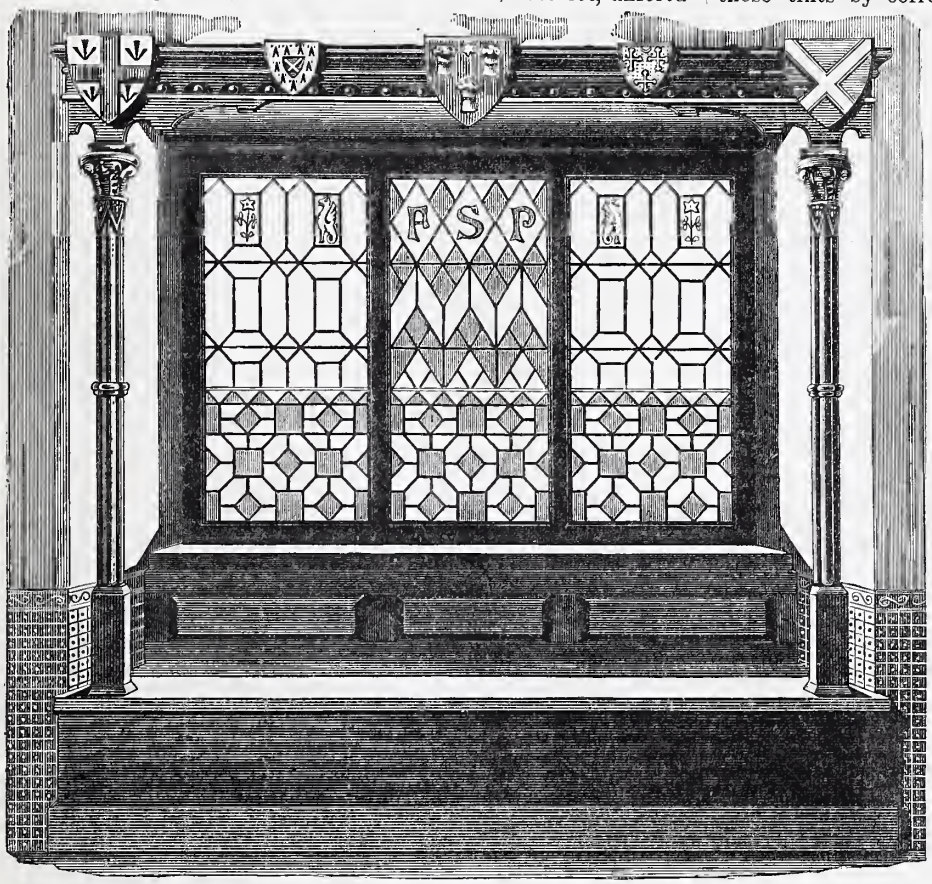



Fig. 19.—Window of Dining-Room.

## MAKING THE BEST OF A BAD HOUSE.

BY MARK MALLETT.

THE DINING-ROOM: THE WINDOW—THE WINDOW CORNICE—THE CORNICE ROUND CEILING—PAINTING AND PAPERING—CONCLUSION.

*The Dining-Room: The Window.*—This room had but a single window, but it was of such a size as to admit abundance of light. It had originally been divided into three lights by handsomely wrought stone mullions, but these had disappeared, and square wooden uprights, 2 in. wide, had taken their places. They were in the right situations, so I did not remove them as I had those in the study, but used them on the centres of the handsome mullions which appear in the illustration (Fig. 19). The leaded lights were of much the same character as those in the study, and by no means worth preserving. I proposed to put in new ones, and, as I was not now compelled to economise every ray of daylight, I indulged in more ornamental glass than in the former room.

This window looked directly into the village street, and it was desirable that the glass in its lower portion should form a screen. In designing my lights, therefore, I arranged that the lower third should be entirely in coloured cathedral glass, but of a very low and quiet tone—the prevailing tint being green, varied with faint reds and yellows. No glaring colour was admitted. The illustration in which I can convey the arrangement of the lead lines, and merely hint at variations in tone, does not, unfortunately, enable me to show the pleasing effect of colour produced.

As regards the two outside lights, their upper two-thirds were of plain white glass, except the two plaques bearing heraldic badges near the top. These plaques were of white cathedral, the charges on them drawn in brown matting colour, and the background, or "field," washed in with gold-stain.

In the central light, as is indicated, the plain white glass is arranged in combination with low-toned coloured glass of the same kind and tints as below; and instead of the plaques at top I introduced panes bearing my initials, brought out in the same manner with gold-stain.

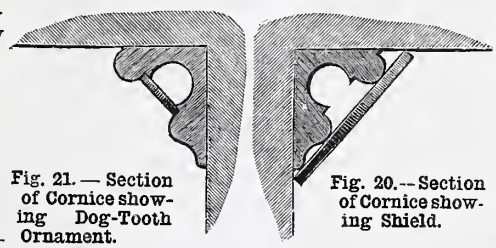


Fig. 21.—Section of Cornice showing Dog-Tooth Ornament.

Fig. 20.—Section of Cornice showing Shield.

This window is about 6 ft. broad by 3½ ft. high. The leaded lights, with ties, bars, etc., all ready for fixing, cost me, if I remember rightly, about 45s. I fixed them myself. I took the precaution to draw a full-sized cartoon of the lead lines of the central and of one of the side lights, for the guidance of the workman. Also I drew out to full size on tracing paper the initials and one of each of the badges (the wyvern and the columbine) for the use of the glass-painter. For the tinted portion I selected patterns of the glass, numbered them, and indicated all such panes as were to be of those tints by corresponding numbers on the cartoon. All possibility of mistakes in colour was thus guarded against. The subdued and harmonious effect of this window has, I think, been praised by all judges in matters of taste who have seen it. The only positive colour contained in it—if that can so be called—is the gold ground of the plaques, etc. There are no strong reds or greens, and no blue whatever.

*The Window Cornice.*—The opening to this window was bare and ugly, there being no woodwork round it. Most persons would, I suppose, have masked it by a large curtain pole and heavy curtains; but this would not have agreed with my scheme of decoration. The illustration (Fig. 19) gives a fair idea of the plan adopted. The carved pillars which flank it are the footposts of that same demolished four-post bedstead of the old school of which mention has already been made on more than one occasion. They have clustered shafts, and are beautifully carved in dark mahogany, in the style of a hundred years since. The complete bedstead cost me, at an auction sale, 20s. These pillars were indeed so good in their way that I was glad to bring them into a position where they would be more seen than in a bedroom. The cornice itself is of ebonised pine; the shields which decorate it are emblazoned in their proper heraldic tinctures.

*The Ceiling Cornice.*—The upper portion of this window cornice is of the same moulding as that used over the door in the hall; in the present case it is continued as a ceiling cornice round the entire room. It is seen in section in Figs. 20 and 21. Its projection is 2 in., and its depth may be slightly more. It has an effective hollow in its middle. By the hundred feet run it cost me, I think, about 23s. 6d. Of course, I had to ebonise and polish it myself. Having fixed it round the room, I attached to it a series of shields, as in the section, Fig. 20. They were of the same size as the smaller ones on the window cornice (Fig. 19), namely, 5½ in. high. They were cut from

½ in. pine board, and emblazoned with proper heraldic tinctures, their sides being ebonised like the moulding on which they lie. At the corners of the room the upper portions of the shields touch; at other places there is a space of about 2 ft. between each two shields, and in the centre of this space is a square dog-tooth ornament, cut from ¼ in. pine and gilded. How this is arranged is seen in section in Fig. 21. Thus the shields and ornaments alternate.

Being something of the genealogist and herald, I charged these shields with the arms of as many different families as I have reasons for supposing to be connected with my own, by blood or marriage. They thus form a sort of family history in brief, as well as tending to brighten up my walls with their gilding and brilliant colours.

*Painting and Papering.*—The skirting boards, the door frames and architraves, and the doors themselves, their panels only excepted, I painted of a dead black; the panels I coloured of a deep Pompeian red. Much the same system of colouring was also adopted throughout the hall and study. I am much of Mr. Ruskin's opinion as to the superior artistic effect of self-colours over graining, if arranged with judgment. Certainly for the amateur they are much to be preferred. Anyone of ordinary intelligence can soon pick up the knack of laying on self-colours properly, whereas graining demands very considerable skill. There is no graining in my house. The papers used on my dining-room walls were such as showed only different shades of brown.

At this point I may fairly bring my remarks on this subject to a close, having brought under the reader's notice the most prominent of the various steps I took in "making the best of a bad house," or, in other words, what I did to convert bald, bare-looking, and unpromising premises into a place which at least had the merit of satisfying the eye, even of a hypercritical observer, in general arrangement, form, and colour.

## COPYRIGHT IN SCULPTURE.

BY CHARLES KELSEY.

INTRODUCTION—THE SCULPTURE COPYRIGHT ACT—DEFINITION OF SCULPTURE—WORKS MUST BE ORIGINAL—HOW TO SECURE COPYRIGHT—DEFINITION OF PUBLICATION—DURATION OF COPYRIGHT—ACTION FOR OFFENCES—CONCLUSION.

*Introduction.*—This paper is written as a sequel to the articles on the Registration of Designs, which have recently appeared in WORK. It was noted in those articles that sculpture was expressly excluded from the operation of the Act which governs the registration of designs; and as in some cases—such, for instance, as small statuettes—it is difficult, when protection is required, to decide which is the better course to pursue, this brief statement of the law as to sculpture copyright has been written.

*The Sculpture Copyright Act.*—Copyright in sculpture is governed and regulated by the provisions of the Act of Parliament known as the 54 Geo. III., cap. 56.

This Act was passed in A.D. 1814, taking the place of an older Act (38 Geo. III., cap. 71) passed in A.D. 1798, which was found faulty in practice and required amendment.

This existing Act, then, must be examined for information and guidance.

*Definition of Sculpture.*—The first point to determine is the definition, for copyright purposes, of the term "sculpture."

The term, as generally used, means statues and the like, carved in marble or stone. Cast statues in bronze and similar metals, carvings or castings in alto- and basso-relievo, are also included. The Act covers all these, and also takes in other things which are not now usually considered as being sculpture.

The term "sculpture," for the purposes of this Act, includes:—

Sculptures, models, copies, or casts of the human figure, whether treated singly or in groups, whether nude or draped, combined with animals or otherwise. Also portions of the human figure, including busts.

Also sculptures, models, copies, or casts of animals, or portions of animals, whether treated singly or in groups, in combination with the human figure or otherwise.

Also any carvings or castings, or models in alto- or basso-relievo—*i.e.*, high or low relief—and any other subject, being matter of invention in sculpture.

Also casts taken from Nature—such as casts of the human figure, or animals, or portions of either of them, and casts taken from any other natural object.

This definition is wide enough to cover works in marble, stone, plaster, metal, wood, ivory, bone, pottery, terra-cotta, earthenware, clay, wax, or any other material in which such works can be, or usually are, executed.

*Works must be Original.*—It should be noted that these works, to be entitled to protection, must be "new or original," meaning, evidently, thereby the original emanations of the brain and art of the sculptor, and not mere copies taken from previously existing works.

In my first paper on the Registration of Designs (Vol. III., p. 564), I dealt with the same terms, which appear also in that Act, and those remarks may usefully be referred to, as further illustrative of this point.

*How to secure the Copyright.*—The process of securing the copyright in any such work is a very simple one. No registration or payment of fees, as is the case in designs, is required; the sculptor is only required to put upon all and every such sculpture, model, cast, etc., issued by him, his name or names, and the date of publication.

*Definition of Publication.*—"Date of publication" would appear to be the date on which such sculpture is issued, sold, or exhibited in public. It does not necessarily mean the date of completion of the work, for it may remain in the private studio of the sculptor for a considerable time before it is exhibited to the public. This same term has been dealt with in the papers relating to designs, previously mentioned; and in the case of designs the term "publication" has been held to include such an act as showing it to persons for the purpose of securing orders. Probably a similar meaning would be held to apply to the term as used in reference to sculpture.

*Duration of Copyright.*—The copyright so acquired lasts for a period of fourteen years from the date of publication; during that period the sole right and property in such a work is vested in the proprietor. He can sell, or assign, this right to any other person at his pleasure.

If the original sculptor is still living at the expiration of the first term of fourteen years, a further term of copyright for another fourteen years is vested in him. If he is dead at the expiration of the first term, the private copyright ceases, and it becomes public property.

*Actions for Offences.*—The Act also says that any action for any offence against this Act must be brought within the period of six months next after the discovery of such offence, and not afterwards.

*Conclusion.*—Such, in brief, are the provisions of the law regulating copyright in sculpture; and this information will be interesting and valuable to those readers of WORK who practise the arts of carving, modelling, and plaster-cast making, as showing them how to secure copyright in their works.

## AN ANTIQUE DUTCH CHAIR.

BY REX MAGNUS.

IN the tumble-down hut at Zaandam, in Holland, which is shown to tourists as the resting-place of Peter the Great, while resident in that town for the purpose of learning the "schipmaaker's geschaft," there is no furniture to be seen other than a table and two or three old chairs. These latter are of little artistic merit, but are eminently quaint, and, in the opinion of the writer, are very suggestive to the amateur cabinet-maker, offering great scope for amplification or ornamentation. Fig. 1 shows the general

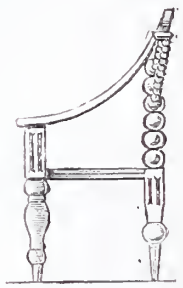


Fig. 3.

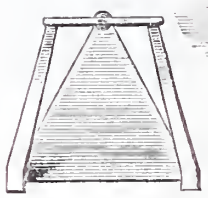


Fig. 2.

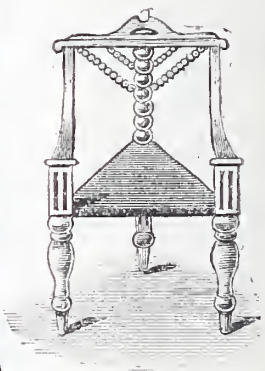


Fig. 1.

**Fig. 1.—Dutch Chair of Sixteenth Century. Fig. 2.—Plan. Fig. 3.—Side Elevation.**

construction of such chairs, but as it is drawn from memory, is probably inexact as to the turnings of the legs, which look like anachronisms. Still, there is nothing to prevent the would-be maker from selecting his own particular form of leg—probably the plainer and severer, the more "in keeping" the result would be. Oak, of course, would be the wood to use if one had the choice, but beech or elm would look equally well when stained up and polished. In the originals the seats are simply triangular boards, without the least attempt to "shape," as in modern wooden seats. But a very handsome article of furniture might be made by padding the seat and upholstering in leather. In the originals the workmanship also is as crude as the accompanying drawings, which I hope will be sufficient of a guide to anyone attempting to make it. Instead of adhering slavishly to conventional models, amateurs should study the Swedish, Norwegian, or Danish designs in common use for tables, chairs, stools, etc.,

all of which will be found well worthy of attention. It is surprising that our technical journals provide us with so few such, as they are, for the most part, easy of construction, while admitting of any amount of ornamentation.

## AN EASILY-MADE CHEST OF DRAWERS.

BY DAVID DENNING.

UTILITY—ORIGINATION OF NAME—SIZE—MATERIAL — ENDS — TOP BEARERS — BOTTOM — DRAWER BEARERS — RUNNERS — GUIDE — DRAWER SIDES—FRONTS—BACKS—BOTTOMS — MOULDINGS.

As a receptacle for stowing away not only clothes but sundry articles of all kinds, it may be questioned whether any piece of furniture is so generally popular and convenient as what is known as a "chest" of drawers. Even in the wardrobe—which, when of large size, to a certain extent supersedes this useful piece of furniture—a considerable portion is generally devoted to what may be called an enclosed chest of drawers.

As an explanation of a combination of drawers being termed a chest, it may be interesting to note that, as is no doubt well known to the majority of readers, what is generally understood as a chest—*i.e.*, a box—has only a lid to close the top. Chests, of which many old specimens are still extant, at one time formed the storing accommodation for clothes, etc. These old specimens generally stand on legs. Well, by degrees it became customary to put a drawer, or drawers, under the box bottom—the convenience of a drawer, especially when shallow, being, no doubt, readily recognised. The next development was to have two tiers or rows of drawers, with what was, to all intents, the old-fashioned chest with lid above them. By degrees the chest contained nothing but drawers—the lid was done away with. The old title of a chest of drawers has stuck to the modern article, however, and probably at the present time there is no one in Great Britain or the sister island who is unfamiliar with it.

Instead of being a chest, the outer part—that in which the drawers are enclosed—is rather a cupboard without doors, and with rails on which the drawers fit; and if the young or inexperienced maker will bear this in mind, I think some of his difficulties in devising elaborations of a simple chest of drawers will be lessened. It is, however, not my intention now to explain the construction of anything but a simple chest of drawers, and that, too, in the simplest manner, so that anyone almost may undertake it, even though he has little or no skill in drawer work.

However simple in theory and easy to the expert, every novice who has tried it knows that a considerable amount of care and accurate workmanship are wanted. The dovetailing bothers him especially.

Now, I intend to show those who, for any reason, do not want to make drawers in the usual way how they may make a good, useful chest, without more than a very small amount of skill and with few tools, by a very easy method.

The size I must leave to the convenience of the maker, but it may be said that a "four foot" is usually regarded as the standard, and the arrangement shown in Fig. 1 is the ordinary one.

It may be assumed that pine, or American white-wood, which is now obtainable occasionally at about the same price, will be the material, and the only thing which it may be necessary to mention is that, if pine be chosen, it should be free from knots. The other seldom has any.

It stands to reason that the first thing the maker has to do is to decide on the size of the chest, and general arrangement of the drawers. He will then be able to joint up, if necessary, to get the requisite width of plank for the top and ends. The thickness of stuff for these parts, it may be assumed, will be 1 in. Less might be managed with, but then it would be almost impossible to dispense with lining up, and this would entail not only more labour, but would require greater skill.

In actual construction the first proceeding will be to connect the two end pieces. This may be done by nailing the top and bottom direct to them; but if such rough-and-ready joinery will do for any reader, I may as well say that he surely can hardly require directions. It will be better to take a little more trouble and do the thing properly by connecting the ends with bearers, at any rate at the top. The top, or cover, will then be fastened to them. The bottom ends may be treated in the same way, but very little more skill will be required to fit in a solid bottom.

For the top bearers two pieces at least should be used: one at the back, and the other in front. A good deal depends on the width of these pieces, as well as on the width of the chest, whether one more, in the centre, will not be advisable. They should not be less than 3 in. wide, while if they are a good deal more it will not do any harm; for their purpose is to rigidly connect the ends, as well as form a vehicle to which the top is fixed. In thickness they should not be less than 1 in. stuff.

The ordinary way of fixing these would be to lap dovetail them in, but it will be sufficient to sink them into the ends. To manage this, mark their thickness on the inner side of the ends, measuring from the top edge. Then cut away, say, half, or a little more, of the thickness of the ends down to this gauged line for a sufficient space to allow the ends of the bearers to lie within them, with the upper surfaces of the bearers and the top edges of the ends exactly flush.

The front edge of the front bearer must also be flush with the front edges of the ends. That this may be managed without the unsightliness which would be caused by the bearer showing through into the ends, cut a short distance back on the ends of the bearer, making them narrower where they fit into the spaces cut for them, as represented in Fig. 2. The back bearer may as well be set entirely about ½ in. within the ends—*i.e.*, these will project that distance beyond its hinder edge, thus affording supports for the top ends of the backing to be fixed on afterwards.

The bottom may be made in the same way, but it will be almost better to make it solid. A little more material will be required in this case, but then there will not be the labour of fixing runners for the bottom drawers. To fasten the solid bottom in, it is only necessary to cut two or three tenons on it, as in Fig. 3, and corresponding sockets as at top for them.

Naturally, this form of construction does not bind the ends so securely as dovetails would, but then the requisite degree of strength can be got easily by the use of glue and nails. The former, of course, does not hold well on end grains, but still, if properly used, it has some power. The nails—nothing is better for the purpose than the ordinary French or wire nails—should be of a good length—say, 2 in. or 2½ in.—and be driven in slanting in opposite directions.

Before the parts referred to can be fixed finally, it will, however, be necessary to arrange and fasten the pieces on which the drawers run. These pieces are the bearers between the drawers, and by which they are supported in front, and the runners extending from back to front for the edges of the drawer sides to slide against. The bottom drawer, of course, requires neither bearer nor runners below it, as the solid bottom serves for both.

The other bearers should be the same thickness as already mentioned, and it will be noted that they are required in front only. They must be cut back like the top front bearer, and sunk into mortises, or holes, prepared for them in the ends. A nail into each, driven in slantingly from the back edge, should hold them secure enough; for, being tenoned in, they will support any weight the drawers will hold. If, however, the mortises are too large, and the tenons obviously fit too loosely, these may be fastened tightly in by what is called "foxing" them. To do this, slightly split the ends of the bearers, and insert a small wedge or two part way. As the tenon is forced home the wedge will be driven further into the split, and consequently force the inner edges of the tenon wider apart, and cause a tight fit.

The runners now demand attention. They should be of exactly the same substance as the bearers, so that both on the upper and under surfaces they may be flush. It will also be necessary to see that they are fitted square across; for if all, or any of them, incline upwards or downwards, the drawers themselves—however well-made they may be—will be sure to fit badly. The width of the runners may be anything, but in this case it will not be necessary for them to be more than an inch, while narrower—anything not less than the thickness of the drawer side—might suffice. There is, however, no object in having them as narrow as they might be. Now, to glue them on to the ends may seem to the novice an easy way of fastening them, and, so far as the actual fixing is concerned, it might be satisfactory enough; but the result probably would be to cause the ends to split by interfering with the natural play of the wood. To go into the reasons for this would require too much space, and it must suffice to say that the ends must on no account be bound, as they would be were the runners to be glued along their entire length. It will be better to dispense with glue entirely for them; but if any is considered necessary, let it be just a touch at their front ends. One or two nails driven straight through, though, about the same place, will be sufficient, unless the drawers have to contain an unusual weight, and, in any case, screws will probably suffice. The hinder end of the runners should be fastened by one nail, driven in part way only, on the slant from behind, as shown in Fig. 4. By this means the end is allowed to contract without splitting.

The upright fitting between the two top drawers is so simple that it is unnecessary to explain it in detail. There must be another runner behind it, and this runner, having to support two drawer sides, must be wider than the others.

To prevent these drawers "wobbling" sideways, a guide must be fixed on the runner of exactly the thickness of the upright. It may be either glued or nailed on.

The main portion of the carcase being ready, the top may be fastened on at any time. It will be fastened on by a few screws, driven in through the top bearers, and should hardly be less than of 1 in. stuff. The carcase will either be fastened on to a plinth—which is nothing more than a frame of, say, 4 in. in depth of 1 in. stuff—or, as is often done, on turned stumps.

The construction of the drawers may seem the most formidable portion of the work, but little difficulty will occur if the following method be adopted. Dovetailing will be dispensed with, and nails be used instead.

The drawer sides—of thin, say ½ in., stuff—should be got out first, and each be accurately fitted to the place it is ultimately to occupy. To prevent mistakes, they should all be marked to show what part they are intended for, as it will be very accurate workmanship if they are all of exactly the same size, and consequently interchangeable.

The drawer fronts of 1 in. stuff, instead of, as is usual with dovetailed joints, occupying the whole of each opening, must be shorter by the thickness of the two sides, for these are to be nailed on to the ends of the front. To nail the front on to the sides would be very bad joinery; for instead of pulling the drawer out when wanted, the front would very likely come away. An easy way of fitting the fronts will be to place the sides in position in the job, thus giving the exact size to which the fronts should be cut. It may be well to note that at this stage no attempt should be made to give the drawers an easy fit. On the contrary, all the parts should fit very tightly, as the completed drawer can be subsequently sufficiently eased with glass-paper, or even, if necessary, by having a shaving or two removed by the plane. If made easy fitting at first, they will probably be too loose afterwards.

The drawer backs will be of the same length as the fronts, but it is usual for them to be narrower, not only to allow of the bottoms being under them, but to be a little lower at the top than the sides are. Like the front, the sides will be nailed on to them.

Before fixing these parts together, the drawer bottom fittings should be attended to. The bottoms might be nailed on, but a far better way will be to devote a little more time, and proceed in a more workmanlike manner. Those who have a plough plane may prefer to make the usual slips for fitting the bottom into; but for the benefit of others another arrangement, which answers exactly the same purpose, is given as follows: Glue a square strip of wood — say ¼ in. square—on the inner face of each side, close to the lower edge, and extending from the inside of the front to the back. Above each strip, leaving a sufficient space for the thickness of the bottom, glue another. Between the two there will thus be a kind of groove, within which the bottom will be held. It may be glued to the drawer front, though it will be preferable to have a similar groove there, too, but on no account use glue in the groove or anywhere else. The drawer back fits above the bottom, which should be left projecting ½ in. or so. If necessary a brad, or, far better, a screw, may be driven into the back through the bottom, though, if this is glued in front, there will be great risk of its splitting as it contracts.

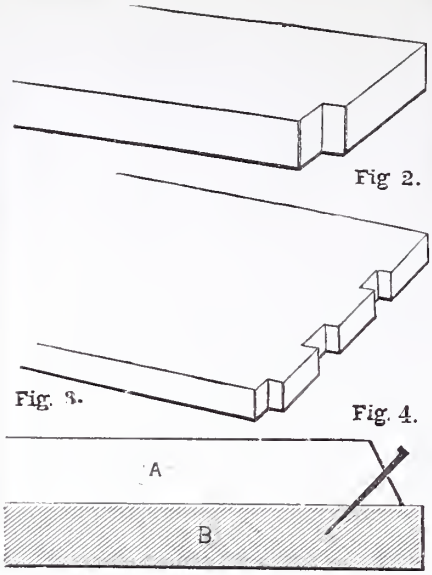



Fig. 2.—End of Bearer. Fig. 3.—End of Batten. Fig. 4.—Fastening of Runners (A) to End Section (B).

It will be noticed that the end grain of the sides shows in front. If this is objected to, as it probably will be, it is only necessary to fasten on a simple moulding, mitred at the corners, and carried round the drawer front. This gives a handsome appearance to the whole, and the unusual construction of the drawers can only be detected by an examination of the sides when they are pulled out.

Such matters as locks, handles, and method of finishing the work, either by staining, painting, or any other means, may be safely left to the consideration of the maker. If he follows the suggestions given, he may rest assured that he will have a chest of drawers which, for appearance and solidity, will compare very favourably with those of ordinary construction, and not be any less useful.

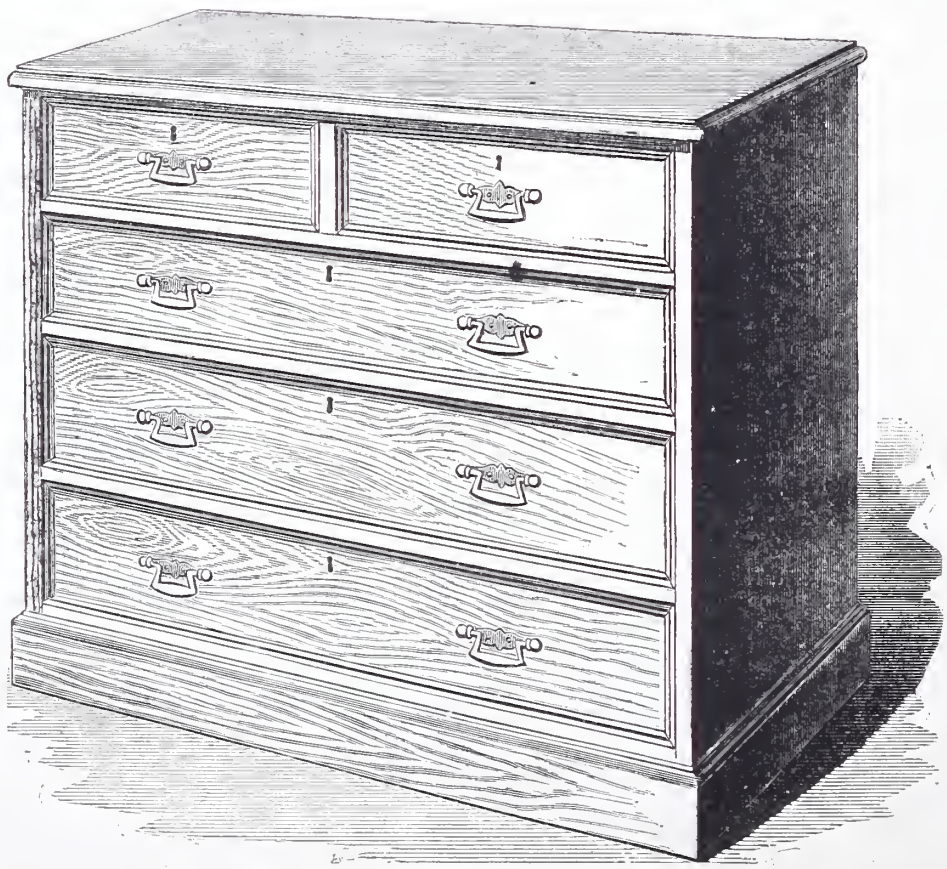


Fig. 1.—Easily-made Chest of Drawers: Perspective View.

## STAGE CARPENTRY.

BY WILLIAM CORBOULD.

ROLLERS: HOW TO MAKE, FIX, AND WORK THEM—THE FIXING OF THEIR ROPES, AND HOW THEY SHOULD WORK, ETC. ETC.

My intention in this paper is to explain, by diagrams, the way in which to make three or four different kinds of rollers or tumblers. A certain amount of skill is required in one or two of the rules, which I shall explain as simply as possible. The first will be a solid roller, which would do for a small cloth, such as 15 ft. by 12 ft. In choosing a piece of timber for this purpose, let it be dry, "straight," and clean, free from knots as possible, and about 3½ in. or 4 in. square. First plane off the four corners (see Fig. 1), which brings it to an "octagon," after which you go on planing off the eight corners until you get a nice round surface. Rub it over with a piece of coarse glass-paper, and you have a simple roller ready. You may now tack your cloth or scene on to it as it is, taking care that you tack it perfectly straight. It would be best to draw a line on the roller by the aid of your charcoal line, and tack to it: this will ensure the cloth rolling up straight. The way it should roll will be explained further on. Another good plan is to saw your roller straight through, placing the cloth between the two sections (see Fig. 2), tacking it on the face of one section. Afterwards place the two sections together, and put two, three, or more screws in them, taking care that the heads of the screws are level with the roller, or they will soon spoil the scene; countersink the wood a bit, so that the screw-heads are a little below the surface. Afterwards fill them with a little hard stopping of glue and whiting, with a

little boiled oil. When dry, paper off smoothly. This is a solid roller.

We now come to rollers that are what I will call "built." It is obvious that solid rollers, larger than the first one I have made, would be too heavy. When a roller reaches the dimensions of more than 3 in. or 4 in. in diameter, and, say, 15 ft. or 18 ft. long, it should be made hollow. There are several ways of making these. I will describe the two simplest. Suppose we are making a roller 6 in. in diameter, or thereabouts. First have a piece of timber about 5 in. square and 4 ft. or 5 ft. long; plane off the four corners, bringing it to an "octagon," the same as Fig. 1. You now saw this into pieces about 6 in. long. These are the cores which you build your roller on. You have now sixteen slating battens; bevel off two edges with the plane, making them somewhat wedge-shaped (see Fig. 3). When you have finished all of them, cut four in half, which gives you eight 6 ft. and eight 12 ft. lengths. Take first a 12 ft. length; divide this equally with five of your cores (see Fig. 4), taking care to have the one at the end (A, Fig. 4) divided in half, so that the next length will rest on the other half to butt or slope against the 12 ft. length (see B). This would be a 6 ft. length. Put a brush of glue between your cores and the battens; nail them down with 1½ in. nails. If you now go on alternately altering the lengths by placing a 12 ft. length alongside the 6 ft., and a 6 ft. by the side of your 12 ft., each time you will see that you break the joint (see Fig. 5). When you have got all your lengths together, you will find that the roller will be an 18 ft. one. You might extend it to 20 ft. or 22 ft., but it would not be advisable to go beyond that. Get it now on your bench or two tables, solid. As you have to plane off your eight corners to get it as round as possible, always remember, when nailing, to have your nails in the centre of your battens, or you will not be able to plane it round, let alone spoiling the plane. When you have worked it round and "smoothly" as you can get it, make some strips of canvas, about 2 in. wide and 6 ft. long. Commence at one end of your roller by first well gluing it all round for about 18 in.; take a strip of canvas, hold it slanting ways, and roll it round, just allowing the canvas to touch the edge of each turn. When you have got as far as you have glued, go on the same as before; and when you have finished, well rub down with a wet rag, the same way as explained in the making of "Profile" (see No. 140, Vol. III.).

Now for roller No. 3. This may be made to any size or length. Columns are made in the same way for large buildings on the stage, either interior or exterior, which must be light in structure, one man often having to carry one on and off the stage, where the scene has to be shifted quickly. The first thing is to prepare the cores, the diameter varying according to the size of your tumbler or roller. They are made of elm or beech.

*The way to get Roller out.* — You must not have the piece of wood less than 1 in. thick. We will suppose the roller to be 9 in. in diameter. Square out a piece of 9½ in. with your compasses, strike a circle 9 in. in diameter, and saw this all round: this is the solid disc or core. Should the laths or battens you are using to make the skeleton of (see Fig. 6) be 1 in. square, strike another circle on the core, 1 in. from the edge (see Fig. 7). Now divide the core into as many parts as you intend the skeleton should be made—that is, as many battens as you intend should form the circle to carry the outer skin or covering of profile. Now at the corner of each square, bore a hole either with gimlet or centre-piece, large enough to receive your profile saw (see Fig. 7). Cut out all the squares. These square-cut holes, as you no doubt see by this time, are to receive the inch square battens (see dotted lines, Fig. 6). You will want a core about every two or three feet, according to the size of the roller you are making. When you have ascertained that, and made them all, you commence putting your roller together. You must divide your battens, as explained in Fig. 5, in the making of roller No. 2; and where they join, dovetail them together (bevel on B, Fig. 4).

Fig. 8 represents the core when cut and finished. The square hole in the centre is for the purpose of a batten passing through the whole of the cores. In fitting the battens into the cores, use your glue brush, putting a fine inch and a half nail through the battens to the core (A, Fig. 6). We will now suppose the skeleton complete, and ready for the outer covering of profile. The profile

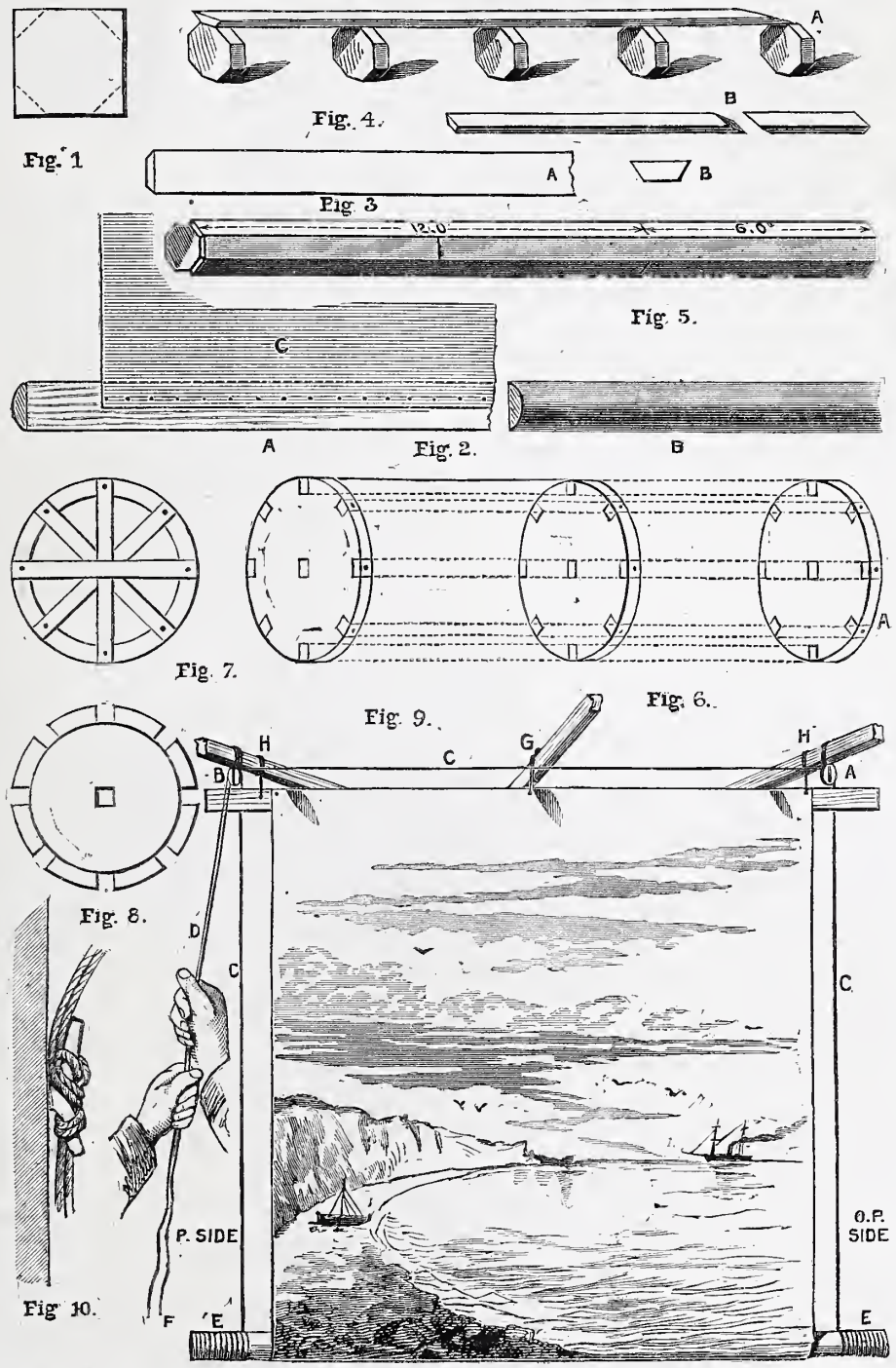



**Fig. 1.—Mode of shaping Octagonal Block. Fig. 2.—Rounded Roller cut in two, with Cloth (C) tacked on Part A before replacing Part B. Fig. 3.—Lath with Edges bevelled to fit on Side of Octagonal Block. Fig. 4.—Lath with End bevelled at A for Overlap by next Lath, as at B, nailed along Series of Octagonal Blocks. Fig. 5.—Laths tacked to Blocks so as to break Joints. Fig. 6.—Skeleton View of Large Circular Roller. Fig. 7.—End, etc., formed by nailing Laths to Ring. Fig. 8.—Disc notched to receive Laths. Fig. 9.—Method of Roping a Roller. Fig. 10.—Cleat for securing Rope.**

boards are laid on, and bent round to the skeleton. To do this, you must lay the board flat on your bench, and make a chalk line, about 2 in. apart—that is, divide the board its whole length, commencing 2 in. from either side. A 9 in. board might have four lines. Take your tenon saw and cut about half through the board, covering the whole of the lines. You will see now that you can bend the boards round easy enough. Have a good straight-edge to your boards, so that they may butt well together. Mark your first board where the cores are, so that you may know well where to nail to in the finishing. Should the profile boards be stout, you must have more cuts in them, or the roller would not be round. You may cover the joins of the profile with a strip of canvas, well rubbed down.

*How to Rove a Roller.*—To the amateur this is a difficult thing to do. We will suppose you were about fixing a cloth 18 ft. wide and 20 ft. high to the rafters. Forty-eight yards of rope would be required, one double and one single block. Fig. 9, A, is the single block; B the double block; C, C, C are the ropes attached to the roller running through the blocks to the hands at D, which part we call the fall, because as you haul the scene or cloth up, the ropes pass through the hands and it falls to the ground. When the cloth is right up, the ropes are fastened off on a belaying-pin or cleat (see Fig. 10), fixed to any convenient spot opposite the cloth, and clear of the head. It is usual to have them arranged in a row, where two or more cloths are hung together. The rope is attached to the roller either by a staple driven in the end of the roller at E E, the rope being passed through, and a firm knot tied in the end to prevent its slipping through, or the ends are nailed with clout nails, about 1 in. When the rope is fixed, it must be passed round the front of the roller, so that the part C is always at the back. We have the rope forty-eight yards long. First fasten at E, O.P. side; pass the other end through the single block, A, taking it through the back sheaf of the double block, B; then pass the end through the front sheaf of block B, and fasten it on the roller, E, P. side. Put about fourteen turns round the roller at each end, pull up, and when it goes all right, having two turns on the roller when it is up, roll up and down two or three times. To make sure, you may cut the rope at F, which will keep the coiling out of the ropes, allowing it to work right. G is the centre deadline, helping to keep the cloth straight, and free from bagginess. H, H are the two side deadlines. By the term "deadlines" is meant all lines that are fixed and do not work.

To the reader who may not know, I will explain what a profile saw is. You purchase the handle, which has two screws in it to hold the saw, and insert a saw blade at pleasure. The saws are very narrow, after the style of a keyhole saw, or compass saw, and cost about 3d. each. Of course, the handle will last for years; it costs about 2s.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### Work Involving Curved Lines.

Hitherto we have considered work with straight lines only, except the stuck or added decoration of mouldings.

We will now try to combine curved lines with the straight ones. The simplest form of curved surfaces presents itself in those cases where the larger surfaces are flat, but the edges are cut in various curved lines. Many examples can be seen in legs of forms and stools, wrought barge-boards, finials, ornaments for staircases, pierced and shaped balusters, canopy boards, the shaped legs of console tables, etc.

However these are cut when large numbers are required, the amateur will cut those he wants with either the bow saw or a compass saw. Now, the use of the bow saw depends on one very simple condition, which, however, is not easy to obey. The saw should be held so that its blade is at right angles to the board being cut. It is difficult to explain how this can be done, but consideration will prove that it is, and must be, the condition of accurate sawing. It may be needful to use the saw somewhat higher than is usual in wood fixed in the bench-screw, but some little practice will soon show the way, if the practice is combined with an effort to do the best, and a knowledge of the conditions to be observed. Sometimes it is difficult to see the line, because the saw is in the line of vision. In that case, shift the position of the wood. The cleaning-off of these curved edges will be done with a spokeshave, which should be kept sharp, and used with a constant reference to the most favourable way of the grain. Whenever any roughness or tearing results from the use of the spokeshave, reverse the action, and better work may be expected. For large curves, a compass-plane may be procured, but amateurs will not generally need it. Other curved work likely to be required by an amateur include shaped mouldings for the ornamenting of cabinets. In such cases it will be best to cut out the outline as above, making the joints either in a vertical or a horizontal plane, as may be required, and, by the aid of a template, cut to the profile of the moulding; carve it with chisels and gouges, using the chisels first to obtain the members which chisels can form; then those that need a gouge—hollow curves; then chisels to melt the hollows, where needed, into rounds; finally using scrapers made to suit the whole or part of the moulding, according to the size required. Many curved forms are made of thin wood bent round a strong-shaped mould. These offer a difficulty that is more one of method than of workmanship. Curved work is sometimes—indeed, I may say frequently—built up of pieces of segmental form, but this chiefly occurs in pattern-making, which is rather out of the amateur's province.

Thus in making a semi-circular heading, say to a wooden garden arch, or the arched entrance to a trellised porch, the amateur will find it convenient possibly to form it out of three thicknesses of wood, put together as segments of circles instead of sawing it out of the solid.

Mouldings can often be bent round curved edges, sometimes without, but often with the aid of sawing. This sawing is needful only when the curve is of small radius, or the moulding is thick. Instances can often be seen in staircases, on the edge of the skirting next the wall, and particularly in the case of winding stairs. When these saw-kerfs are necessary, glue should also be used, as well as fine nails or brads.

I do not think I have said that the spokeshave must be sharpened entirely on the inner edge, which is inconvenient but obligatory—inconvenient because of the two tangs which hold the blade in the handle; obligatory because the flat outer side of the blade forms the guiding surface of the tool, and therefore should not have its accuracy diminished by the use of the oilstone.

## OUR GUIDE TO GOOD THINGS.

*** Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 115.—Manual Instruction in Wood.

The work before me purports to be "A First Year's Course of Manual Instruction in Wood," arranged for the use of teachers and pupils of elementary schools, by Joseph H. Judd, Member of the Institution of Mechanical Engineers (M.Inst.M.E.), and Head Master of the Brighton Technical and Manual Instruction School. It is illustrated with numerous engravings of tools and technical procedure in wood-working, and contains a useful appendix in the form of "Lecture Notes on Soft Woods in Common Use."

A glance through this pamphlet, which, I think, would have been better and more comfortable to handle had it been produced in ordinary book form and not in the shape of a small, oblong drawing-book, is certainly all that its author claims for it, and may be regarded as carrying out the principle embodied in it, and its general aim and scope—namely, that of a first year's course in wood-working—in a most satisfactory and efficient manner, and is none too much for any conscientious and intelligent student to accomplish in the first twelve months of his training, provided that he has the will and time to obtain sufficient practice in each lesson before he proceeds to that which immediately succeeds it. The exercises, so called, are twenty-four in number, and the first deals with the use of the two-foot rule for drawing and marking off material. The exercises, it should be said, are mostly in three parts—namely, (1) Introduction; (2) Description of Tools; and (3) Instructions. Exercises 2 to 6 inclusive are devoted to "sawing to a line" (along the grain), and the use of various tools that are chiefly used by the beginner, thus making him acquainted with the nature and uses of the tools he has to deal with, and what is to be done by their aid. The remainder of the exercises, from No. 7 to No. 24, is devoted to a consideration of the various modes of jointing, and includes many that may never have been heard of by some of our amateur wood-workers, and which have certainly not yet been touched on in the pages of WORK. For the benefit of my readers I will append a list of these exercises, so that if any of them are unknown to them, they may supply themselves with the book itself, which is published by the author at the Technical School, York Place, Brighton, and is sent by him post free to any address for 1s. To return to the joints described, they are: simple halving joint; dovetail halving (first method); half-lap joint; dovetail halving (second method); notching; cogging joint; bridle joint; stop bridle; oblique bridle; simple mortise and tenon; haunched mortise and tenon; oblique mortise and tenon; tuck tenon; bevel and mitre joints; and rebated and stop-chamfered frame with combination bridle and mitre joints. The method adopted in describing each mode of jointing is particularly good, and runs in this manner: Firstly, the application of the joint is shown, and the purposes for which it is adapted, and the uses to which it is put in practical work; then instructions for making the joint itself are given in due order, enumerating the various steps to be taken in due order from the beginning of the work to its finish. Thirdly, an equally useful step is taken in recapitulating these operations very briefly in due order of procedure, so as to give, as it were, a bird's-eye view of the whole in tabulated form; and lastly, a list is given of the various tools required and used in the construction of the joint under consideration. Mr. Judd's book is undoubtedly a good one. The Editor.

# SHOP:

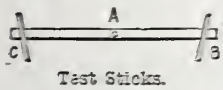
## A CORNER FOR THOSE WHO WANT TO TALK IT.

**** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

### I.—LETTERS FROM CORRESPONDENTS.

**Short Lessons in Wood-working.**—J. C. K. (*London, N.W.*) writes:—"In column 2, line 15, p. 567, No. 140, Mr. Baxter says, 'See that these are parallel.' The pieces or their position when placed in relation to each other? 'These pieces are to be placed across the work, one at each end,' etc., as below probably. If placed by hazard a little oblique to right angles to piece A, the 'winding sticks,' C, B, may show truth, yet A may be 'winding.' How about the middle of A at o? this must be tested as well as the ends."—[The words "see that they are parallel" refers to the winding strips. If my polite critic reads the sentences before the words quoted, he will, I hope, understand. I may be allowed to humbly point out that the effort to plane two pieces so as to agree is advised, and precedes the mention of the winding sticks in my paper. J. C. K. may be informed that it is just possible that two surfaces agree, and yet neither be perfectly flat. The winding sticks are introduced as another step in the beginner's effort to attain the mastery of the plane. "The pieces are to be placed across the work at each end." J. C. K. may, if he chooses, use a try-square to test the exactitude of the position of the winding strips; then when he views them they will not appear foreshortened, and the test will be *slightly* more decisive, but the accidental deviation from a correct position will not matter to the young beginner. I take the word *across* to mean roughly at something near right angles, or to include such a meaning. J. C. K. ought to have read the whole of the short lesson, and he would have found—"When some facility has been obtained, the blade of a 12 in. square or a straight-edge should be employed to test the accuracy or the want of it." I think this is sufficient for a beginner, if not for a critic.—B. A. B.]



Test Sticks.

**Spots for Emigrants.**—DISGUSTED writes:—"For some time past I have been turning over in my mind whether I should not resort to emigration with the view to obtaining more regular work and better wages than are open to me in the old country. My chief difficulty is where to go to, and it has occurred to me that much service might be rendered to many similarly placed to myself were you to open your 'Shop' columns occasionally to a few suggestions from your readers who either are already or who have been abroad, and can speak with authority on the requirements for, and prospects of, the districts they know about. The labour market of England is overstocked, and I can do better out of it, if I can get my WORK."—[If you are disgusted with the old country, you ought to emigrate, but be sure and continue your allegiance to WORK wherever you are. We shall be very pleased to have the views of our home and many foreign readers about the best spots for emigrants.—ED.]

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Harmonium Reeds.**—GAMMA.—From what you tell us, there is nothing to be done but to put new reeds to the instrument. The old ones are evidently worn out, and do not offer that resistance to the air necessary to produce the sharp tone you require.—G.

**Ornamental Carved Stools.**—J. W. B. (*Huddersfield*).—Try an advertisement in WORK.

**Graining and Marbling.**—E. S. C. (*Gravesend*).—Your letter has been dealt with by our specialist. In case you have missed it, the name of W. Kirby, 46, Clipstone Street, Great Portland Street, London, is known to us as a good grainer and marbler. You had better question him yourself as to whether he teaches the art.

**Drinking Flask.**—J. J. (*Trealaw*).—We cannot give the maker of this a free advertisement in WORK by quoting his address. Any stamped letter shall be forwarded.

**Camphor Black.**—WORKITE.—Camphor black is not mentioned in the leading colourmen's lists in London. It was doubtless derived from a French or American list as a term to signify superior black pigment. To kill the yellow tinge in clay blue, not black, is used to be most effective.—J. C. K.

**Softening Dressed Rabbit Skins.**—ALLEN.—You can render them soft by rubbing. If, as you say, they are now so hard as to be liable to crack, you can make them more mellow by first rolling in a damp cloth. Draw them backwards and forwards over a blunt metal edge, such as a door scraper or through the handle of a drawer. The softening may be helped by working some mellowing substance into the skin, such as soft soap, grease, or oil. Kid skins are softened for glove making by saturating with yolk of egg, and then drawing them to and fro over a blunt knife. The skins brought from South Africa owe their exquisite softness entirely to patient rubbing between the hands of native women. You propose buying the back numbers of WORK. In them you will find information on this subject in various places, notably in Vol. II., pp. 294 and 330 (Nos. 70 and 104).—M. M.

**Pantograph.**—G. H. (*London, W.*).—A description of this appeared in WORK, No. 42.

**An Artist's Studio Easel.**—D. S. R. (*Cambuslang*).—This subject was treated in No. 142 of WORK.

**Window Frame.**—LEARNER.—Window-frame making has been treated in WORK, Nos. 125 and 129. Buy the numbers of your bookseller.

**Battery for Medical Coil.**—C. B. (*Old Street*).—The exciting paste in your dry battery was probably a paste of sulphate of mercury. If you clean the zinc and carbon rods and the cell, and recharge it with this paste on blotting-paper, the battery may be restored and put in working order. The Electric Stores Co., Cannon Street, E.C., have now some good things in the way of dry batteries, some of which are very small and powerful, and would, I think, just suit your small coil. I am glad to hear of your success with electric bells made from directions given in WORK, and also your achievement with a coil made from bits of information picked up in "Shop." You will be interested in knowing that something better in the way of coils is in the Editor's hands. The superiority of the pictures in WORK over those of some other journals is due to the fact that Messrs. Cassell & Co. have an art department, employing skilled artists and engravers, who work up authors' rough drawings into a presentable form before they are published in WORK. The journal you name merely transfers a copy of a rough sketch to a zinc plate, and prints a *facsimile* of a contributor's rough drawing, hence the scrawls of which you complain.—G. E. B.

**Electric Belts.**—C. V. (*Bristol*).—I think the flexible wire cords should be soldered to the insides of the zinc discs. If put on the outsides, they would, as you remark, be liable to chafe the skin, and this must be avoided by all means. It would be an advantage to have two or three rows of discs in the width of a belt, but the discs should be small to avoid overweight of the belt. The number of discs is immaterial—about a dozen in a row, divided into four sections of three in each section, would be enough. Connect them by flexible wire cord, not by wires only. A great interest is being taken in this subject just now, and several persons have written to tell of the benefit they have derived from wearing these belts.—G. E. B.

**Medical Battery.**—J. R. (*Glasgow*).—I suspect you mean a medical coil, although you have asked for a medical battery. Any galvanic battery will serve as a medical battery if you have cells enough in series to generate the necessary pressure or E.M.F. to send the current through a body. This may be done with a small medical coil and one cell of a battery, so I suspect you want a coil. I have not space at my command here to describe one, but there is a series of articles on the subject in the Editor's hands, and a full description of such a coil appears therein.—G. E. B.

**Electric Belt.**—N. S. (*Cambridge*).—So many different electric belts have been and are advertised that I am unable to say how the belt is made to which you refer, as you only give the price of the belt as a clue for my guidance. I have seen several methods of making these belts, and all agree in the material employed for the couples. These are discs, plates, or strips of zinc opposed to discs, plates, or strips of copper. Discs of metal from the size of a penny to that of a crown are generally employed in preference to plates or strips. In some belts the two discs are riveted together through the belt, with the zinc discs inside. In another form they are linked together by links passing through the belt. In another, the row of copper discs on the outside is made to overlap the edges of the zinc discs inside, and the two are connected by clasps on opposite edges. In some the rows run up and down across the width of the belt; in others the discs form parallel rows running the length of the belt; in others the rows are grouped as shown in your sketch. When grouped as shown in your sketch, the generated current will not pass around the body. The zinc discs must be inside next a flannel protection, and separated from the copper discs by thin flannel. The zinc of one couple must be connected to the copper of the next, and this is done by means of flexible wire cord soldered to the discs. There has been much about these belts in the third volume of WORK. Kindly get the index about to be published and search for yourself.—G. E. B.

**Coupling Transformers.**—NED.—As you have a spare transformer of the "same size and make" as that now in use, your course is quite clear. Couple the two transformers in parallel, and take current from both for your incandescent lamps. There need be no fear of burning anything up, as transformers of the "same size and make" are destined to run in parallel, and, therefore, do not differ in the direction of the winding. If you cannot determine how a transformer is wound by examining the wires and connections, you may do so by noting the direction of the induced current. If this differs from that of its companion, then it is probably wound in an opposite direction, always presuming that you connect both to the source of current by the right terminals. If you find the current from the second transformer going in the wrong direction, alter the connections and send the direct current from the dynamo in the opposite direction. But if you are going to supply current to a new set of lamps in another circuit, the direction of the induced current need not be taken into consideration, since incandescent lamps will burn equally well when the current is sent through them in either direction. There will be no difficulty whatever in connecting the voltmeter to them by means of branch circuits controlled by switches. Merely put in a looped circuit as for an extra lamp, and have a switch in the circuit in the ordinary way. The pressure will be the same in all branches of the same circuit.—G. E. B.

**Enamelling Electro-Plate.**—E. A. (*Sheffield*).—I think you must mean lacquering electro-plated articles, not enamelling, since the process of enamelling proper would injure the electro-plated surface. Electro-plated surfaces are protected from injury by giving them a coat of transparent lacquer. This may be tinted with aniline dye to any colour, and the coat will then resemble enamel. I have found the transparent lacquer named Kristaline, sold by Messrs. J. E. Hartley & Sons, a very good lacquer for the purpose. It may be applied with a soft varnish brush on the previously warmed electro-plated goods, or these may be dipped in the lacquer, then hung up in a dust-proof closet, heated to 90° Fahr., to drain and dry. Electro-plate thus protected is almost untarnishable and may be exposed to the fumes of gas or damp sea air without "going off colour."—G. E. B.

**Recharging Electric Bell Battery.**—OLD BOAT.—From your description of the battery I infer it to be a Leclanché battery. The inner cells are of porous earthenware, filled with a mixture of manganese and carbon peboles packed closely around a central plate of carbon. The glass cells are to be charged with a saturated solution of sal-ammoniac—that is, as much sal-ammoniac as will dissolve in enough rain-water to nearly fill the cells. This will take nearly ½ lb. of sal-ammoniac, and will cost about 6d. First fill up the jars with warm water, and add about a tablespoonful of spirits of salts to each. Allow the porous cells and zincs to soak in this for half an hour, then brush them with a hard brush, and rinse in clean warm water. Clean the screws with emery-cloth, and clean the ends of the wires from the zincs, so as to have clean wires clipped by clean screws. Connect the zinc in one cell to the screw of the carbon in the next cell, and connect the zinc of this cell to the bell wire. The other bell wire will go to the carbon in the other cell. Charge the cells to within 1 in. of their tops with the mixture of sal-ammoniac and water mentioned above. The stuff may be got from a druggist, or a drysalter, or an oil-and-colour shop.—G. E. B.

**Consumption of Steam.**—G. B. (*Armadale Station*).—We are unable to give our correspondent the information he seeks, inasmuch as he does not furnish us with the two most important points needed to enable us to ascertain the facts, and these are—first, how far the steam is allowed to follow the piston in the cylinder before it is shut off from the boiler—*i.e.*, what is technically termed the point of cut-off; and next the number of strokes per minute in the single-acting engine, and the number of revolutions per minute in the other, and whether there are one or two cylinders to this engine. When we have these particulars, we shall be happy to settle the question.—C. E.

**Compressed Air Engines.**—SIMPLE FIDELLS.—It is only for special purposes, where a very light motor is required, or work done in places difficult of access—as in mines and tunnels—that compressed air can be recommended for conveying power. The original power is supplied by an air compressor, and the air becomes heated when compressed; the heat thus generated, in part or entirely, passes away in waste by radiation. You can no doubt compress air by a windmill working air compressors, but it would be far more economical to store the power by pumping water into an accumulator and drive your lathe or other machine by an ordinary hydraulic engine. An air compressor for high pressure is not easy of construction except by a specialist. On this subject I think you might get information from Messrs. John Fowler & Co., Leeds. For particulars of hydraulic engines you might apply to Messrs. Tangye & Co., Birmingham.—F. C.

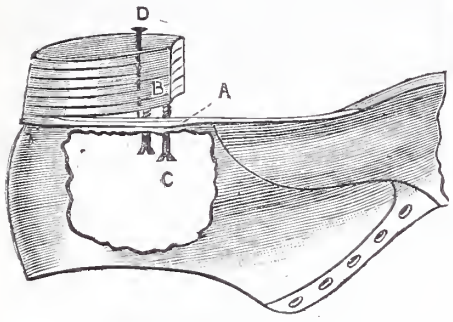
**Roller for Mangle.**—AMATEUR TURNER.—Any wood turner would supply you with this; or write to any maker of mangles—Kant & Co., High Holborn, London, or Harper Twelvetrees, Finsbury Square, London.

**Lathe Wheel.**—GAMMA.—Your best plan would be to sell the weights, and buy a metal wheel with the proceeds. I sometimes get cast-iron mowing-machine wheels for 1s. or 1s. 6d. If you had a small wooden cart-wheel, you could weight its rim by boring holes at intervals and pouring melted lead in. Whether you could beat the clock-weights into shape depends upon their present form, but probably not. It would be much easier to melt the lead and cast it in a mould.—SELF-HELPER.

**Hand Saw.**—DOBBS.—Your question in reference to grinding a hand saw at home rather surprises me, as the simplest form of grinding machine would

cost a deal more than a good hand saw; therefore it would not pay you to erect such a machine merely to grind one saw. It would be far better for you to purchase a saw of the thickness you require. A saw may be ground thinner by placing it between two grindstones, each stone revolved in an opposite direction, the stones being revolved by toothed wheels. But even such a simple device would cost you more than several new hand saws; and after the saw had been ground it would require glazing to give it a fine surface. This would add to the cost. My advice to you is to abandon the idea of grinding your hand saw thinner.—A. R.

**Repairing Heels.**—J. B. (*Dalton-in-Furness*).—By what I can glean from your question I see no reason why you should take the heel down and rebuild it. It is not quite your fault, for it should not have given way there unless you knocked it about without regarding it as a shoe. But the best thing to do now is to bore two holes, each large enough to admit of a screw passing through, as at A in the




Heel-Repairing Diagram.

figure, and then make two small holes at B, just as a lead for the screws, which can be about ¾ in. or 1 in. long. Now screw the two well into the heel from the inside, as at C; then put it on the iron foot, and drive a long French nail in from the top just behind the screws, as at D, and I think you will then find the heel as solid as it was at first. Perhaps you may, by putting in another screw, be able to dispense with the nail. If so, so much the better, as nothing can then be seen of the job from the outside.—W. G.

**Repairing Shoes.**—J. B. (*Dalton-in-Furness*).—You say you have soled a pair of shoes, and when you were taking off the old sole the under one came away. This being so, you should not have soled it until you had first repaired the damage you had done, which should have been rectified in the following manner:—If you are repairing on an iron last, or an iron-bottom last, hammer the middle sole (the under one) back into its place, first taking out all the old nails; then, supposing the line A A in the figure to be the place where the rivets will pass through the middle sole when you have put the sole on, put a few short rivets or long tingles, according to the sub-

Sole-Repairing Diagram.

stance of the bottom, in through the line B B. These dots show pretty well where the tingles should be put. They should only just be long enough to clench on the bottom of the last. If you are repairing on wooden lasts, when this is being done you must take them off and slip them on the iron foot to clench them, for they must be clenched before the new sole is put on. When you are putting the new sole on and patting in the rivets, put an extra long one in here and there, say an inch apart, and these just long enough to clench through the whole—that is, the new sole, middle sole, tops, inner sole, etc. The long rivets should be brass, so that when the shoe is soled again these will draw out with the thin old sole, and not disturb the middle sole again in so doing.—W. G.

**WORK in the Antipodes.**—REV. E. C. I. (*Kyneton, Australia*).—Glad to hear that WORK reaches you so promptly. As to your promising wood-carving pupil, Brocket, you cannot do better than write to Mr. G. A. Rogers, Wood-Carving School, Maddox Street, London, or Mr. Hemms (wood carver), of Exeter, England. We shall be very pleased to see the specimens of the work done at your school.—ED.

**Power of Model Engine, etc.**—A. H. (*Bridgeton*).—The power of your engine you can reckon yourself if you will read the explanation on p. 24 of the present volume. I cannot put it any plainer. The area of 1¼ in. is 1·2 sq. in., and the area of 1½ in. is 1·76. Say you have 50 lb. pressure in boiler and an average of 40 lb. per square inch on the piston:—Area of 1¼ piston=1·2 sq. in.; area of 1½ piston=1·767 sq. in.; 1·2 × 40 = 48 lb. on 1¼ piston; 1·767 × 40 = 70·68 lb. on 1½ piston. Now for speed, you can take 200 revolutions; piston moves 5 in. at each revolution, and 5 × 200 = 1,000 in. = 83 ft. per minute moved by piston; 83 × 48 lb. = 3,984 foot-lb.; 83 × 70 lb. = 5,810 foot-lb. Thus 1¼ diameter may give one-man power, and 1½ diameter half as much again.

**Hot-Air Engine.**—F. F. (*Homeland, Polk County, Florida, U.S.A.*).—Your letter has been forwarded.

**Barometer.**—W. B. R. (*Westbury*).—It is not possible, by the method you suggest, to construct a barometer using either glycerine or any other liquid except mercury. The diameter of the tube does not in any way enter into the question. The same height of column would be required whether the tube were $\frac{1}{100}$ in. or 100 ft. bore. As the specific gravity of pure glycerine is about 1·2, the length of the tube must be at least 30 ft. Of course this is out of the question for an amateur. In order to make a satisfactory mercury barometer, so many precautions have to be taken that I should advise W. B. R. to either refrain from attempting the manufacture of one or else to purchase one direct from the makers, who have every facility for the process.—J. G. L.

**Nozzle for Water Motor.**—R. R. T. (*Frome*).—If you have a supply pipe running full, there is no reason why you should not use a nozzle ¾ in. diameter. It would be an advantage to make the floats concave towards the jet, so that its pressure may be always normal. The running would certainly be improved by the introduction of a fly-wheel. You do not mention the length of pipe through which the water flows, so it is not easy to determine the power; but if you have a pressure of 150 feet, and only a short delivery pipe, the discharge through a ¾ in. adjutage will be about 90 gallons per minute: so the work done by the water would be 90 × 10 lbs. per gall. × 150 ft. fall = 135,000 foot-lbs. per minute. The form of motor used might give an efficiency of 33 per cent., or 45,000 foot-lbs. per minute. The corresponding horse-power is 45,000 ÷ 33,000 = 1·37 h.-p. nearly.—F. C.

**Wire Gongs.**—VERY ANXIOUS.—Of the making of these I have had no chance of observation or knowledge. Therefore, rather than lead you astray, I will ask those readers who possess the information to respond as promptly and generously as did those who replied to a query concerning mole-traps, which was as equally a puzzle to me. A set of deep-sounding chimes as fitted to American clocks is what particulars are desired of.—J. S.

**Venetian Iron-work.**—T. M. M. (*Bristol*).—As far as I know, W. Whiteley, Westbourne Grove, W., is the only firm which keeps in stock the iron strips used for Venetian iron-work. At the builders' counter in the ironmongery department of this business, you can obtain everything connected with this style of work. The strips are to be got ½ in., ⅝ in., and ¾ in. in width—any other width to order—and they are 18 in. or 24 in. in length. They are sold by weight, the price being 10d. per lb. The necessary tools can also be got there; those sufficient for beginners can be purchased for some few shillings. They consist of one pair of flat snips, one pair of 4½ in. flat-nose pliers, one pair of 5 in. flat-nose pliers, one pair of 4½ in. round-nose pliers, and one pair of 5 in. round-nose pliers. Iron wire for attaching is 8d. per lb. I feel quite sure that if you write to this firm, they will forward you all the materials necessary for your work. If you should, after all, prefer to buy the goods personally, I think you can order the strips from any ironmonger's, but it will always take some few days before you will get them. The strips are mainly cut from large sheets of iron in "24-wire gauge quality," as the technical term is: each sheet is 6 ft. by 2 ft., and the weight is about 12 lb. As you will see, there can be cut two gross of strips, ½ in. wide, 24 in. long, out of one sheet, the price thus being ½d. for each strip. The black used for iron-work is Berlin black; it is kept by all ironmongers; it is to be applied after the work is finished, usually in one, sometimes in two, coats.—J. N.

**Weather-Glass Tube.**—BAROMETER, YOUNG AMATEUR, and OTHERS.—The reason for using such a long tube is twofold. (1) If a short length of tube, say 3 ft., be used, there is always a liability of an overflow when the barometer is unusually low (*high*, of course, in the glycerine barometer). (2) I gave 4 ft. as the length of tube, as this is a usual size; and by using this size a little latitude in the size of the bottle is allowed. One correspondent states that he cannot get the glycerine to rise more than 12 in. In reply, I may say that if this happened with an instrument made according to my instructions, the reason will probably be found in one of two things: either the barometer (mercury) was unusually high—and hence the air in the bottle was unusually compressed—or, as I think more probable, some mistake has been made in the construction: possibly in the size of the bottle. In reply to those correspondents who ask where glass tubes may be purchased, I may say, as I have already said, of any scientific instrument dealer, or, in default of these, Reynolds & Branson, Commercial Street, Leeds, or Messrs. Philip Harris & Co., Bull Ring, Birmingham.—H. L.

**Incubator.**—F. H. (*Finchley*).—It is a matter of choice whether evaporating tray should be fixed to centre frames or not. It is not absolutely necessary, but if desired it can be so fixed by a couple of lugs or ears soldered to bottom of tray. As the lamp flue forms part of the evaporating tray, it must be fixed to it with hard solder, as stated in the article. The radiating disc need not be fixed. It is better if loose and laid between the arms of tripod, which should be shaped as Fig. 1 herewith, and which should grip the disc tightly. The lines in drawings on p. 609 are somewhat blurred and do not show this clearly. There is no sheet of metal over centre frames, as is clearly shown by reference to Fig. 3, p. 609. How is regulator to be fixed? This is a matter I quite overlooked. It should be fixed with a small metal strap, as shown by Fig. 2 herewith, the straight parts being slotted to slip over screws (round-headed) inserted in centre frames for the

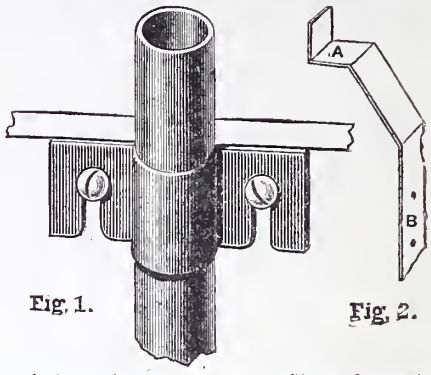



Fig. 1. Fig. 2.

**Incubator. Fig. 1.—Clip or Strap for fixing Regulator Tube. Fig. 2.—Arm of Tripod Head to Lamp Flue—A, Flat Portion for Disc to rest on; B, Rivet Holes.**

purpose. The hole in perforated zinc will fix the short limb. If the strap does not quite fit the long limb, a chip of wood pushed in behind the glass will make all secure. The float or plunger may be turned out of bone or ivory, or may be a cork nicely fitted, but if the latter is used, take care it does not get wet, or it will swell and bend in the tube. The former is the best, and it should be about ¾ in. long, and fit the tube without any play. P.S.—In reply to your second letter, please allow us breathing time. There is great pressure on "Shop," and each reply has to take its turn. Were it not so, it is a little unreasonable to expect an answer within a week, and in your case a diagram has to be drawn and engraved. Other correspondents please note.—LEGHORN.

**Microscopes.**—CANTAB has asked three very definite questions:—(1) "A short description how to mount object glass for microscope?" If you are purposing to use a good object-glass, I advise you to buy it mounted in its cell, and do not attempt to mount a good one yourself, as they are costly things. There will be a thread chased on the cell; a corresponding thread must be chased in the nose-piece. Supposing, however, you intend to experiment with a low-price lens, it might be worth your while to mount it. Fig. 1 is perhaps the simplest plan. A little cell is made to take the lens, which screws on to the nose-piece. Fig. 2 is a better plan, but more difficult, perhaps. (2) "The difference between the eye-pieces known as A, B, C?" The

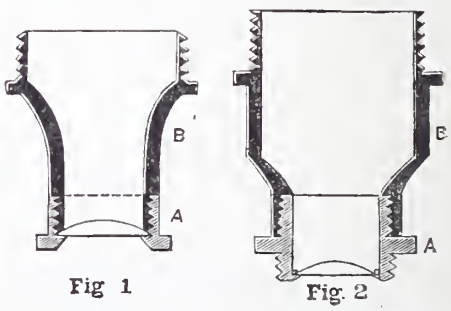



Fig 1 Fig. 2

**Microscopic Object-Glasses. Fig. 1.—A, Cell containing Lens; B, Nose-Piece screwed into Cell, retaining it in its place. Fig. 2.—A, Cell with the Lens bezelled; B, Projecting End of Cell carries a thread to carry a doublet or treblet.**

difference is simply one of magnifying power. There is no absolute measurement, as the power of an eye-piece all depends on the length of the power tube. The difference is only relatively. The optician who supplies you with the lens would, if desired, supply different powers. (3) "When may we expect the promised article on Eye-pieces?" In this matter I can only say the Editor is supreme, and he alone knows. Many others have asked the same question. I have no doubt at the proper time it will be forthcoming. I am pleased to know you are working from my design. I have heard from several correspondents who have done so, and it has gratified me to learn that they have succeeded, and are pleased with the results.—O. B.

**Amateur Mechanical Dentistry.**—S. E. (*Camberwell*).—First as to taking the impression and procuring model. To replace natural teeth that have been extracted with artificial teeth, supposing time has been allowed for the gums to heal, the mode of procedure would he thus:—Procure a variety of impression trays, also composition and pure beeswax, to be obtained at the dental depôts. Having found a tray to fit the mouth accurately, whether it be for upper or lower, you take a portion of composition or wax and soften it by placing in hot water. Be careful not to put any more composition in the tray than you want for your impression. When it has become sufficiently soft, take it and knead it well in the palm of the hand, after which, while it is soft, you shape it to fit the tray; and having placed it round the tray, you convey to the mouth of patient. If for the upper, you press well up, for the lower well down, taking great care that your tray is quite square and level in the mouth. Hold it in this position till the composition has become hard; then be very careful in withdrawing it, which must be done by raising the tray slightly by the handle, to allow air to find its way at the back of the palate, when it can he readily withdrawn. This requires great care, otherwise it will drag and give a false impression. In taking this impression it is necessary that it should be correct, for what your impression is so will your work be when finished. This accuracy can only be obtained hy constant practice. Supposing our impression to be correct, we then have to get a model from it. We take plaster of Paris, tho best to bo obtained at the dental depôts, and mix with water a little thicker than the consistency of cream, taking care to mix well to avoid air bubbles. We then pour into the impression sufficient to fill the tray. The remainder that is left in the vessel is mixed quickly with an addition of plaster, and is then placed on a flat surface to about the thickness of your tray; then take your tray and turn it over, so that the plaster may unite. When it has remained so for twenty minutes, you may trim round with a knife all superfluous plaster beyond the tray. When it has become quite hard, you may take it from the board, which it will readily leave by tapping the board, and place it in hot water. Let it remain until your composition has become quite soft, take it out, and the composition will leave the model readily; then you have a correct model, providing your impression is perfect. This procedure is precisely the same for plate work, only that your model must be made deeper. Supposing our model to be correct, and we have to make a partial upper case in vulcanite, we then have to obtain a correct bite. This may be done by taking impressions of both upper and lower jaws, and obtaining models from each. We now want to put, say, five teeth in the upper jaw. We now take some composition, made soft by placing it in hot water, and stretched to the thickness you will require your vulcanite to be, and pressed well into your model, exactly where you require the vulcanite. Then take toughened wax, made so by adding gum mastic, say two ounces and a-half to one pound of beeswax, with a little whiting added, melted together, and poured on a plate or other flat surface, previously made moist, or the wax will stick. When set, take pieces and warm them and fill in places on model where you intend the artificial teeth to he, taking care that the wax adheres firmly to composition already on model, having previously shaken a little French chalk all over the model to prevent the wax sticking. In some cases bonds or clasps are required, but we take it for granted that the present case is to be kept up by suction. Now take composition and wax combined off the model, and slightly warm wax only, either over spirit-lamp or by holding in a little hot water. You place it in the patient's mouth while wax is soft, and request the patient to bite up slowly; repeat this two or three times and carefully watch your patient's mouth and see that the lips meet with the case in the mouth without any effort whatever. Being satisfied that your bite is correct, you may then remove it carefully from the mouth, taking care not to break it, and place it on the model. Then you take your lower model and place it on the upper, when you will find that the indentations made in the wax while in the mouth will correspond with the teeth on model of lower jaw. Supposing the two models fit accurately one with the other, they are retained in that position hy placing an elastic band round them both to prevent them shifting. We then mix plaster of Paris rather thick and pour on a flat surface, to about three or four inches square and about one and a-half inches thick. Having previously painted the back ends of both models over with a non-adhesive liquid, obtained at the dental depôts, to prevent adhesion, place your two models in the plaster on the board (front of mouth upwards) and allow the plaster to set, when you will be able to take them up, and with a slight tap they will separate themselves from the back. You then take away your wax and composition and obtain your artificial teeth, having taken the exact shade of your patient's teeth, and grind them to fit the gum: lathe and wheels can be obtained at dental depôts. This, also, is one of the things that requires great care and practice. Suppose we are using pin teeth, you roughen the ends of both pins and turn them outward, thus, ⅂⅃. This must be done to prevent them dragging out when in use in the patient's mouth. You then take modelling wax sufficient to fill the place of the intended vulcanite. Having warmed it, you place it on the model and press well down, when it will remain in that position. Then take your teeth and place them in the vacant spaces, at the same time watching the length of your teeth for the bite, which is seen hy placing your two models together on the back. This also is very important. You then put more modelling wax round the backs of your teeth, sufficient to obscure the pins; you then trim and smooth off with modelling tools, for what your case is in the wax so it will he when finished. Your case is now ready for packing. More anon.—DENTA.

**Covered Strings for Piano.**—T. S. (*Bognor*)—I presume some of your strings are covered with white metal and the remainder with copper. I prefer copper-covered, as they retain their tone longer than the metal, so you may have them copper-covered throughout. I would advise you to send an inch or two of the first and last covered strings as to thickness, as well as the paper pattern, and write on the pattern fifteen single and fifteen double notes. The name of the ironmonger you require is J. and J. Goddard, ironmongers, Tottenham Court Road. You could get the strings made there if you choose. The price of covered strings fluctuates with the price of copper in the market. As a rule they are 2s. 6d. per lb. If you had described your instrument I could have told you the weight you would require. If it is a modern piano, about 4 ft. high, I should say 4½ lbs. would he heavy enough.—T. E.

**Wood Imitation.**—INQUIRER.—The only school that I am aware of, at which the imitation of woods and marbles is seriously taught, in London or its environment, is the establishment at Finshury in connection with the London City Guilds. Certainly there are a few private schools—or, rather, classes held hy leading marhlers, etc., for learners—but the fees are usually very high. I believe—and I speak from some knowledge and experience—that much more can be done hy home study and practice in these matters than hy class lessons and studies. To make the former thoroughly successful, however, these things are necessary: patient determination and continuous effort on the part of the student, and a good technical guide and samples by which to work. The former you must yourself supply, or "go under"; the latter you can get, in good value for the cost, from Vol. II. of WORK, or with every possible advantage that skill and coloured patterns can give by getting the "Art of Graining" from Manchester (see advertisement in WORK).—DECORATOR.

**Keeping Brushes Moist.**—S. J. G. (*London, W.C.*).—Paint hrushes naturally get hard and useless if left exposed to the air with paint in the bristles, since the very property that causes the paint to dry causes this hardening. If the hrushes are small and used very seldom, they should have the paint rinsed out with a little turpentino or petroleum, and then carefully washed *clean* with soap in warm water; well rinse in cold water, and then set aside to dry gradually. Don't use *soda:* it ruins the bristles; and don't use *hot* water—it dissolves the cement that holds the bristles to the handle. If the brushes are used too often for washing, the paint should be well scraped out, and then the brush stood in a vessel with sufficient water to cover the bristles, but not more than that, since the string binding the brush gets rotted. Varnish brushes you must serve exactly as those used for paint, so far as washing goes; but if they are large brushes, and required often, they must he carefully stood—not jammed—in a vessel containing raw linseed oil, instead of water as with paint hrushes. Scrape water, paint, and oil well out of the brush each time it is required and done with.—F. P.

**Bamboo Canes.**—G. R. E. (*Crigglestone*).—Bamhoo canes can be purchased in small quantities, of all sizes and dimensions, and at very reasonable rates, from Messrs. Eaton & Co., who advertise in WORK. Respecting a stain for bamboo to give a walnut colour, I think the best and easiest plan would be to purchase some good hard-drying (or "Church") oak varnish. This is a copal varnish, drying in about eight hours, and is then very hard for handling. Ordinary oak varnish does not dry sufficiently hard for articles of furniture, etc. Bamboo will not take a dye like ordinary wood; the former is not nearly so absorbent. I think, if you purchase a little—threepennyworth—of *best* burnt Turkey umber, ready ground in oil, and then mix this with the above varnish (say one pint), you will get a stain and varnish combined which will work easily, give any depth of colour according to the amount of umber used, and will dry hard and glossy.—F. P.

**Tarred Wall.**—RUFUS.—The proportion of hot Russian tallow to be incorporated with limewash as a coating for walls exposed to much bad weather is more a question of economy than ounces. Although 1 lb. of tallow to the gallon of wash would he sufficient for all ordinary purposes (this would be about 3 lb. to a good bucketful), double that quantity could doubtless be advantageously used in some instances; whilst 50 per cent. less than the proportion given would he sufficient to give a good, useful body to the wash. In every case the two ingredients must be thoroughly mixed and incorporated with each other before being spread.—F. P.

**Child's Cot.**—M. M. E. (*Openshaw*).—The only way in which I think you can overcome the nuisance occasioned hy the ends of the swinging cot wearing the supporting posts away, is, unless you face the damaged posts with iron, to curve each post on the side directly presented to the end of the cot, the curve embracing the whole area aggricved and extending as close under the bearing as is possible without weakening the post. The depth of each curve must, of course, be sufficient to permit the cot to swing without any part of it or its supporting irons contacting with the posts. If the damage results only in the immediate vicinity of the parts marked D in your sketch, then a short curve only will he necessary. A gradual curve is preferable to an ahrupt one, as with the latter the posts may be somewhat weakened.—J. S.

**Inlaying with Fret Machine.**—J. T. S. (*Sheffield*).—I must say that your present question is far from clear. What do you want to know? To say "inlaying with fret machine" gives no clue. If your wish is to cut inlay with a fret machine instead of with a "donkey" (the machine identified with inlay cutting), of course you can do so, although not so neatly or comfortably. The veneer should be placed between two thicker boards during the process. I cannot say whether any book on inlay shows a "donkey," or deals with machines, but if you would like a sketch of one I would prepare one for you in these pages similar to that I have seen a professional friend use with surprising ease and accuracy. The saw works horizontally, while the further end of the frame travels in a swinging pair of supporters.—J. S.

**Lenses: How to Grind them.**—J. A. (*Wandsworth*).—It is impossible to exactly say when the papers upon the above subject will make their appearance, but they will doubtless appear as soon as a favourable opportunity occurs. You should bear in mind that it is impossible to treat everything at once, and something must wait. In the meantime, if you have any special question, it shall receive every attention.—C. A. P.

**French Grey Paint.**—A READER.—The ingredients for making about 40 lh. of best glossy paint for indoors, tinted to a French grey colour, would be, say, ¼ cwt. (28 lb.) *genuine* white lead, 3 lb. best patent dryers, about ½ gallon raw linseed oil, and 1 quart turpentine. Break up the lead and dryers with a broad stick to the consistency of a thick paste, using linseed oil. If all is to be tinted one colour, for French grey add a little ultramarine blue (so-called) and either a little Venetian red or common hlack. If you want a "warm" grey, add the red; if a cool, metallic tint, add the black. The ultramarine you can only buy in powder; well mix this with a little oil before adding it to the paint; the other colours you will easily get ready ground in oil. Respecting the economical aspect of ready-mixed *v.* hest paint, it cannot be expected that the former, sold as low as 3½d. per lb. in some parts, can he equal in value to the best white lead paint, especially as you may have to give 4d. per lb. for the *genuine* white lead. The blue powder will probably cost about 2s. 6d. per lb., and you will require at least ½ lh. of that. The liquids lower the average cost. per lb. when the quantity is all made ready for use; but when you consider the time required for making the paint, matching a particular colour, and then straining the paint through muslin or a very fine sieve, the price usually asked for such best paint—viz., 6d. per lb.—is but fair value. Eight lb. of paint for painting the wall of one room is not at all a large quantity. For first coating on new plaster, you can use nearly all linseed oil and a little dryers—very little lead. This will stop the suction of the plaster, and then with two more good coats of paint you *may* make a decent job; but, as a rule, new plaster requires four coats to get a good surface. I am afraid you will find oil paint very costly for the house throughout. For the bed- and sitting-rooms I should strongly advise you to try "Alahastine."—DECORATOR.

**Fretwork Machine.**—TYRO.—Consult the indexes to Vols. I. and II., which can be had of any bookseller, at the price of 1d. each.

**Safety Fuse for Electric Lamps.**—H. M. T. (*Cornwall*).—You may include a 25-volt, 8 c.-p. lamp in a 50-volt electric lighting circuit if you place the lamp in a branch connected with the main circuit, and insert enough resistance in the branch to balance (together with the resistance of the 8 c.-p. lamp) the resistance of the 50-volt lamps. In doing this you will not reduce the voltage of the current (that is, current pressure), but you will reduce the volume of the current passing through that branch of the circuit. Ohm's law does not teach you that you can reduce the voltage in a circuit by inserting a resistance to the current in that circuit. It teaches you that the volume of current flowing in an electric circuit is equal to the total voltage, pressure, or E.M.F., divided by the total resistance of all the conductors in that circuit, according to the formula, $C=\frac{E}{R}$. We will apply this law to your case. The 25-volt 8 c.-p. lamp will take ·96 ampère of current to properly light it, or say nearly 1 ampère in a 25-volt circuit. We will suppose its resistance, therefore, to be 25 ohms. Now, if we placed this lamp in a 50-volt circuit, the result would be for a moment, $\frac{E\ 50}{R\ 25}=C\ 2$ ampères, the next moment darkness. Now, if we insert a resistance of 25 ohms in circuit with the lamp, the result will be $\frac{E\ 50}{R\ 25+25}=C\ 1$ ampère, the voltage of the current being the same in both, but the volume of the current reduced to one-half by the extra resistance. Include a safety fuse in this resistance to protect your lamp.—G. E. B.

**Dry Plates Backed.**—M. E. (*Leicester*).—Procure some hurnt sienna, ground in water, from the colour-dealer's, and mix it with equal parts of methylated spirit and water to the consistence of thick cream. The proportions are immaterial. Add a little caramel, say 2 oz. to ½ lb. of the sienna, and ½ oz. gum arabic,

dissolved in water. The whole being thoroughly mixed, a hog-hair brush, charged with the compound, is passed over the back of the plate, painting to within about half an inch of the edges, and then kept in the dark to dry. A very small quantity of the paint is sufficient. The plates can be backed in this manner and put in the dark slides whilst wet, but if any quantity have to be done it is best to let them thoroughly dry in a warm room. Set on a shelf, face to the wall, great care being taken to prevent light getting to them. Any plate-dealer will supply backed plates to order: they are not usually kept in stock.

### III.—Questions Submitted to Readers.

**** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

**Rubbering Steel.**—A. H. (*Manningham*) will thank any reader to give him information regarding "the best method of covering a steel ring with indiarubber, *not* by vulcanising."

**Black Skin Dye.**—M. T. (*Newcastle*) writes:—"Will any reader kindly oblige with information as to what will dye a hare-skin black?"

**Paste Diamonds.**—J. H. (*Bury*) will thank any reader of Work to give him information how paste diamonds are made.

**Fender Designs.**—N. E. R. H. (*Newcastle-on-Tyne*) writes:—"Would any reader kindly tell me where I could get designs for a large fender top, say 9 in. high by 10 in. broad, and 3 ft. 15 in. long—or higher, if pillars are required? Is there anything new in patterns?"

**Screw Cutting.**—Lathe writes:—"I want to know of the best book on this subject. Replies will oblige."

**Sleigh Bells.**—A. S. (*London, E.C.*) writes:—"Can anyone tell me, through 'Shop' columns, how to alter the tone of 'sleigh' bells (metal) so as to match with others?"—[An important bell work the general method for tuning bells is by filing.—Ed.]

**Enamel.**—W. B. (*London, N.*) writes:—"I used some enamel on a brass ornament (which I previously cleaned), and applied it in a warm atmosphere, but the smell did not go off for quite three weeks, and fairly poisoned the atmosphere. Will any reader kindly say in 'Shop' what was the cause of this, and how to prevent it? I have a cruet-stand I want to apply it to, but fear the smell."

**Indiarubber.**—J. W. H. (*Brackley*) writes:—"Having a lot of old indiarubber I should like to utilise it. I should be glad if anyone could give me the current price for old indiarubber, and the best place or firm as a market."

**Marqueterie or Buhl Work.**—Subscriber A. W. writes:—"Can any of your readers give me information respecting marquetrie or buhl work?"

**Air Pump.**—H. S. M. (*Ripon*) will feel obliged to any reader who will give him information as to the Mawson & Swan air pump.

**Monuments and Tombstone Stains.**—Monumental Sculptor writes:—"I should feel greatly indebted, and I have no doubt many of my fellow-craftsmen would too, to be informed of some solution that will remove discolorations in marbles standing indoors and in the open air, and which solution would not destroy the marble."

**Electricity.**—P. L. (*Selly Oak*) writes:—"Will any reader tell me the price of a small, but good, book on electricity suitable for a beginner?"

**Softening Indiarubber and Metals.**—Ludovicus writes:—"What is used to make indiarubber soft enough to make rubber stamps? Also, which is the easiest way to soften iron or steel as soft as lead?"

**Monogram.**—B. R. (*Sandbach*) writes:—"May I ask if any reader of Work would kindly give me a monogram of the letters H. L. for painting on glass, to be seen through, and to be illuminated?"

**Oil Light.**—G. C. (*Pendleton*) writes:—"Will any reader of Work have the kindness to explain the mechanism of the Wells' oil light, or any other similar light produced from oil by the same means? Also if it could be advantageously used on a very small scale? The light alluded to is used largely among contractors and for out-door use."

**Pipe Mouthpiece Thread.**—S. M. A. D. A. (*Tunbridge Wells*) writes:—"Can any reader of 'Shop' oblige by informing me how to make the thread in amber mouthpieces for pipes? I can drill them, but not get a good thread for the screws."

**Engineering Examinations.**—Young Engineer writes:—"I would thank any reader to enlighten me as to any public competition or examinations in which an engineer student may compete, in order to lighten the cost to a poor student seeking to qualify as a C.E."

**Quarter Horse-power Gas Engine.**—T. P. B. (*Bradford*) writes: "Will any reader oblige by telling me how to make a ¼ horse-power gas engine, which would, I feel certain, be better adapted to all home workers than a steam one, as it would not require a boiler?"

**Lathe Outfit.**—Young Turner writes:—"I want to take up the lathe as a hobby, and should feel much obliged to any experienced turner if he would inform me the best kit to get, and where to purchase same. My age is nineteen."—[Young Turner should consult the advertising pages of Work.]

**Glass Cement.**—A.S. writes:—"I shall be obliged if anyone will kindly tell me of an adhesive for glass which will withstand continued wet."

**Banner and Flag Painting.**—Banner (*Wynberg, South Africa*) writes:—"Will any kind reader of Work let me know where I can get a book on flag and banner painting; also a firm for painter's materials; also books on coach painting, etc?"

**Bookcase.**—R. S. (*Chorley, Lancashire*) writes:—"Would any reader of Work kindly give me a sketch or some instructions of how to make a small portable bookcase, which would fold up and appear like a box, and not have too much work about it?"

**Microscopic Objective.**—W.S. (*Gosport*) writes:—"I have an objective mount of the usual English pattern, to which I want to put lenses for 2 in. focus. It is made for two lenses nearly together. I desire the shape of lenses, and the focal length of each, and whether one or both should be achromatic."

**Lenses.**—Scientific asks:—"Can any reader of Work tell me how to make and polish lenses, or where I can get the necessary information? Also, where could I get a good quality of glass for the above purpose?"

### IV.—Questions Answered by Correspondents.

**Wool Winder.**—M. (*Bishop Auckland*) writes, in reply to Mart (see p. 621, No. 143):—"Make a cross of two laths half lapped together, of a suitable size for the hanks of wool. Bore three or more ¼ in. holes in the ends, and fix four pegs in them 4 in. long. Make a stand of 1 in. board, 9 in. square; fix in the centre of this a piece of wood 1 in. high, with a

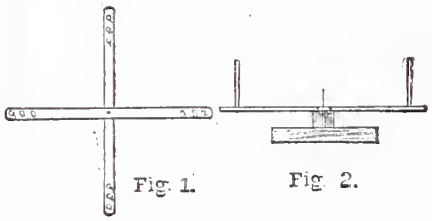


Fig. 1. Fig. 2.

Wool-Winder. Fig. 1.—Cross for holding Wool. Fig. 2.—Cross fixed on Stand.

wire in the centre. The stand should be weighted with a plate of lead, to prevent it being moved. The cross is fixed on the wire, and the wool on the pegs; as the wool is wound the cross turns round. Fig. 1 shows the cross; Fig. 2 the stand and cross fixed upon it. There is another form which folds up. If you want this, write again, and I will send sketch of it."

**Luminous Paint.**—F. S. (*Leek*) writes, in reply to R. R. (*Upholland*) (see p. 637, No. 141):—"The following is a good recipe: For orange luminous paint, 46 parts of varnish are mixed with 17·5 parts prepared barium sulphate, 1 part Indian yellow, 1·5 parts prepared madder lake, and 38 parts luminous calcium sulphide. For yellow luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts barium chromate, and 34 parts luminous calcium sulphide. For green luminous paint, 48 parts varnish are mixed with 10 parts prepared barium sulphate, 8 parts chromium oxide green, and 34 parts luminous calcium sulphide."

**Steel Springs.**—A. Darwin (*Harrison Street, Hillsborough, Sheffield*) writes to Wing (see p. 686, No. 147):—"Wing can be supplied with these by writing to the above address, coiled or in full length to coil himself."

**Modelling Wax.**—Eddifra writes, in answer to Carver (see p. 622, No. 143):—"Use white wax, melted and mixed with lard. In working it, the board or stone is best moistened with water, to prevent it sticking. Dip the tools also in water. To colour it, use dry colours."

### V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—F. (*Huddersfield*); W. H. B. (*Salford*); A. C. (*Leeds*); D. C. (*Kinross*); Eddifra; W. G. W. (*Bruton*); W. A. Y. (*Poole*); N. W. (*Camberwell*); D. S. (*Stanley*); J. L. (*Harleston*); S. & J. (*Shanbryde*); Thornhill; A. B. (*Blackburn*); G. F. B. (*Victoria Barracks*); Amateur; D. L. (*Selly Oak*); W. E. N. (*Deptford*); E. D. (*London, S.E.*); J. B. (*Liverpool*); F. & C. (*Liverpool*); W. G. (*Ruabon*); J. S. (*Wakefield*); W. V. E. (*Derby*); R. S. (*Blackburn*); P. S. (*London, E.C.*); A. P. (*Longsight*); W. F. (*Winchester*); J. R. E. (*Congo, S. W. Africa*); E. W. (*Chirk*); T. E. A. (*Manchester*); F. M. (*King's Lynn*); H. G. P. (*Brixton*); Moroanwg; Young Joiner; C. O. S. (*Tenby*); C. H. W. (*Dewsbury*); Subscriber; Calne: Stero; P. P. (*Withington*); E. H. L. (*Leicester*); F. P. (*Northwich*); W. H. (*Northwich*); C. P. & Co. (*London S.E.*); H. M. W. (*Bootle*); S. F. C. (*Stoke Newington*); G. W. S. (*Hyde*); W. H. (*Birmingham*); Youthful Reader; J. S. (*Glasgow*); J. H. B. (*Manchester*); Shopite; F. S. B. (*Queensbury*); Electrician; G. S. (*Stangate*); Oven; W. E. D. (*Belfast*); S. A. L. (*Portsmouth*); H. J. (*Orford*); E. P. B. (*Penge*); J. S. (*Bedford Leigh*); Chips; W. L. P. (*Glasgow*); R. J. H. (*Dublin*); E. C. M. (*Portadown*); P. B. (*Oldham*); J. C. (*Ardwick*); W. H. W. (*Lambeth*); Anti-Procrastination; Amateur; J. W. D. (*Chorley*); A. W. T. (*Sheffield*); H. F. (*Taylow*); C. S. (*Seacombe*); Baseboard; J. W. T. *Huntingdon*); Grateful; Constant Reader; Bona Fide; Chick; E. H. M. (*Bideford*); C. H. T. (*Wigan*); W. L. (*Fitchin*); J. E. (*Liverpool*); Canoe; Oldham Engineer; P. B. (*Harthill*); H. W. (*Halifax*); H. S. (*Dalston Lane*); W. W. N. (*Leeds*); Horology.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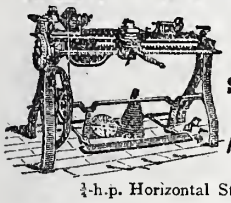

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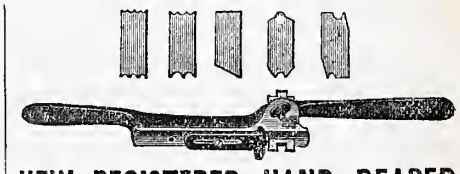

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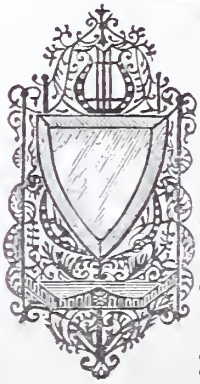

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# WORK

## An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.


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### A WORKMAN'S TOOL CHEST.

BY FRED CROCKER.

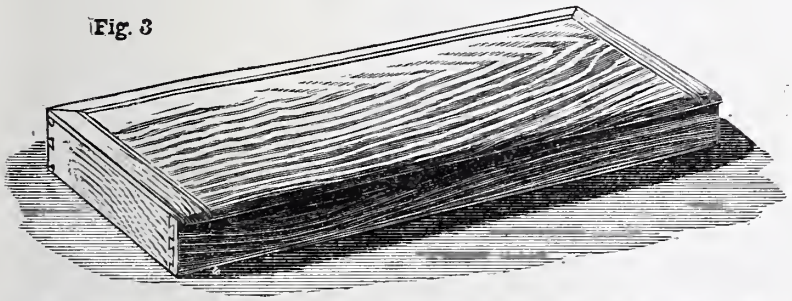
ADVANTAGES OF SLIDING TILLS—SIZE—MATERIALS—CONSTRUCTION.

IN making a "workman's tool chest," the object should be to economise space as much as possible, and to aim at lightness, combined with sufficient strength for the purpose required. The latter is necessary, especially for railway travelling, as they get rough handling by the Companies' servants, who—judging from the appearance of the tools after a journey—move the chest by tipping it end over end.

*Advantages of Sliding Tills.*—A reference to the drawings (Figs. 1, 2, 3) will show that sliding tills are given, which are preferable to the nest of drawers you sometimes find at the back of a tool chest. The former occupy less space, require less material and labour in making, and by sliding one over the other the whole length of each may be seen at a glance, and the tools easily found. Again, there is no danger of a tool such as a gauge binding against the bottom of the drawer above it; and there is also an advantage in packing: you simply tack a strip of wood in the slides at the ends of the tills to secure them, or use the space between as a clothes-box for working clothes.

*Size.*—The size, which may be gathered from Figs. 1 and 2, is smaller than that generally used by cabinet makers and joiners; but at the present time, when

Fig. 3



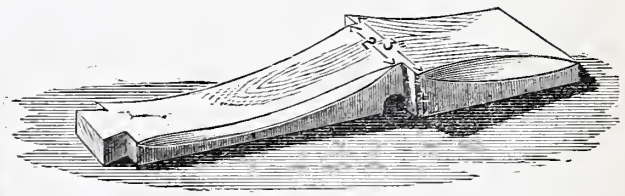


Fig. 4

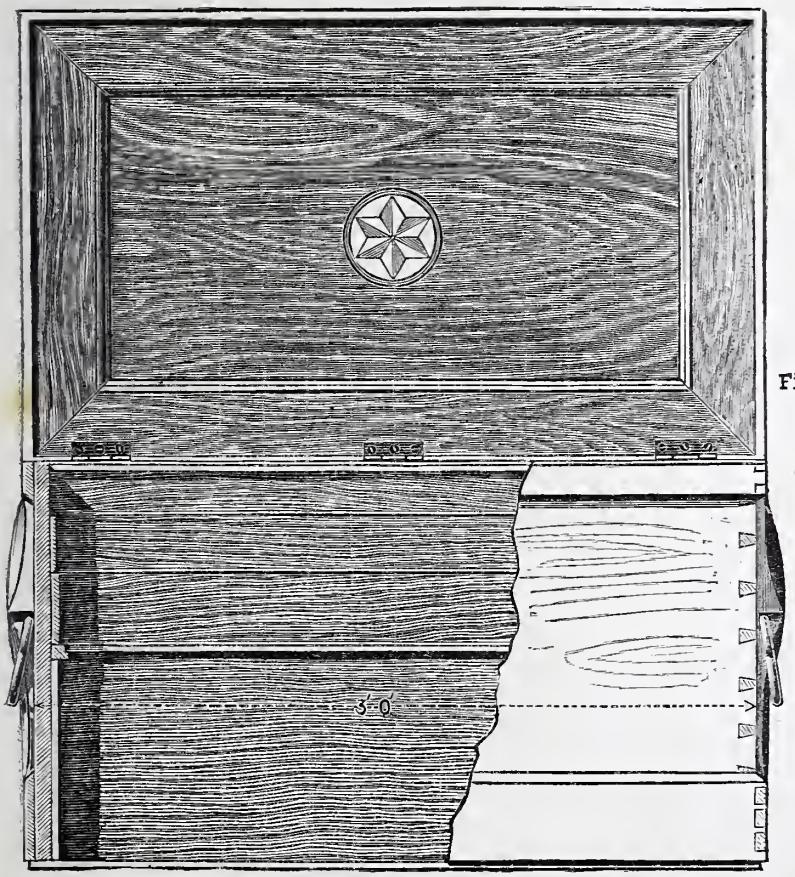



Fig. 1.

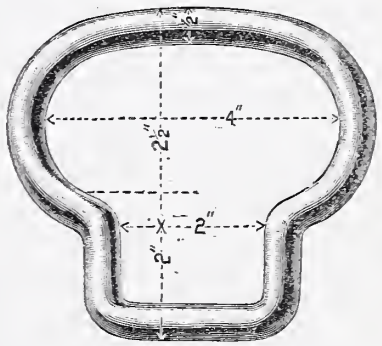



Fig. 5

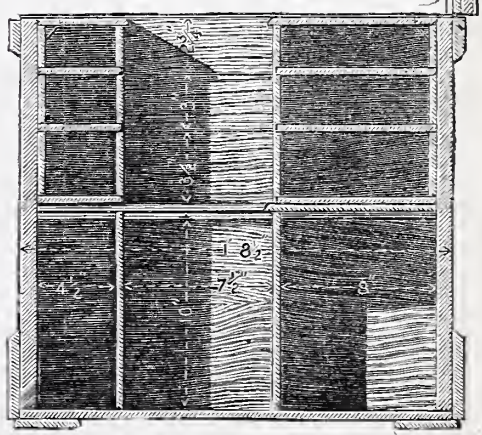



Fig. 2

Fig. 1.—Longitudinal Section and Part Front Elevation of Workman's Tool Chest. (Scale, 1½ in. to 1 ft.) Fig. 2.—Cross Section. (Scale, 1¼ in. to 1 ft.)
Fig. 3.—Top Till. Fig. 4.—Handle Bearer. Fig. 5.—Handle.

machinery is so much used, I should think it would be large enough for the average workman. This, however, may be modified to suit the particular trade or branch the maker may be engaged in.

*Materials.*—The sides and lid may be made of American pine, which should finish ¾ in. thick, and if not wide enough may be jointed; the bottom of ⅝ in. match-boarding; the plinth, etc., of Baltic deal; and the inside may be fitted up with Honduras mahogany ⅛ in. thick, which, for narrow boards, is fairly cheap, and is not so liable to twist as some of the more expensive qualities of fancy wood.

*Construction.*—First plane up and dovetail the carcase together, making the pins rather large; then screw the bottom on. Next the plinth may be screwed on sides and ends, and dovetailed at the corners—the pins being in opposition to those on the carcase, as shown in Fig. 1. Now the handles should be put on. These are made of ½ in. round iron (Fig. 5), and are far better than the pieces of rope you sometimes see used for the purpose. The handle bearers (Fig. 4) may be of oak, and should be screwed from the inside. A dovetail is shown at the bottom, which may be cut into the plinth if the worker thinks there is an advantage in using it. The handles should be kept well up, so that the chest will not turn over if it should at any time be craned. Next, the till slides are put on inside the ends. These consist of a piece of veneer for the top, a piece of ⅜ in. mahogany for the middle, and a piece of ⅝ in. for the bottom. To the latter is screwed a piece 1¼ in. by ¾ in., having a ⅜ in. rebate, to form a slide for the well board. Beneath this a block 7½ in. wide is fitted in, to which the well sides are secured. Some strips of mahogany ¾ in. wide by ¼ in. thick, and equal in length to the sides and ends, are now required. These are glued on round the top of the sides and ends, and mitred at the corners. The lid will be the next thing to occupy our attention. It is not advisable to clamp it, as the pieces at the ends are often a source of weakness. The inside is veneered, and banded with a 3 in. margin of ⅜ in. mahogany, mitred at the corners, forming a central sunk panel. The ⅝ in. ogee mould may be stuck on the edge of the margin, or may be planted in. The centre may be ornamented with a monogram, or some other simple inlay, as shown in the sketch. The plinth (½ in. thick) is next screwed on, and round the top some 1 in. by $\frac{3}{32}$ in. hoop iron (see Fig. 2). This protects the lid, should the lid be used as a sawing trestle at any time. Between the hoop iron the space is filled in with ⅜ in. board screwed on across the grain of the lid, and rounded at the edges. This protects and considerably strengthens it. Sometimes thick canvas is used instead of the ⅜ in. board. The tills are dovetailed together, the top ones (Fig. 3) having a lid. The margin, 1¼ in. wide, may be secured with angle blocks glued inside. The divisions lengthways may be made to suit the requirements of the worker; for instance, the top till (back) may have an 8 in. division at each end for bits, the centre being reserved for gouges or carving tools. Small knobs are sometimes put on the front of the tills, but these are in the way of packing; if anything is used for the purpose, it should be small flush rings. The bottom space at the back will accommodate such planes as beads, rounds, hollows, etc., placed on end; while that at the front may have a rack for saws.

The lid is hinged with three 2½ or 3 in. brass butt hinges, and a bead put on to line with the knuckles of the hinges, forming a sort of rule joint. This prevents the ingress of wet, dust, etc. A good lock should be provided, and two holes bored, so that the lid may be screwed down to prevent its being burst off. If the worker intends taking a trip to the Colonies, he may still further strengthen his tool chest by procuring a dozen pieces of thin iron, 6 in. long by 1½ in. wide, bending these to form angle plates, and screwing them on the outside. The inside should be French polished; the outside may have two coats of lead colour and one of brunswick black.

Minor details of construction are omitted, as they have often been given before; but should any difficulty arise, or should any practical reader have an improvement to suggest, the columns of "Shop" are always open.

## PRACTICAL PAPERS FOR SMITHS.

BY J. H.

ARRANGEMENTS SUITED TO VARIOUS TYPES OF SHOPS—STORAGE OF SMALL TOOLS IN RACKS—TOOL BENCH OR STAND—STAND FOR HEAVY APPLIANCES—MACHINES—VICES—DRILLING APPARATUS—SWAGE-BLOCK—STAND FOR SWAGE-BLOCK—HAMMERS—BOLT-FORGING MACHINE—SAWS—CRANE—STORAGE OF BARS AND RODS—STORAGE OF SCRAP—CONDITIONS AFFECTING THE FUTURE OF THE CRAFT.

IN this concluding paper I will treat, as I promised, of the arrangements of the smithy.

*Arrangements suited to Various Types of Shops.*—The arrangements of smithies, and their tools and appliances, differ as widely as do those of carpenters' shops or engineers' machine and fitting shops. From the country smithy of the roadside to the smithy of twenty or thirty fires is a long stage—a stage bridged by shops of all sizes and varied arrangements. In the small shops, machines and power-driving are *nil*; in the large ones, hand-work is reduced to a minimum. A few remarks relative to the arrangements of smithies of various sizes will, therefore, appropriately close this series.

My remarks will have reference to (1) small tools, (2) to machines and appliances, and (3) to storage of iron and scrap.

(1) *Storage of Small Tools in Racks.*—Small tools—as tongs, swages, fullers, flatters, punches, and such like—accumulate in large numbers, and litter the place unless proper means are taken to keep them in some order. There are two methods of storage—racks and stands. The most common method is that of racks, fixed against the wall by the side of the forge. These are simply stout parallel iron bars, supported between uprights, at a distance of from 6 in. to 8 in. from the wall, between which bars the shanks or handles of the tools, as the case may be, are dropped, their enlarged portions resting upon the top edges of the bars. The tool-racks against the wall are formed by driving two uprights into the ground at each end, and riveting the horizontal bars of iron to these. The uprights and the bars alike are of flat iron—measuring, say, 2 in. by ½ in.—placed edgewise. There may be two or three series of these horizontal bars, at heights of about a foot apart, dependent on the sizes of the tools used.

For the lightest tools, handled with withies, or with round rods, it is sufficient to employ short lengths of round rod riveted into flat bar. The flat bars are then secured to vertical uprights driven into the ground and leaning against the wall, and the rods stand out like spike nails. Upon these the light tools are hung by their handles.

The flat bars may measure 2 in. by ½ in., and the rods be of ½ in. iron, 5 in. or 6 in. long. These lighter racks should be placed above the racks of parallel bars just previously described.

A large quantity of tools can be easily stored in this fashion without occupying any of the floor-area of the shop, and are quite handy, since the smith has but to turn round from the anvil to pick out any tool required.

*Tool Bench or Stand.*—The other method is to have an oblong open bench or stand of wood, framed together with good rigid diagonals. The top is crossed with strips or rods, leaving open spaces, in which the shanks or the handles of the tools drop. Unless there is plenty of floor-room available, this is not so good as the rack, because the latter occupies scarcely any floor-space. But such a stand is very serviceable adjoining machines like the steam- or drop-hammer, or the Oliver. Without it, the tools would lie about round the machines in confusion.

*Stand for Heavy Appliances.*—For the heavier appliances used with the steam and other hammers, stands of a different kind are also made use of. Thus, two cast-iron standards of A form, with three or four pairs of internal flanges facing towards each other, carry stout deal planks between them, which are bolted to the flanges. Upon these deals the heavy spring-swages, die-blocks, cutting-off tools, hoop-tongs, etc., are laid side by side, the lighter on the top shelves, the heavier beneath, ready to hand, and without superposition of one tool on another.

(2) *Machines.*—The machines and larger appliances used in a smithy are very numerous in some shops, very sparse in others. In a country shop the vice, drill, and swage-block are frequently almost the only ones that merit notice; in large shops the steam or other hammer, the bolt-forging machine, the hot and cold iron saws, and the crane, are essential adjuncts. A few words on each of these must suffice.

*Vices.*—The ordinary tail or standing vice is, on the whole, as good as any. The high-class vices with parallel jaws and instantaneous grip arrangements used by fitters are scarcely suitable for the smithy, where the work is mostly of a rough character. If a regular bench is put up in the smithy, the tail-vice may be attached to it; or a small vice-bench, two or three feet in length only, may be attached to the wall beside the forge, and the vice fastened to that; or it may be self-contained, standing on a tripod anywhere in the shop, and so be movable.

*Drilling Apparatus.*—For drilling large holes, the ratchet-brace is the best tool to use. It can be fixed upon a bench in a permanent position, or it can be fixed where wanted on work in hand. A press-drill thrust down with a lever is also a common appliance in country shops. For a modern shop where drilling is done, a double-geared hand or power drill is the most efficient tool.

*Swage-Block.*—I have not yet alluded to the common swage-block, an appliance without which no smith's outfit is fairly complete. It is an almost universal tool. Its body is pierced with numerous holes—round, square, and oblong. Its edges are provided with indentations of curved and V'd forms, in various sizes. The block is used, when lying flat, as a bolster upon which holes are punched and drifted; and as a heading-tool, upon which shouldered work is finished. When laid upon one of its edges, the indentations upon the edges

fulfil the function of bottom swages for circular, hexagonal, and rectangular work.

*Stand for Swage-Block.*—The stand upon which the block is mounted consists of two cast-iron frames—an upper and a lower. The upper one is provided with strips, enclosing the block. The two are united rigidly by means of four shouldered wrought-iron pillars, whose pins pass through holes cast in the frames, and which are riveted over at top and bottom.

*Hammers.*—In a country shop destitute of power, the old Oliver is a most useful tool. It is efficient, easily and cheaply rigged up by smith and carpenter, and though, of course, not so rapid in its action as a steam-hammer, is its best substitute, and is entirely under the control of the forgeman. If power is available, then the drop-hammer is an improvement on the Oliver, and one that is employed in many large firms. With steam-power, the steam-hammer is the most efficient; but it consumes a large quantity of steam, requires the attendance of a man to operate the valves, and is costly, and therefore only suitable to large shops. Its place is always about the centre of the shop, to afford all the room available for the turning about and manipulation of long forgings, rods, and bars. Still, when the shop is of sufficient size to pay for the introduction of a steam-driven hammer, its uses are very varied and manifold; and fresh classes of manufacture can be developed that could not have been undertaken without the hammer. In a myriad ways the hammer can be utilised, and the slow operations of the striker be expedited manifold.

*Bolt-Forging Machine.*—The bolt-forging machine is a power-driven machine, by which bolts and their heads are formed between dies having a rapid vertical movement imparted from a long cam-shaft. Where bolts are made in even moderate quantities, the bolt-machine soon pays for itself.

*Saws.*—An almost necessary adjunct to this machine is the power-driven hot and cold iron saws. The first is a comparatively thin saw, run dry at a high rate of speed, that cuts through red-hot rods and bars almost instantly. The second is a thicker saw, that cuts slowly, running in water the while. The first makes a rough cut; the second is quite smooth and clean.

*Crane.*—The best crane for the smithy is a wall-crane that leaves the whole of the space underneath the jib quite clear. The framing is triangular, comprising the horizontal jib, the diagonal tie-rods above the jib, and the vertical rod upon which the whole swings. The top and bottom pivots of the vertical member turn in castings bolted through the wall. The jib is formed of flat parallel bars, upon which a light carriage or jenny runs, and from which the chain depends. The chain may be an endless chain with a loose sheave-pulley and hook, suitable for light weights; or differential pulley-blocks may be suspended from a hook for lifting heavy loads. The length of the jib will be such that it will command the forge-fire, the anvil, and, if necessary, any other appliances.

(3) *Storage of Bars and Rods.*—The stock of iron and steel bars and rods of a smithy should be kept in a shed, or at one side or end of the shop, stacked against a wall, the bars standing upon the ground and leaning against the wall. They can then be picked out without having to remove some bars to get at others, as must be the case when they are laid horizontally. As far as room will permit, all bars of different dimensions should be kept distinct. Short horizontal rods should be driven into the wall, standing out a foot or more, to divide the space into bays for iron of different sections and sizes—something similar to the arrangements used for stacking timber on end.

*Storage of Scrap.*—Odds and ends of iron bar and rod, and pieces cut off forgings, accumulate rapidly in a smithy. They are all valuable in turn, because they frequently save the cutting of a long bar. The best way to store these is at one end of the shop, spread over the ground; or, if space is limited, upon a stand like that used for the die-blocks and spring-swages. The less they are piled up the better, because, if spread thinly, any pieces required are more quickly seen, and selected for use.

*Conditions affecting the Future of the Craft.*—Owing to the gradual introduction of labour-saving machines into smiths' shops—the steam-hammers, bolt-machines, forging-machines, saws, etc.—and the increasing practice of stamping or die-forging, the craft of the smith is being affected in the same way that other crafts are being influenced. The inevitable result is sure to follow. Some considerable amount of skill will be sacrificed to specialty and to mechanical routine, and all-round smiths will become more and more scarce. But it cannot be helped. We are, all of us, the offspring of our age, and are borne along by its tendencies. All the more reason, however, why every craftsman should endeavour to gain a broad culture, and keep in touch with all modern improvements and studies bearing on his craft, and thus supplement the inevitable narrowing influences of the modern division of labour, and atrophy of manual skill and of the art of craftsmanship brought about by machinery.

## HOW TO CONVERT AN OLD HAND-BELL INTO AN ELECTRIC BELL.

BY G. E. BONNEY.

The Class of Bells which may be Converted—The Gong—The Magnet Core—The Armature—The Bobbin and Coil—The Contact Spring—Fitting the Parts—Battery to Ring the Bell.

Inquiries from correspondents respecting the internal fittings and mechanism of a Jensen electric bell have led me to think that there may be a few amateurs who are the happy possessors of old bell gongs which they may like to fit up as electric bells. The gongs referred to here, are those belonging to house-bells, worked with wires and cranks, or hand-bells of the church-bell pattern. These may be utilised as gongs for electric bells, and the fittings for the same may be enclosed inside the gongs, as in the bells introduced by Mr. Jensen. As there may be some readers of Work who would thus like to try their hands at converting a gong of the old system into an electric bell of the new system, I herewith give a few simple directions and diagrams to show how it may be done.

*The Gong.*—First a few words respecting the gong—that is, the bell itself—as we find it in the lumber room. It may be dirty and dusty, and attached to a rusty spring. We can do very well without all these accessories, so will clear them away at once. We will not bother ourselves about a handle to the bell until it is nearly finished. The bell may be of any size, from $1\frac{1}{2}$ in. across the mouth up to 6 in. I do not advise working on a larger or a smaller size than the above, as the smaller sizes will not afford much room to work in, and the larger sizes will take up too much battery power to work them. By this hint it will be understood that the fittings will have to be adapted to the size of the bell, and must be made proportionate throughout. I shall, therefore, not be able to give measurements of the various parts, as these must be found by measurements of the bells, but will give rules for obtaining these measurements, and also give the shapes of the various parts. The bell must be first cleaned, and the rusty spring taken off with an old rasp file; then a hole must be drilled exactly through the centre of the crown to receive the screwed shank of the magnet core and its insulating sleeve. The internal fittings of the bell will be held up by this shank, and it will also serve to convey the current to the magnet. It must therefore be strong, and must be insulated from the bell. A hole $\frac{3}{16}$ in. in diameter would be large enough to take the shank, but as this must be surrounded by an insulating sleeve of ebonite or boxwood, it will be advisable to take out enough to form a $\frac{3}{8}$ in. hole. This done, the bell will be ready for its fittings.

*The Magnet Core.*—In electric bells, there are usually two magnet cores, to hold two bobbins filled with wire. In this bell we have little space at our command, so shall have to put up with only one core and one bobbin of wire. As part of the core will pass through a hole in the crown of the bell, and be held in position by a nut on the top, we must take measurements for length of core from fully $\frac{5}{8}$ in. above the top of the gong down through the centre to within $\frac{1}{2}$ in. of the bottom. This will give the length; now for the diameter. This should be $\frac{1}{4}$ in. for a $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. gong, $\frac{3}{8}$ in. for a 3 in. up to 4 in. gong, and $\frac{1}{2}$ in. for gongs above 4 in. up to 6 in. The material must be best soft iron. One end of this small bar must be turned down to form a shank, to pass through the hole made in the crown of the gong, and a screw-thread cut on its upper part (to fit the nuts, Figs. 8 and 9), as shown at Fig. 1. Just above the shoulder of this shank we shall want a thin collar or washer of ebonite or boxwood, to insulate the shoulder from the gong and to carry the contact spring, so must leave the shank long enough to take this, which must be thick enough to carry two short screws for holding up the contact spring. About $\frac{1}{4}$ in. below the shoulder, drill a small hole right through the core, to take a pin on which the gimbal or loose sleeve of the armature and hammer will hang. The lower part of the core should now be turned smoothly, and the upper pole-piece fitted to it. This pole-piece (shown at Fig. 2) is another piece of soft iron, from $\frac{3}{16}$ in. to $\frac{1}{4}$ in. in thickness, wide enough to allow a hole in one end to fit on the core, and long enough to allow the other end to project a little over the edge of the bobbin, as shown at Fig. 7.

A corresponding pole-piece will go on the end of the core, after the bobbin with its coil of wire has been fitted on the core, so should be got ready now. It must be understood that the very softest and best-annealed iron will be required in core and pole-pieces, to prevent the least trace of permanent magnetism being retained after the iron has been magnetised.

*The Armature.*—This also must be made out of soft, annealed iron, to the form shown at Fig. 3, then filed smooth and bright. The width of this piece should correspond nearly with the width of the pole-pieces, and its

thickness may also be the same, whilst it must be long enough to reach from gimbal to lower pole-piece, as shown at Fig. 7. At the upper end, it must be bent as shown in the figure, and this bent part filed down thin enough to go easily into the jaws of the gimbal, or loose collar holding the armature and hammer, as shown at A (Fig. 2). This part is best made of thin brass, which need not have a greater thickness than $\frac{1}{8}$ in., bent around the core to fit it closely on two sides of the oval. Its form is shown at B (Fig. 2). Its jaws will clasp the upper bent part of the armature, and be secured thereto by two small rivets, passing through holes drilled through the jaws and armature. At the opposite side of the oval, drill a $\frac{3}{16}$ in. hole, to take the end of the hammer-shank, which may be fitted in and soldered, or tapped and screwed in, as may be deemed best by the workman. The hammer-shank may be of iron or hard brass wire, from $\frac{1}{8}$ in. to $\frac{3}{16}$ in. in diameter, and long enough, when bent to shape, to reach from the gimbal down to the lower edge of the bell. The hammer-head is simply a small brass ball or marble, with a small hole drilled and tapped to receive the screwed end of the hammer-shank. The gimbal, with its hammer and armature, may now be set aside until the core has been fitted with its bobbin of wire.

*The Bobbin and Coil.*—The bobbin or reel on which the coil of wire is to be wound may be made of ebonite or of boxwood, or of *papier-mâché*. It must fit tightly on the core, and its diameter should be about three times the diameter of the core, whilst its length must be governed by the space between the pole-pieces between which it will be snugly clipped. The flanges may be $\frac{1}{16}$ in. to $\frac{1}{8}$ in. in thickness, according to size of bobbin, but the body should be turned down so as to leave just a thin shell between the core and the wire, because a better magnetic effect is produced in the core when the wire is brought close to it. Fill the bobbin with silk-covered copper wire, and see that it is free from kinks, knots, and bare places. The wire should be wound on evenly, as a reel of cotton is wound. Leave out about 4 in. of the commencing end to connect up the coil with; finish off at the same end of the bobbin, and leave about 4 in. of free wire for connections. The sizes of wire should be No. 28 for the small bells, No. 26 for the medium size, and No. 24 for the larger size bells. The bobbin may be wound on the core, or first wound and then slipped on carefully, to prevent fracture of the flanges. The lower pole-piece must then be fitted on with the same care. If the amateur is not able to fit these pole-pieces tight, they may be secured to the core by a small set screw in each piece. The relative positions of these parts are clearly shown in Fig. 7.

*The Contact Spring.*—This may be cut out of thin spring steel, spring brass, or German silver—the latter being preferable—to the form shown at Fig. 4. The broad part must have two holes drilled in it, as shown, to take two small screws for fixing it to the insulating sleeve (Fig. 5). At the other end solder on a thickening lug of brass to hold the adjusting screw, and drill a hole through lug and spring to take this screw. The small contact screw, shown close by, is made of brass. A tiny hole should be drilled in the end of this screw, and plugged with a tightly-fitting scrap of platinum wire, or a piece of platinum foil may be soldered over the end of the screw. The insulating collar (Fig. 6) should be of ebonite or of boxwood. This will occupy the position shown at A D (Fig. 7), and must be made to fit this part. It will there serve the purpose of holding up the contact spring, and insulating it from the gong and from the core.

*Fitting the Parts.*—The various parts being all made, we may now fit them together. First, plug the hole in the crown of the gong with the insulating sleeve (Fig. 5). Next place the gimbal in its position on the core, and secure it there by a pin of hard brass passing through gimbal and core. See that the gimbal swings freely on the pin, and is poised aright. The weight of the hammer should keep that side down close to the bobbin when the core is upright. When the armature is pressed against the pole-pieces, it should fit fairly and squarely on them. Now place the insulating collar (Fig. 6), with the contact spring fixed to it, in its proper position in the crown of the bell, and fit the core in its place, just to see how the parts suit each other. Curve the hammer shaft so as to cause the hammer to strike the edge of the bell. Curve the contact spring until it keeps the armature in its right position, close to, but not touching, the pole-pieces. Note where the contact screw touches the armature, and mark the spot. Take these parts out again, and solder a scrap of platinum foil on the back of the armature, on the spot where the contact spring touches it, then place the fittings back in their places. This time we may connect up the coil, and make all secure. Lay bare about $\frac{1}{2}$ in. of each end of the wire; secure one end under the contact spring as shown at D, and the other cleaned end against a cleaned spot on the gong under the insulating collar, as shown at A (Fig. 7).

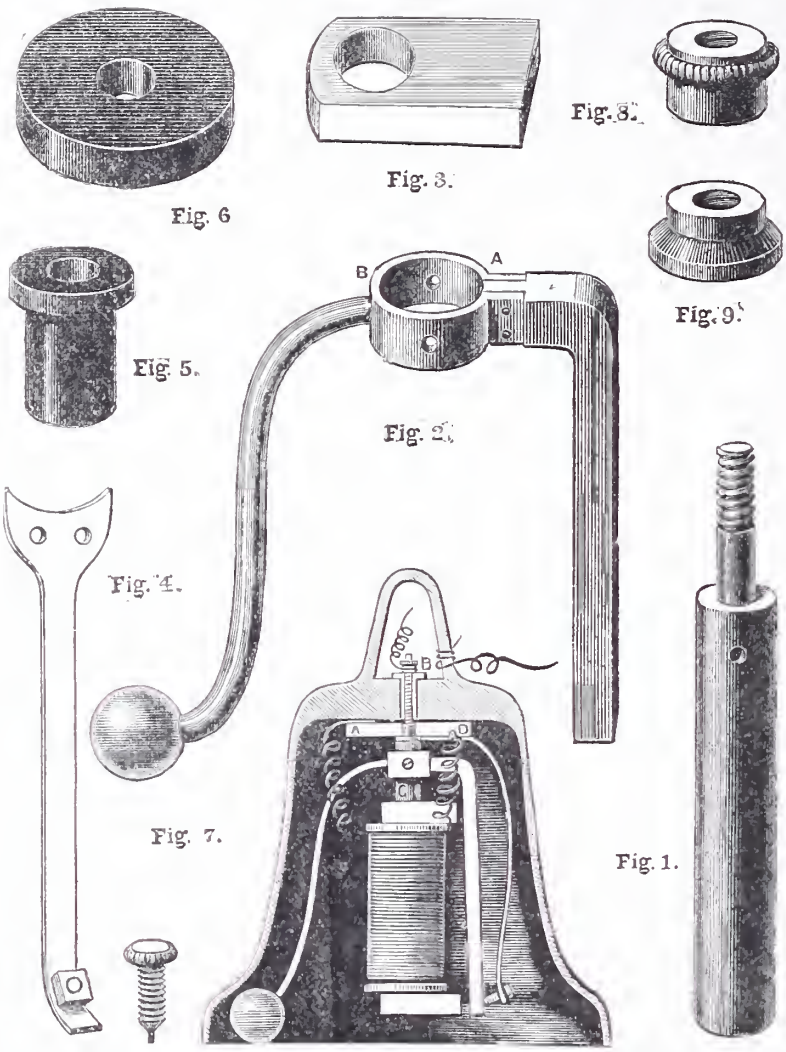



Fig. 1.—Core of Bell Magnet. Fig. 2.—Armature Hammer and Gimbal connected together. Fig. 3.—Pole-Piece of Armature. Fig. 4.—Contact Spring and Screw. Fig. 5.—Insulating Sleeve of Ebonite. Fig. 6.—Insulating Collar of Ebonite. Fig. 7.—Showing Internal Fittings and Connection. Fig. 8.—Upper Connecting Nut of Bell Magnet Core. Fig. 9.—Lower Holding Nut of ditto.

We may now see about a loop or handle for the bell. This is shown at Fig. 7 as part of the gong. A similar-shaped piece of brass or of copper may be soldered to our finished bell in the same position, or a piece of No. 8 brass or copper wire will serve the purpose for small bells. The handle will be hung on a bracket, and one of the line wires connected to the bracket, under one of its screws. The handle and the bracket will therefore form parts of the electric circuit; therefore, all points of contact must be clean. The other line wire will be connected to the binding screw on the bell, at the top of the magnet core. This wire should therefore be coiled in the form of a helix at the end, to ensure due flexibility.

*Battery to Ring the Bell.*—Two No. 2 Leclanché or Gassner, or E.S. dry cells will serve to ring the small bells, but three Gassner, or E.S. dry cells in series are recommended for the other sizes, as a battery of these cells furnishes a large volume of current for a long time without any attention.

## SCARF ORNAMENTS.

BY H. S. GOLDSMITH.

### Scarf Rings.

SPACE being in very great demand in this paper, short introductory remarks are advisable. They will be very few in this case, being merely the statement that this is written to explain the mechanical details of scarf rings—not the artistic. Thus, the same lines will be followed in this case as in the

previous papers in WORK on ear-rings and scarf pins.

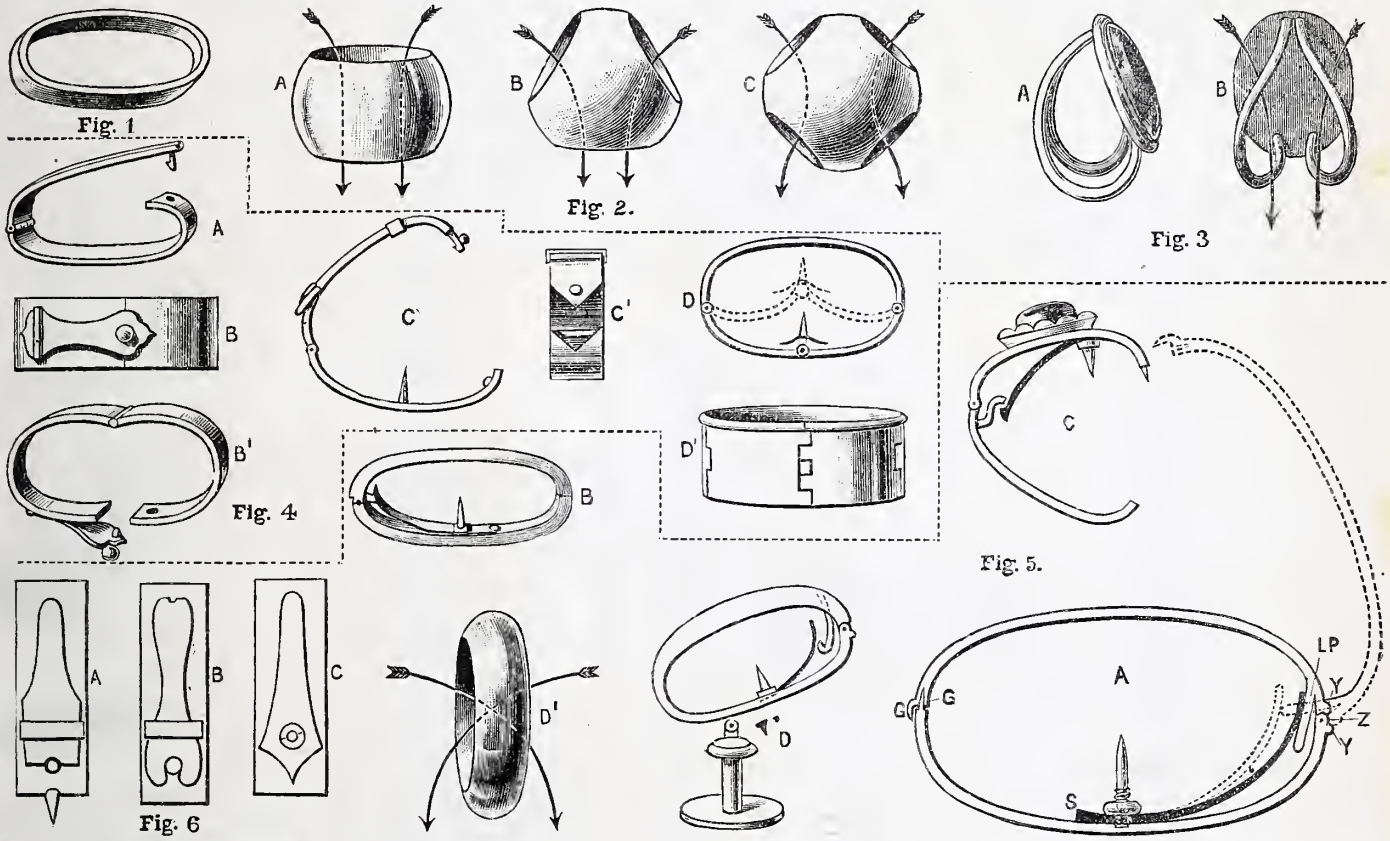
The simplest form of scarf slide or scarf ring is one that merely slides over the scarf, and is retained in its position by the two folds of the scarf, which, when passed through the same aperture, fit the ring or slide rather tight. Such a simple form of this ornament as these (which has nothing added to a plain oval or round mount to obtain security) can be put in the same class as finger rings, when they are used as scarf rings; and one feels rather inclined to believe that finger rings are the real originators of the article, notwithstanding the rather flat, oval form, now the most common shape in which this ornament is found.

that are generally made, and afterwards we can gradually note the complications as they are added. The simplest would be that shown in Fig. 1, which is an oval, plain gold band about 1 in. long and ½ in. wide, the depth being about ¼ in. to ⅜ in. These measurements are not to be taken altogether as standards, but as a fair average, they having been arrived at by comparison and measurement of several.

Three other very simple ones are shown in Fig. 2, A, B, C. They are all made from hollow, round beads, pierced by round holes in the various ways shown, the direction the scarf takes being indicated by the arrows. Of these, Fig 2, B, is the most usual, and can be just as well worn the other way up.

presently, there is a spike often added, which penetrates the scarf, to keep the scarf ring in its place; but with Fig. 3 there is no need of such a spike, because the wire mount is made to fit over the top part of the collar stud, and, generally, spikes cannot be used with any advantage unless there is a joint (as in Fig. 5, A, B, C, D) which allows the ring to reach its proper place on the scarf before it is closed, for it is by the action of closing the scarf ring that the spike is made to penetrate.

The first departure from the simple, rigid form is by making the band of two pieces and jointing them together, such as we see in Fig. 4, A, B, C, D. Three (Fig. 4, A, B, C) are held fastened by a peg on one piece,




**RIGID FORMS OF SCARF RINGS. Fig. 1.—Plain Band Scarf Slide. Fig. 2.—A, B, C, Three Simple Forms made from hollow Beads, pierced in different directions, the Arrows showing the direction the Scarf takes. Fig. 3.—Skeleton Scarf Slide Mount—A, Side View; B, Back View. JOINTED FORMS OF SCARF RINGS. Fig. 4.—A, Simple Form, fastening by a Peg snapping into a Hole; B, Another way of using the same Fastening, Front View; B', Side View of same, partly open; C, Fastens by snapping over a Bar; C', End View of same, partly open; D, Three-jointed Form, Side View, showing in Dotted Lines the Position when fastened; D', Back View of same, showing Construction of the Joints. JOINTED FORMS OF SCARF RINGS WITH SPRINGS AND LEVER PIECES. Fig. 5.—A, Enlarged Diagram; the two Halves are jointed at Z, two Stop-pieces to regulate the Opening, Y Y; L P is the Lever Peg attached firmly to one half; S, the Spring which acts against L P, Dotted Lines showing the relative Position when open; G, G, Guiding Pieces at the Shutting Edges; B, Form with Sunk Joint, and different Forms of Lever and Spring; C, Form with another kind of Spring and Shape of Lever Peg; D, One that is intended to be worn vertically instead of horizontally, shown in the Side View for another kind of Lever Peg, and the way it is attached to the Collar Stud; D', Front View of same, the Arrows showing the way the Scarf passes. Fig. 6.—A, B, C, Three Patterns of Springs.**

The finger rings most likely to be used for this purpose will be those with a very long oval head, composed of a border of stones surrounding a painting—*i.e.*, memorial rings, which, for the most part, were found to be rather uncomfortable things to wear on account of their size. Even now, it is not at all an uncommon thing to see a diamond ring or a signet ring worn on the scarf. However, it is not with these finger rings that we have to deal in this paper, but with the various forms of ornament especially designed for wear on the scarf—ornament where the scarf is retained in its place by being threaded through some ring-shape or other, instead of being skewered on, as is done with scarf pins.

Barring finger rings, we will, then, consider first the simplest forms of scarf slide

The next one (Fig. 3, A and B) is that wherein spaces or passages for the scarf are arranged by having a wire mount made and attached as shown in the sketches—one a side view and one a back view of the article. In this one the loops, in their upper part, are intended to fit over the front of the collar stud—hang on to it, as it were—and consequently to keep the ornament always well up to the top.

This skeleton pattern, as we may call it, seems the best to use when the front consists of a large oval stone—say, a cameo—for then the stone and its setting need only form the front; while, if a band like Fig. 1 is used for such a shaped stone, it will probably project on each side of the setting, and will not always look as if it belongs to the ornament, but more or less of a makeshift. As we shall see

snapping into a hole (Fig. 4, A and B), or over the bar on the other piece (Fig. 4, C). To either of these a spike, such as shown in Fig. 5, B, can be added.

The fourth (Fig. 4, D) has three hinges, and the position, when closed, is shown in dotted lines. The closed portion here is retained, because the front of the slide—which is somewhat of the shape of a bow—has the ends made to spring slightly inwards, and in that way it acts as a spring to force the inside plate and spike forward against the two parts of the scarf that are passed through it. The spike and plate is on a loose piece of joint, and forms the centre one of the five shown in Fig. 4, D'.

In three of these last, no reserve force is present to keep the ring closed, and once the scarf ring gets open, there is

nothing—except, perhaps, a spike—to prevent the scarf ring falling and getting lost. Such conditions not being satisfactory, the type illustrated in Fig. 5 is preferred; but both Figs. 4 and 5 are combined in one article sometimes.

For security, as well as for convenience in adjusting, we find that the greater number of scarf rings are now made like Fig. 5, A, B, C, and D.

These all have springs, so fitted that their force shall be exerted to close the scarf ring, and keep it closed.

In spring scarf slides, the two necessary things to obtain—after we have got our joint well made, and with the guiding pieces (if any) on the shutting edges—are (1) the lever peg, soundly and firmly attached to one half, and so placed and shaped that the spring is able to exert sufficient force on it to keep the two parts closed up; (2) that the spring itself shall be of a suitable shape and strength, and so placed that it will act on the peg as it should do, and yet will allow of sufficient opening of the scarf ring to easily insert the scarf. In the diagrams there are shown different shapes that these lever pegs take, and there are also several forms of springs (Fig. 6). The different forms of both one and the other are not very material, for the work in each case is the same, and will be best explained by the enlarged diagram (Fig. 5, A).

The large ellipse represents a side view of a scarf ring, jointed at one end so as to allow an opening of rather less than a right angle. If the scarf slide has to open wider than those shown in the sketches, a longer spring will be required, otherwise it would slip under the lever peg, and would then very effectually prevent the closing of the ring until the joint pin was taken out and the spring readjusted.

One other advantage of this restricted opening is that pressure is always *on* the spring, so it does not require to be fastened in its place with a screw, but will remain perfectly steady and act perfectly well if it is passed under a bar and against a stop, as in Fig. 5, B, and Fig. 6, A and B.

To restrict the opening to the usual angle, we have to do one of three things: two to the joint—viz., either let it in deep, like Fig. 5, B, or else add pieces, or a piece, along the joint, like Fig. 5, A; or, if the spring is held in its place by a screw, it may be made like Fig. 5, C—that is, with a step-like end, to prevent the lever peg going beyond its proper position.

The shutting edges, although sometimes finished flush, like Fig. 5, B, more generally have a raised piece added, which has to do two things. One is to hide the shutting edges if they do not quite meet; the other is to act as a guide to the opposite half, and lead it into its place, right in line with, and close to, the other half.

Another piece is also used to lead the two parts into a correct position one with the other, and that is shown in Fig. 5, A and C—that is to say, a tapering piece, placed on one side so that it will lead the other by fitting into it.

The position of the spikes is often changed from the central position, as in Fig. 5, A, to a place nearer the shutting edges (Fig. 5, C), and one even sees it attached to the side, where more strength can be got than if it were soldered in the middle.

We generally have the spring and spike on the back part of the scarf ring, but there is no particular advantage in that, and on occasion it will be better to reverse the positions, as in Fig. 5, C, particularly if by so doing we can get a firmer base for our spring and spike as we can when an ornament is fixed on the front.

There have been scarf slides made and patented which were intended to retain a vertical position (as Fig. 5, D and D'), the scarf passing as indicated by the arrows. They have not been much used, and seemed to require a special collar stud and peg to steady them.

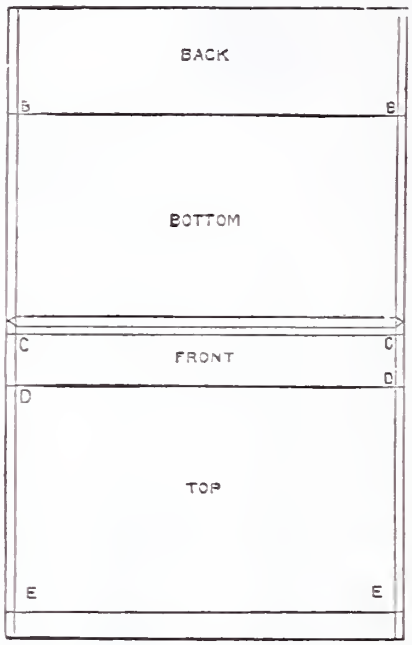
Although not worn in that vertical position, it is possible to wear most of those we now make in that way, if a change is desired.

The three forms of springs (Fig. 6, A, B, and C) are such as one generally uses. The two first are kept steady by means of transverse bars or bridges, and also by pressing against a stop-piece or bead. One is grooved to fit over the lever piece.

The third is one that would be screwed or held by a nut, and the thickness of gold to be used for all forms would be about size 7 to 10 Shakespeare gauge, and should be hammered to get it nice and tough.

In conclusion, let me say that these things have to be borne in mind: (1), strength of the hinge; (2) the firm attachment of the lever peg, and a good form of same; (3) the strength and firm position of the spring at one end, so as to allow the other end to always act steadily on the peg in the one direction. The length of the spring must be properly considered too, and as for the gold it is made of, let it be rather tough; polish it bright, and also polish that part of the lever peg against which it acts, in order to reduce the friction as much as possible—a polished surface being, of course, better than a coloured, or even a gilt, surface for such purposes as this.

If these things are attended to, there should be no doubt about obtaining a successful result when making a spring scarf slide. If any difficulty is found, there is "Shop" always open for inquiry.



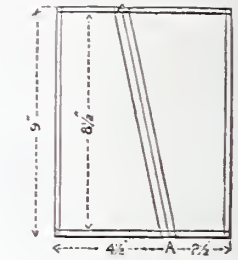




Fig. 1.

Fig. 2.

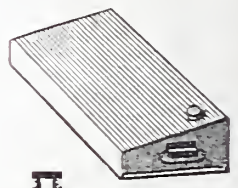


Fig. 4.

Fig. 5.

Fig. 3.

Fig. 1.—Piece of Tin with two Ends of Foot-Warmer marked out. Fig. 2.—Piece of Tin (2½ in. by 16½ in.) for Top, Front, Bottom, and Back of Foot-Warmer. Fig. 3.—Mallet for turning Flanges. Fig. 4.—Foot-Warmer complete. Fig. 5.—Section of Cap.

## HOW TO MAKE A CARRIAGE FOOT-WARMER.

BY J. L. D.

Those who drive to any extent in this bitterly cold weather will, without doubt, appreciate the comfort of a foot-warmer, and many who dabble more or less in amateur mechanics will be able, by following carefully my instructions, to make for themselves a foot-warmer quite equal, if not superior, to those which can be bought.

Some time ago I undertook the manufacture of one for myself, and succeeded fairly well, although tin-plate work is not at all my strong point. Ruminating afterwards on the various stages of my work, I thought out a plan which I imagined would produce a better finished article with less trouble.

To test my new idea I determined to make another foot-warmer for presentation to a friend, and in this I succeeded beyond my most sanguine expectations. The work was so easy that I do not see why any of the readers of Work who can solder should be without this useful article.

I write, of course, as an amateur, and in this particular branch of manufacture, a poor one, but this ought not to deter my readers from following my example. It ought rather to encourage them to find that a novice succeeded so well.

The size of the foot-warmer will be governed, to a certain extent, by the size of the tin from which it is made.

I got three sheets of strong tin, which is sold under the name of boat tin, and measures 12½ in. by 17 in. The cost is 4d. a sheet. I also got half a pound of tinman's solder: cost 7d., which is, I believe, excessive.

After much calculation I cut the ends out of a piece of tin like Fig. 1, which is a rectangle 9 in. by 7 in. The line A A, dividing the opposite sides into parts 4½ in. and 2½ in. long respectively, makes the two sides from this piece of tin.

When they were separated I placed them together and saw that they were both exactly the same size. Then, with a marking gauge, I drew lines right round each end, as shown in Fig. 1. These lines are ¼ in. from the edges. The little square pieces at the corners I then cut out carefully with the shears. I next turned up the flanges along the marked lines by laying the tin on the planed surface of my lathe-bed, having the line over the edge of the bed, and the ¼ in. flange overhanging; then I struck the overhanging part with a sort of bat, made like Fig. 3, so as to turn down the entire flange at once. With two or three strokes I made the flange at right angles to the remainder. Then I went to the next edge, and so on all round. It required some little practice to strike the whole length of the tin at once with Fig. 3, and occasionally the point or handle would hit first, but this made very little difference, as the whole flange was easily turned in the end. Fig. 3 is of oak, about 10 in. long, 3 in. wide, and 1 in. thick.

The second end was flanged opposite to the first, so that when they were put back to back the flanges turned out ; they were, in fact, right and left, and it is important to remember this before commencing to flange the second.

Having completed the ends, I had to decide upon the proper length for the foot-warmer ; 17 in., the length of the tin, I considered too long, and 12 in., the breadth thereof, I thought too narrow, so I fixed upon 15 in. as being the finished length. I therefore cut the two sheets 15½ in. long, the extra ½ in. being for turning in. I then joined the two sheets together, edge to edge, by turning down ¼ in. of the edge of one, turning up ¼ in. of the edge of the other, hooking them together, and hammering down flat. Before I turned them down, however, I cut the corners off, which served to make the joint thinner at the ends.

I then ran a little solder along the joint at both sides, making sure that it took well all the way. I had now a sheet of tin about 24½ in. by 15½ in., which I proceeded to trim so as to make the edges quite straight and parallel. I then drew lines across it to mark the positions for the bends : B B, 4 in. from the end ; C C, 8½ in. from B B ; D D, 2 in. from C C ; E E, about 8¾ in. from D D. In other words, from B B to the edge is the height of the back of the ends ; from B B to C C is the breadth of the bottom, and so on all round.

Having these marked lightly with an awl, I turned up the edges of the sheet at right angles to the body, ¼ in. wide, and with a triangular file nicked the flanges where the cross lines came—*i.e.*, at the points B, B, C, C, D, D, E, E. I then turned the sheet square up at B B, again square up at C C, and again at E E. I then laid one of the ends in the position which it was finally to occupy, having its flanges turned out, against which the back, the bottom, and the front were lying.

I then ran solder all round the end inside, being careful, especially about the corners. The other end I then put in place and ran solder round it likewise. After this I turned down the flanges of the back, bottom, and front so as to overlap those of the ends. It was necessary now to bend down the top along the line D D, in Fig. 2. I cut a piece of oak the exact length, so as to fit inside the foot-warmer, and 2 in. wide. This I placed in front, resting on the bottom, and had no difficulty in bending the top down sharply over it, afterwards springing it up for the removal of the wood. The inch from E E to the edge overlapped the back and served as a joint. I found it easy to turn in the flange of the top over the ends and solder it from the outside, making all perfectly water-tight. While soldering the overlap at the back I held a piece of wood so as to keep the edge of the tin right down to his fellow, otherwise they had a tendency to part company. It will be seen that the ends are ¼ in. inside the edges of the sides of this foot-warmer—something like the bottom of a barrel—and this is the plan which made its construction so easy to me.

In my workshop I found a piece of brass pipe, about ¾ in. diameter, screwed into another piece. I bored a hole in the top of the foot-warmer the exact size of the larger piece of pipe, and soldered in about ¼ in. of the screwed part. I then cut off a piece of the other which screwed into it, and fitted a cap to that and secured it with solder. Thus I had a screw plug which allowed of the foot-warmer being filled, and kept the water safe when it was in. A handle of wire at the same end completed the work, which has for some time given the greatest satisfaction.

## TWO ARMOURERS' HAMMERS.

BY CAROLUS REX.

To fully realise the dignity of handicraft, we must consider the methods of the painstaking and patient masters of the various mechanical arts in bygone ages, while such of their tools and appliances as have come down to us are also revelations of the honour and dignity with which such crafts were originally invested. Who, for instance, can imagine the wielders of such tools as the two hammers here portrayed to have been other than stately and eminently dignified masters of the most honourable and lucrative handicraft of their age? Truly, no mere smiths or workmen were they, but artists keenly alive to all that was graceful and beautiful in connection with their calling, as well as skilful workers in the metals over which they had the mastery. The tool roughly sketched in Fig. 1 would appear to have been a kind of planishing hammer, and is noticeable not only by reason of the extreme elegance of its ornamentation (which the writer has only succeeded in caricaturing in his very rough drawing), but also on account of the very peculiar shape of the handle, which, moreover, is covered with chamois-leather. No mere labourer or 'prentice hand could have used, effectively, this hammer. Its weight is about six pounds, and its face is a plane surface ; hence, without great skill, every blow would bruise. The head is of chiselled steel, highly wrought and exquisitely finished, and there are few modern die-sinkers who could turn out as creditable a piece of work. The piggish-looking head shown in my sketch is, in the original, that of a conventional dolphin, and on the other side there is another head—that of a lion—in equally high relief. The scroll-work is also delicately undercut, and the execution throughout is evidently that of a master hand. The other hammer, portrayed in Fig. 2, is widely different in shape, material, and treatment. It is of bronze, gilt, and damascened with wire of various colours. The shaft of this tool is also a work of art, every portion, with the one exception of the steel ferrule next the head, being beautifully inlaid. The wood is of dark colour, something like cocoa wood, and the stars of the upper part are of gold wire. Towards the lower third of the handle is an ivory ferrule, shown plain in the sketch. The lowest section is of the same dark wood as the upper, and is elegantly inlaid with gold wire in the form of scroll-work. The head, in this case, is not square, but has the section of a flattened diamond figure (see Fig. 3). At the extreme end of the shaft there is a small ferrule of ebony. According to our modern ideas, such a handle would be the reverse of "handy," as, for the matter of that, would be the head also ; but from the amount of time, labour, and skill expended upon head and shaft alike, these would appear to have been accepted patterns. It is easy to imagine one of the polished and polite, but brutal, Florentine nobles picking up such tools while lounging in the workshop of his armourer, and looking with reverence and admiration on them as evidences of the skill and dexterity of the craftsman. We can also imagine the smile of complacency which the face of the master would wear when complimented upon his efforts, as well as the scarcely veiled contempt which he surely felt for the wearers of his handiwork, whose only art or accomplishment was the ability to deal hard knocks. We might easily sermonise at great length over such magnificent tools, but must not take up more space. As the knowledge of the implements used by former craftsmen

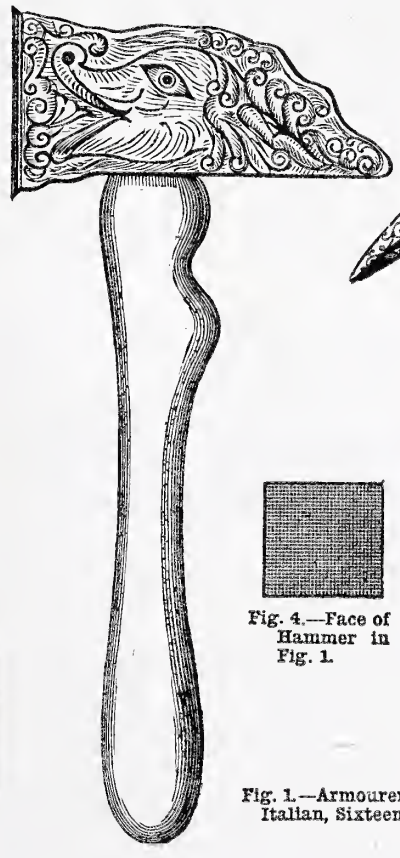


Fig. 1.—Armourer's Hammer. Italian, Sixteenth Century.

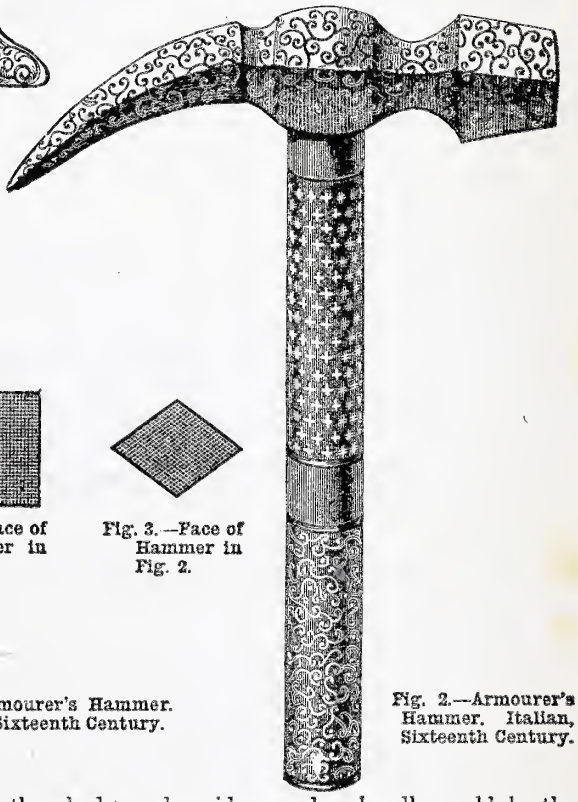


Fig. 2.—Armourer's Hammer. Italian, Sixteenth Century.



Fig. 4.—Face of Hammer in Fig. 1.



Fig. 3.—Face of Hammer in Fig. 2.

is of great use to those of the present day, the writer gives these two ancient tools for what they are worth.

## SCREWING TACKLE.

BY DAMON.

### Screw-Cutting—Screw-Plates.

Outside threads or screws can be cut either with screw-plates and dies, or in the lathe. The screw-plates and dies have several cutting edges, and form several threads—or rather several turns of the thread—at the same time. In the lathe a single pointed tool is generally used, though not always. Modern machinery, made specially for screw-making, is generally adapted to use a modification of the ordinary stocks and dies. Screw-plates and dies can be applied either by hand or power. I propose to take the screw-plate as used for screw-cutting by hand first, as it is the simplest, and pass on to the others later.

Screw-plates are generally used for making only the smallest sizes of screws, say, from ⅛ in. downwards, although they are occasionally made as large as ½ in. One form is shown in Fig. 1. It consists of a flat plate of the best tool steel, varying in thickness from one-half to the full diameter of the screw it is intended to cut. Of course, if several sizes of holes are made in the one plate, the thickness is made suitable for the largest. This plate is drilled with a series of holes corresponding to the sizes of screws it is intended to cut. The chief fault of screw-plates is that the position of the cutting edges with regard to each other is fixed—that is, they cannot be separated or brought closer together. To attempt to cut a full thread by forcing a plate having a standard size tapped hole in it over the rod to be screwed would require the exertion of so much power, apart from the difficulty of getting the plate to start, that the rod or pin would be twisted and perhaps broken. To avoid this, several holes of different diameters are used for the one size of screw. The first one, which is of course the largest, merely marks out the thread. The others are used in succession, each one cutting the thread a little deeper, until the last makes a full thread of the standard diameter. For the very smallest sizes of screws, two or three holes are used; for the larger ones, four, or even six. The holes belonging to one set are connected by lines, as shown in Fig. 1. These lines can be cut with a chisel before the plate is hardened.

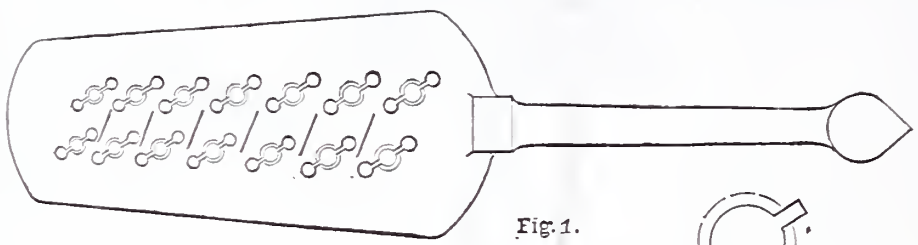


Fig. 1.

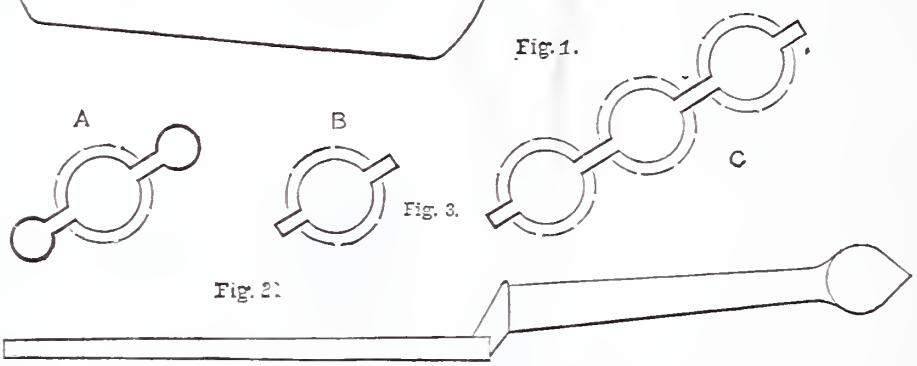



Fig. 3.

Fig. 2.

Fig. 1.—Shows Plan of Ordinary Screw-Plate. Fig. 2.—Shows Side Elevation of ditto. Fig. 3.—A, B, C, shows Three Methods of producing the Cutting Faces.

Having settled the number of holes and their diameters, they are drilled in the plate, which has been previously planed or ground flat on both sides. The holes are generally opened out slightly on the starting side, to make the thread easier to start; though the last hole of a set, which is used more as a gauge than a cutter, is not. The holes are then tapped with a special tap, called a "master" tap. This tap, as I described in my last paper, has more grooves cut in it than an ordinary tap, giving more cutting faces; but, with this exception, it is made and hardened in the ordinary way. The next step is to provide these holes with cutting edges. There are several methods of producing the cutting edges. The most usual is shown in Fig. 1, and at A, Fig. 3. Two small holes are drilled, one on each side of the tapped hole, and close to it. The three holes are then connected by cutting through the metal between them, either with a saw or a small file. This gives four cutting faces, two of which operate when the plate is moved round in one direction, and two when the motion is reversed. This method gives good cutting edges and plenty of room for the cuttings. It is not liable to break in hardening, and is easily cleaned. Sometimes the small holes are omitted, but just the notches cut, as at B, Fig. 3; while occasionally, the holes for the same size of screw are joined together by the notches, as at C, Fig. 3. This latter method has this advantage: If the piece of wire being screwed happens to break off short in the plate, a small saw can be readily used to cut the bit in two. This loosens it, and it is easily removed. The cutting edges having been made, each set of holes is stamped with the size of screw they cut. The plate is then ready for hardening.

In hardening, there is nothing special, except that care must be taken to heat the plate evenly, and avoid burning the cutting edges. Temper slowly to the usual "dark straw" colour.

Screw-plates have occasionally been made for ½ in., and even larger, screws. In these sizes three or four notches are sometimes cut, giving six and eight cutting faces respectively; only half of them, however, acting at the same time, the particular faces cutting depending on the direction in which the plate is turned. For all sizes above ½ in., however, I personally prefer the stock and dies.

The iron intended to be screwed by a plate is generally held in a vice. The point is filed a little taper to enable the plate to start more easily. After the point has been filed up, the plate is applied, the largest hole of the set being used first. Downward pressure, varying with the size of the screw, is necessary to start the thread, after which the plate moves forward by its own action. Starting the thread is the great difficulty. The plate must be kept square with the rod being screwed, or what is known as a "drunken" thread will be made. A little practice will soon give the necessary skill. Of course, the more the point of the iron rod is tapered, the easier it is to start the thread; but, then, all this tapered portion may have to be cut off after the thread is finished, which is a waste both of material and time. Besides, in short screws there is not length enough to allow much tapering, so that it is better to learn to do with as little as possible. Oil is used as a lubricant with iron and steel, but is not required for brass. The plate is worked both forward and backward, and should not be forced on too fast, or the rod will be twisted. A thread can be cut with a plate right up to a shoulder or to the head of a screw. After being used, the holes in the plate should be cleaned, or the next time it is used the cuttings may bind, and break the thread in the plate.

If the rod on which it is desired to cut a thread is steel, and is hard, or has hard places in it, it should be softened before the plate is applied, or the cutting edges will soon be worn out or broken. If the rod or pin to be threaded has been turned in the lathe, it is generally left in the chuck, the point slightly tapered and the plate pressed against it, the lathe meanwhile being pulled round by hand. The screw-plate is sometimes used as a gauge to size when a number of screws have to be cut the same diameter. The screws are cut as nearly alike as possible, and the plate is then passed over them to ensure their similarity. In small machines—such as sewing-machines and automatic tools, which are turned out in duplicate in large numbers—all the separate parts are made interchangeable, so that repairs are more easily executed. All the screws have therefore to be alike, and a screw-plate is a ready means of insuring this.

It must be noticed, by the way, in drilling the holes in a plate, that they must not be drilled the same diameter as the screw they are intended to cut, but what is known as the "tapping size" of that screw—that is, the diameter at the bottom of the thread.

## A FOLDING OR CAMPING-OUT TABLE.

BY A. CABE.

Herewith is illustrated a new form of folding or portable table, of which I, as a practical cabinet maker, have recently made a number. It is admirably adapted for camping out or for summer garden use, and indoors is an excellent breakfast table for, say, a couple of diners; or in the drawing-room, where, made of wood to harmonise with the other furniture, it is a very useful occasional or side table.

I made the first one as a small breakfast

table, to stow away when not in use, being limited for room. The arrangement and construction of the folding framework is quite an original idea, and it is given for the benefit of any readers of WORK who may choose to make it, or have it made for them.

The table in question, which I am at this minute using to write this paper, is made entirely of mahogany. It may be made of other woods, such as oak, American black walnut, or yellow pine. The table stands 29 in. high, and the top is 30 in. long by 24 in. broad. The top is made in three pieces hinged together, the central piece being 4 in. broad and the two hinged leaves being each 10 in. broad, the whole being $\frac{3}{4}$ in. thick. The chief peculiarity, however, consists in the hinged framework.

In the annexed drawings and diagrams, Fig. 1 is the table open for use; Fig. 2 the table folded, when the space it takes up is only $5\frac{1}{2}$ in. (see Fig. 3, which is the end view when folded flat). The diagrams, Figs. 4, 5, 6, and 7, show the structural parts before being put together as a whole. First of all, Fig. 6, the central frame, to which the four legs are hinged, is made. The two uprights are 2 in. by $1\frac{1}{4}$ in.; the upper rail, A, is 2 in. broad by $\frac{3}{4}$ in. thick, and the bottom rail, B, $1\frac{1}{4}$ in. by $\frac{3}{4}$ in. The breadth of this frame is 8 in., and the height over rails $14\frac{1}{2}$ in. The lower ends project downwards $1\frac{1}{2}$ in., and are rounded as shown. On the top of this frame a piece, C, is fitted, 8 in. long and $3\frac{1}{2}$ in. broad, and 1 in. thick. It is cut in at the ends, as shown in Fig. 8, to fit neatly between the uprights of the frame, and is glued and screwed down to the top of rail, A. Four screws are also put through the ends into the uprights (see C, Fig. 6). This top piece is to fix to the under-side of the central portion of the top, and the frame serves the purpose of a table pillar when so fixed (though it does not reach the ground), whereon to fix the four framed legs. One of these frames (Fig. 5) is shown. It also is 8 in. broad, and the frame part is the same length as the central frame. The leg is $1\frac{1}{4}$ in. square, tapering from the middle of its length to $\frac{3}{4}$ in. square where it touches the ground. The two rails and the hingeing stile are all $\frac{3}{4}$ in. thick, upper rail 2 in., lower rail and hingeing stile $1\frac{1}{4}$ in. broad. The hingeing stile projects downwards, and is rounded off the same as the uprights in central frame. These four frames are made in two pairs, or if the $\frac{3}{4}$ in. rails are let into the centre of the $1\frac{1}{4}$ in. legs, instead of flush on one side, then the four frames are all alike. None of the mortises are mortised through, being only 1 in. deep, and cut with a $\frac{5}{16}$ in. mortise chisel (see Fig. 4, A and B). This is a rule that holds good in all cabinet work, as distinguished from joiners' work. The joiner makes all his mortises through, and wedges them on the outside. All the frames of this table are dressed square on the edges; this, of course, is the simplest form. The rails might be stop-chamfered or cut away according to fancy, or perhaps to match some other furniture. The legs might be turned instead of square, or they might be square-chamfered. The frames being square-framed up, and nicely cleaned off and glass-papered, what remains is to hinge them to the central frame. For this I use $2\frac{1}{2}$ in. brass hinges, four pairs for the leg frames and two pairs for the hinged top. When hinged together they should be perfectly level on the top edges, both with each other and with the central plate, C (Fig. 6). I have shown the top hinged, a plain square joint being the simplest method. A much neater method, however, is what is called the Pembroke quadrant joint; in it the hinges are quite invisible, but it requires a pair of planes specially made for the purpose, besides careful fitting and working up. The hinges of the top should be sunk fully the thickness of the hinge plates, so that the leaves when folded down will show a close joint at the inner junction.

It is not necessary that the frames to support the top should fold out to a right angle; it will be enough for them to be at the angle of about 40°, as in Fig. 7. At this angle I insert, in the top on the under-side, small stop-pins $\frac{3}{8}$ in. thick, and projecting downward $\frac{1}{2}$ in. The four frames stop against these pins in the position as shown in Fig. 1.

On the ground of economy, iron hinges might be substituted for the brass ones, being only about a third of the price. The whole table is French polished, but the frames may be only varnished, and the top polished, if required to be finished cheap.

The table, as may be seen, is a very simple one for the amateur cabinet maker to construct, and anyone going in for it will have a table useful, handy, and really original in design. It is far superior to many so-called occasional tables, partly by reason of the facility with which it is reduced in size, or extended when reduced, and partly on account of the many purposes it may be made to serve.

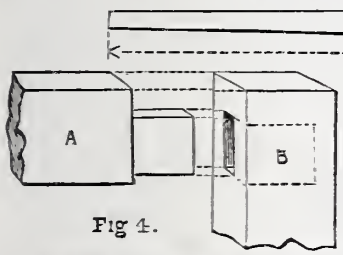


Fig. 4.

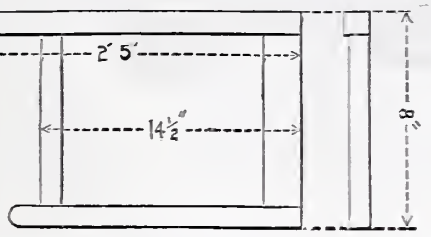


Fig. 5.

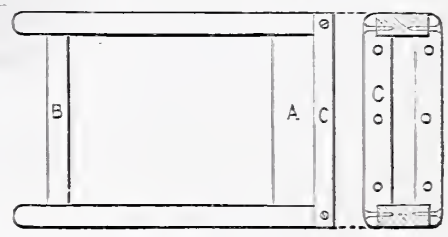


Fig. 6.

Fig. 8.

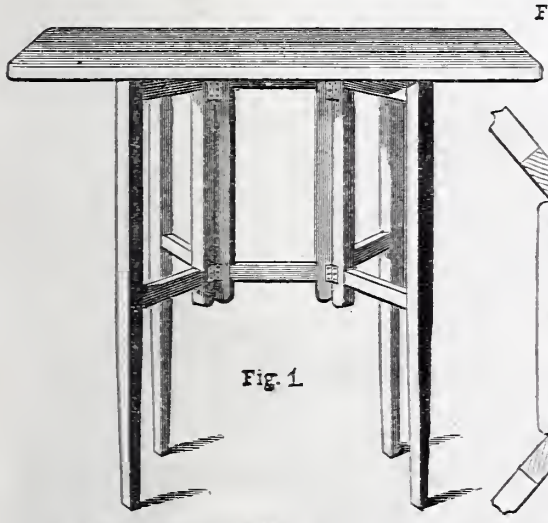


Fig. 1.

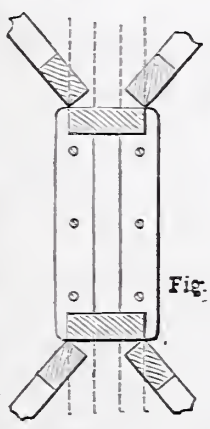


Fig. 7.

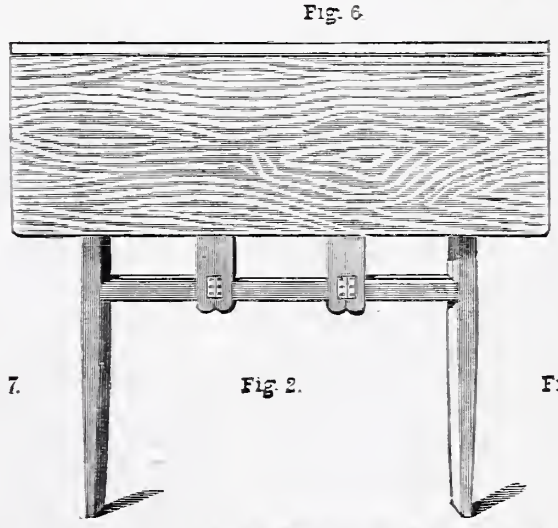


Fig. 2.

Fig. 3.

**Fig. 1.—Perspective View of Table open. Fig. 2.—Table folded. Fig. 3.—End View folded. Fig. 4.—The Mortise and Tenon. Fig. 5.—The Leg Frame. Fig. 6.—The Central Frame. Fig. 7.—Method of hingeing Legs and clamping Frame to Table. Fig. 8.—Piece to fit over Frame.**

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### MITRES AND SCRIBES.

THE word "mitre," which appears to be borrowed from an ecclesiastical ornament, is used by wood-workers to express a joint which bisects an angle, giving to each piece of the material joined *equal* angles. The great majority of mitred joints require the united pieces to make a right angle, or 90°. The mitre angle, therefore, unless otherwise described, is always understood to be 45°. Picture-frames present a good illustration of mitres. As a rectangular figure must have its opposite sides parallel, it must also, of necessity, have its opposite sides equal. If these conditions are to be secured, the eight surfaces, which form by contact the four

uniting joints, must be equal in angle to each other. Taking our illustration from a picture-frame, a little consideration will show that a joint, to be satisfactory, must be at right angles to the plane of the frame in one direction, and must bisect a right angle in the other direction. Now, for mitres of the ordinary type—that is, of 45°—an appliance is, or should be, made by every worker. It would greatly help to secure a correct understanding of special requirements if the worker endeavoured to contrive any appliance to assist him. In the case of ordinary mitres, this is so well known that scarcely anyone makes the mitred joints of picture-frames and other right-angled work without the use of the mitre shooting-board.

For the rare cases in which other than right angles are required, it would not pay for the trouble to make a special block, but a very simple expedient presents itself. Suppose a triangular panel—such as that often used for enclosing the space below stairs—is to be moulded, the moulding itself may be made to assist, being parallel and fairly straight. A pencil-line can be made at the distance from the frame that the width of the moulding indicates. These lines will intersect, and a line drawn from the intersection to the angle of the frame and panel will show the mitred joint. The moulding may be cut to this line, and will then intersect properly.

In moulding door-panels, etc., it is best to cut each piece to fit equally tight, for the ends of a mitred piece of moulding are so easily bruised, and, of course, thereby shortened, that slight differences are easily overlooked in such a case. To make the best of it, put the tightly fitting pieces in last, bending slightly, so that the ends are adjusted first, and the middle pressed down afterwards. This expedient cannot be resorted to in the case of short lengths of stout moulding. Scribing mouldings is a useful method in internal angles, often used in sashes. It consists in tracing the line, which would be made in mitring, on *one* of the intersecting mouldings, and not on both. All the wood that would be covered by the moulding must be then cut away with chisels and gouges, exactly up to the traced line. This, if done properly, is equal to a mitre in appearance, and gives a slight opportunity of adjustment, which the mitre does not.

The judgment of the operator must decide which piece is to be scribed, and which left square. Scribing is often resorted to when various moulded members of different pattern are brought together, in which case a template is of great assistance.

## OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

### 116.—Aublet, Harry & Co.'s Improved Instantaneous Band-Saw Vice.

The length and peculiar formation of the band saw, which, after the manner of an endless cord, is an endless strip of serrated metal, renders it somewhat difficult to hold in a fixed position during the operation of sharpening and setting. It has been reserved for Messrs. Aublet, Harry and Co., who are as yet best known by reason of the excellent quality of the French band saws that they supply, to introduce a vice of sufficient length and sufficient power of grip to hold with firmness a tolerably long piece of a band saw in its jaws while the saw itself is being sharpened and set. The vice itself, when fixed in position to take the saw-blade, is shown in Fig. 1. The jaws and, indeed, the vice itself, are 13½ in. long. The pressure of the jaws which grip and hold the vice is greatest when the handle is in the position shown. When the handle is raised, the pressure is diminished, and the saw-blade is easily removed; but when the handle is depressed, the jaws of the vice are driven into the closest possible contact with the saw, and the saw-blade is held immovable in their grip. This

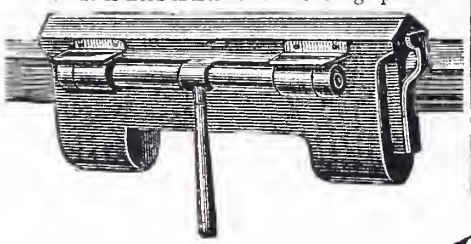


**Fig. 1.—Aublet, Harry & Co.'s Improved Instantaneous Band-Saw Vice.**

is produced by the action of the ends of the bar to which the handle is attached, after the manner of a cam, and when the pressure is withdrawn the jaw in front is apparently fixed outward by the expansion of coiled springs fitted within. At each end of the vice are guides which can be adjusted to suit any width of band saw. The price of the vice is 25s. They should be found in every workshop in which band saws are used.

### 117.—Moor's Blowpipe, for Dentists, Jewellers, Opticians, etc.

A short time since I had the pleasure of noticing an excellent retort stand, which had been invented and introduced for use in the chemical laboratory by Mr. C. G. Moor. He has now placed operative and analytical chemists, dentists, jewellers, opticians, and others under new obligations to him by the introduction of his new blowpipe, as above, which is admirably adapted for the work of brazing and hard soldering, and equally well adapted for ordinary soft soldering, as practised in the metal trades. The blowpipe itself, as Mr. Moor himself explains, "is simple in construction, substantially made, and does not easily get out of order." Its construction will be understood from Fig. 2. The frame can be easily regulated in size, and is of great intensity. A supply of gas is obtained from any gas burner by means of the upper tube, the end of which is composed of tubing of larger diameter than the other tubes, that it may be the more readily slipped over the burner. The lower tube is fitted at the end with a glass mouthpiece, through which the operator blows to increase the intensity of the flame. The lower tube is led into the upper tube near the end of the latter, and the gas and mingled air then passes through a metal tube, to which are attached metal arms in a cruciform arrangement which slides along the tube. These apparently form a support for the metal end of the blowpipe when laid down after using it. The extreme flexibility of the blowpipe, and the ease with which the flame can be directed and applied to all parts of the work, render it a most desirable appliance in the trades named above. The flame gives heat sufficient to melt silver or copper, and even platinum wire when used with hydrogen. The size of the flame can be regulated when in use by compressing the gas tube between the fingers and the palm of the hand. The price of the instrument complete, post free, is only 2s. 9d.

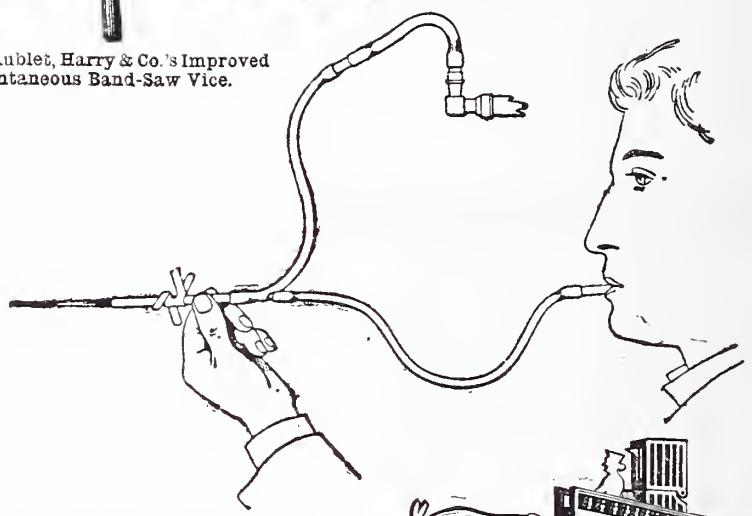


**Fig. 2.—Moor's Blowpipe, for Dentists, Jewellers, Opticians, etc.**

### 118.—Automatic Savings Bank in Fretwork.

Messrs. I. & J. Soar have recently produced some capital designs in fretwork which can be made up into automatic models, which will, no doubt, afford considerable pleasure to those who are fond of this kind of work, both in the making of the toy and in exhibiting its action after it is completed. The value of the model will be apparent from Fig. 3, in which the lower part is a

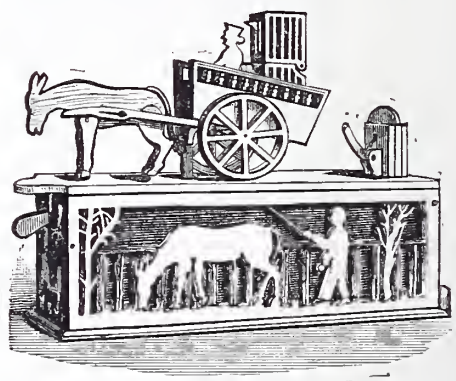


**Fig. 3.—Automatic Savings Box.**

box formed of fret-cut sides and ends and a catch in front and a door behind, which can be opened at the will of the owner. The fret-cut parts of box should be lined with plush. The legs of the donkey on top of the box are first put in position, and a penny is placed in the slot shown at end of top to the right. The catch is pressed upwards to the top of the box, and then a series of events happens in the following order: The donkey's hind legs, being released, fly upwards, the cart is tilted back, and the figure in the cart and the crate behind him are thrown backwards, the crate hits the projecting catch in front of the slot, and this, in its turn, facilitates the descent of the penny through the slot into the box. The inventors have other designs in hand which will be ready shortly. The sum charged for each sheet of designs necessary to make the model is 2s. The designs are clearly and boldly drawn, and will present no difficulty in cutting, even to indifferent fretworkers. The Editor.

# SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

## I.—LETTERS FROM CORRESPONDENTS.

**Varnish.**—A WOODWORKER writes to F. P. (*Newport, Mon.*) (see pp. 699 and 702, Vol. III.):—"In the directions given for making varnish with methylated spirit, shellac, and benzoin, you say the fluid is to stand in an open vessel for a few days, then strain for use. Would not some of the spirit be lost? and as alcohol has an affinity for water, would not the spirit attract watery vapour from the air? and as few people know much about the subject, would you kindly explain the advantages of such exposure in an open vessel? I believe I have come across similar advice in making varnishes with turps, 'at that is so different to methylated spirit that by no means follows that what is good for one solvent is proper for the other. I ask not for the sake of criticism, but solely to gain information."

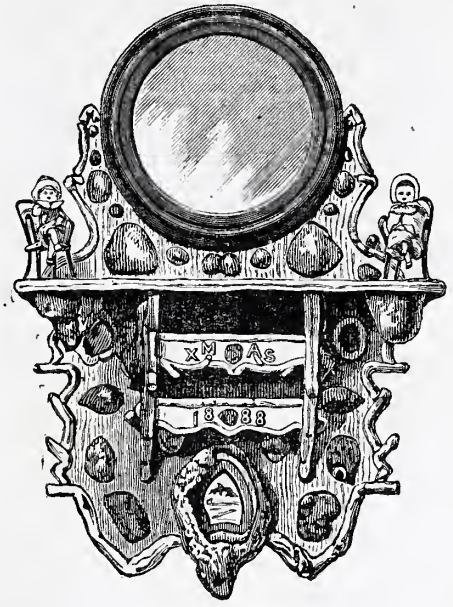
**Wire-Work — Errata.** — J. S. (*London, E.C.*) writes:—"In the inscription under my first series of sketches on p. 692, No. 148, Vol. III., where an allusion is made to Fig. 150, the word 'handle' should be replaced by 'ladle.' And in the same number, in p. 702, the word 'lever' in line 9 of my reply to R. J. (*Burdett Road, E*) should read 'sever.'"

**Testing the Accuracy of Framework.**—J. S. (*London, E.C.*) writes:—"I should like to add a trifle of justifiable stimulus to this 'storm in a tea-cup.' I have not differed in the slightest degree with J. C. K.'s methods. All I did was to protest against his assertion that the simple method was misguiding. I will leave it to the judgment of the readers whether I do not come forth from this scrape untainted, untarnished—well, that's enough. In referring to the last sentence written by J. C. K. on p. 683, where he says, 'If the opposite sides of a picture-frame are equal, and the angles square, no other test is wanted for accuracy,' I will ask if I did not claim that my method was a means to this end. It was to test the squareness of the angles for which I sent the few notes."

**Testing Accuracy of Framework.**—G. P. (*Elgin*) writes:—"I note a further communication by J. C. K. (*London, W.*), *re* the above subject, in WORK, No. 147, p. 683. He there states that 'if the square frame is winding, the diagonals being alike for length would prove the frame was not square at two angles.' That may be so; but what would be the use of, for instance, a picture-frame that was winding? How would the glass lie in the rebate? No, it would not do at all; and no man in his senses would put such work out of his hands. Euclid was referred to to prove my statements; to make an assertion is one thing, to prove the truth of it is another. It is certainly true that the laws of Euclid would prove that the same length diagonals might indicate a trapezoid; but the opposite sides of a trapezoid are not equal, and as the test, about the accuracy of which we differ, is for the squareness of picture-frames, carcases of dressers, etc., which must have their opposite sides equal, I cannot see why the properties of trapezoids have been pushed into the discussion at all. From the last sentence of his communication, I am led to believe that J. C. K. has read my former letter hastily, and has gone away with an erroneous idea of its contents. In that sentence he states a truism: I endeavoured in my note to show that if the opposite sides of a figure be equal, and the diagonals be also equal, then the angles of the figure are bound to be right angles."

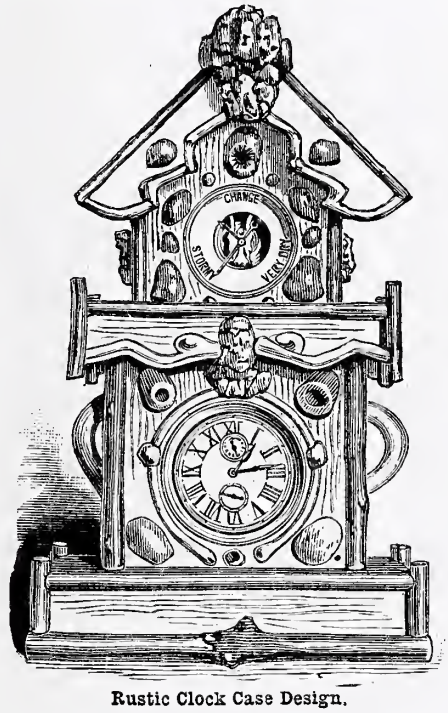
**Macramé Board.** — C. E. M. (*Birkenhead*) writes:—"Will you allow me to correct a misunderstanding in reference to a description of my macramé board, which you published on p. 420, Vol. III.? The writer of the article which appears in No. 147 on 'An Easily-made Macramé Board' mistakes the object of the attachment which I described. He supposes it to be an appliance for holding the vertical strings taut while ornamental knots (such as the Solomon's knot) are being worked on to them. If PASQUIN will turn to my letter again, he will see that that was not the idea at all. It is 'for gripping *the lace* when a long piece is being worked'—*i.e.*, when a piece of work is being made longer than the board, and has to be moved along; to obviate hooking it on to the pegs or screws, and thus dragging the lace, I place it under the spring as described. My board has no arrangement to meet the other difficulty; I have, therefore, overcome it with practice, and always hold the strings tightly between the third and fourth fingers and palm of my left hand."

**Rustic Work.**—P. H. (*Allendale Town*) writes:—"The readers of WORK may be glad of the accompanying designs for a rustic bracket and clock case, made entirely of rustic knots cut from trees and ivy branches, split or sawn up the middle. The case is



Rustic Bracket Design.

fitted with drum clock and barometer. The bracket has a spinning-wheel rim to form a mirror, and looks much nobler than it does in the drawing. It is easily made."—[We are always glad to give insertion in "Shop" to little novelties of this sort,




Rustic Clock Case Design.

and your example might well be followed by others of the thousands of WORK readers. There must be many who have home-made novelties of this order which they could photograph, and send for the benefit of brother chips and workers.—ED.]

## II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**WORK—How to Serve.**—SCHOOLMASTER.—We are glad to get your assurance that you subscribe regularly to WORK, and to hear of your anxiety to help the publication. As you cannot write articles nor draw, what you had better do will be to take two copies instead of one, and push the duplicate off to a friend or relative. If every subscriber did this, WORK would have a truly phenomenal circulation.—ED.

**Quarter Horse-Powor Engine.**—A. W. C. (*Kilburn*).—In Nos. 106, 110, 121, 125, 131, 136, 141, and 145 of WORK will be found articles on this subject.

**Phonograph.**—WIN.—Consult the indexes to WORK, Vols. I. and II.

**One-eighth Horse-Power Hot-Air Engine.**—WIN.—This subject is more fitted for an article than a "Shop" reply. You must kindly wait.

**Water-Colour Painting.**—BLUE EARTH.—A good book on this subject is "Painting in Water Colours," by R. P. Leitch, published by Cassell and Co., London, E.C.

**Nose Instrument.**—J. J. (*The Park*).—We do not undertake to give information about shaping noses in WORK. If your nasal organ does not commend itself to you, and you really cannot reconcile yourself to it, then write to some medical paper, or consult the London Directory for addresses of makers of appliances such as you describe.

**Wheelbarrow, etc.**—PROMETHEUS.—The wheelbarrow article appeared in No. 68 of WORK. Do you refer to "Lighting Arrangements in Temporary Decoration," in WORK, No. 142, by hand light making?

**Incubator Fittings.**—J. W. (*Loughborough*).—For reply to your query, see previous replies in "Shop," or consult the advertisement pages.—LEGHORN.

**Incubator.**—G. S. W. (*Dewsbury*).—You need be under no apprehension that opening the lid will interfere with the regulator. Of course, the rod, R R, will be disengaged from the adjusting screw, S, of damper, but by opening the lid you will naturally reduce the temperature very quickly. The ether vapour will then again liquefy, the mercury will rise in the short limb of tube, and, consequently, fall in the long limb, carrying with it the plunger and rod, so that by the time the lid is closed all will be clear. If, on opening and closing the lid quickly, the weighted end of damper lever is depressed, the rod will resume its normal position, when the lever can be lowered on to it, the screw, S, engaging with the top of rod as before. A joiner making a dovetailed box would make box and lid all in one, and separate by sawing, as I described. If you do not think you could manage to cut it truly, make it in two by all means. Either way, the hinges would have to be fixed to the lid proper, as you term it. It is, however, not nearly so difficult a job as you imagine. For glass tube and thermometer, see previous replies and advertisement. See that the hole in lid through which rod passes is sufficiently taper to allow it to clear on closing the lid.—LEGHORN.

**Ebonising Carved Pinewood.** — H. C. F. (*Hungerford*).—The way in which I have been accustomed to ebonise pine, whether carved or otherwise, has been to brush the wood twice over with a hot and strong decoction of logwood, and afterwards with a solution of iron (made by putting small scraps of iron in a bottle with vinegar), also applied hot; when dry, to go lightly over with fine sand-paper, and to polish with beeswax and turps. But there are other ways of ebonising; and in the back numbers of WORK you will find the matter frequently discussed. Some use a solution of copperas (sulphate of iron) instead of that above mentioned. Some mix the ingredients before applying, and add a little lamp-black or indigo to make the stain more intense. The least trouble is to buy an ebony stain, of which there are plenty in the market. As to the mountings for plush frames, you can doubtless get them from the dealers who supply photographers' sundrics. You might try Harger Bros., Settle, Yorkshire, who advertise in WORK, and who could supply you with the brass back legs.—M. M.

**Collodion Jelly.**—JELLY had better dissolve the jelly in a mixture of equal parts of pure alcohol and ether. If he adds about as much as before the drying took place, and shakes it occasionally, it will soon be restored to its original consistence. The jelly may be broken up in the bottle to facilitate the solution.—D.

**American Organ Building.**—TREWERK.—We have made inquiries, and cannot learn of any work on the making of American organs.—G.—[A series of papers are in hand, specially written for WORK.—ED.]

**Incubator.**—J. F. W. B. (*Leicester*).—(1) The incubator described in No. 143 cannot be purchased complete from any firm, it being my own design, and particulars not having been previously published. If you will send me your address, I will write to you privately. (2) Fittings cannot as yet be obtained from any one firm. Some I bought, and some I made; but if there appears a demand for sets of fittings, I will try and arrange with someone to supply complete sets or portions as required.—LEGHORN.

**Quasi-Square Turning.**—DICK 2.—Yes, this may be done, as you suppose, by cutting in a large turned cylinder several long deep slots of square section. The pieces to be turned would be planed square, so as to fit the slots in which they would be secured. In turning the several pieces of work, the cylinder edges between them will also be turned, so that when each piece has been unfixed and turned quarter-round, the moulding on the cylinder will form a guide for the tool. The three first sides can be turned so that the edge of the work will have the support of the side of the groove; but to prevent breaking down the last edge, a slip of wood must be

carefully fitted in. Perhaps, by great care and with some kinds of hard woods, this precaution might not be required. Is it a *model* hot-air engine that burnt out in a fortnight? What a shame!—F. A. M.

**Boring.**—J. W. (*Glasgow*).—Centre the wood at each end, and mark centre lines on the four sides; then fix it in a horizontal position by cramps or similar means. It will be, perhaps, advisable to have a centre line on the supports as well, so that in case the wood has to be turned end for end, it can be fixed in the same position. Then fix two bearings of hard wood for the shank of the anger to revolve in: these must be exactly central with the centre lines on the wood, one being fixed about 1 ft. from the end of the wood to be bored, and the other 1 ft. from the handle of the anger. This handle should be a good length, so as to give a good purchase in boring. The shank of the anger must be sound and truly central with the boring end. The boring can now be done by revolving the auger in the bearings; and as the handle comes up to the outside bearing, provision must be made for shifting it inwards. The anger should be withdrawn after boring 4 in., and the hole well cleaned out. The utmost care must be taken to see that it is kept in line with those marked on the outside. Should it be found going to one side, the wood should be turned, and the boring commenced from the opposite end. I have seen a tree 20 ft. long bored in this manner for a pump. It would be better to keep the wood larger than 2 in. till it is bored, for fear of getting out of truth. This method may be used for a small number, but if a large number are to be done it will be better to have a machine, as this will be a very slow and tedious process. If you require a machine, you might get one from Messrs. John McDowall and Sons, Johnstone, near Glasgow, as they are makers of wood-working machinery.—M.

**Metal for Photo, etc., Frames.**—C. E. L. (*Andover*).—Gilding metal similar to your sample may be obtained from Messrs. Smallwood & Co., Small Heath, Birmingham, or from the Berndorf Metal Works, Birmingham, who make a speciality of "Oreid" gold-coloured sheets and wires, and who will, on application for quantities, send you the current prices of the different gauges and widths. Another metal for photo mounts is called Britannia metal, and may be treated as found in an article entitled "A Novel and Artistic Photo Mount" (a piece of fancy work for engravers), pp. 141 and 142, Vol. III., of WORK. Price of metal is about 1s. 6d. per lb. There are also in the market numerous fancy and artistic designs in rolled sheet metal, and which are largely used for the purposes named above. The cheapest way of going to work for producing the ornamental material is to have a steel plate engraved with the required design, buying the sheet metal wholesale, cutting the same into sheets, and afterwards sending them to be re-rolled at a sheet metal (cold) rolling-mill. In conclusion, I may observe that nearly all metals fluctuate according to the market, so that a price-list of old date must be viewed with caution.—N. M.

**Boot and Shoe Repairing.**—J. R. (*No Address*).—The numbers of the papers since the paper on Blind Stabbing appeared are 126, 130, and 137 of WORK.

**Locomotive.**—C. W. L. (*Newcastle-on-Tyne*).—The furnace is too small for charcoal; you should have a spirit-lamp. The fact is, many of these toy locos. are frauds. I fear you can do nothing with it.—J.

**Bent Ironwork.**—J. C. (*Liverpool*).—I am preparing a series of papers on the subject for the approaching new volume of WORK, in which the various operations will be illustrated, and a number of designs given.—J. [Watch for No. 157.—ED.]

**Pattern-Making.**—F. W. (*Bradford*).—A journal devoted exclusively to pattern-making would not receive sufficient support to pay expenses. But the subject will be treated in WORK. You may get "Pattern-Making," by myself, published by Crosby Lockwood & Co., Stationers' Hall Court, E.C.—J.

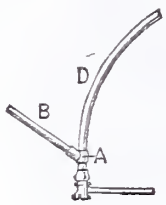
**City and Guilds of London Examinations.**—H. B. (*St. Peter's Park*).—"Elements of Machine Design" (Professor Unioni), "The Strength of Materials" (Professor Anderson), "Principles of Mechanics" (Professor Goodeve), "Steam and Steam Engines" (Jamieson), "The Steam Engine" (Cotterill), "Strains in Structures" (Professor Adams), "The Steam Engine" (Holmes), "Elements of Mechanism" (Goodeve), "Practical Mechanics" (Perry), and many others, may be studied.—J.

**Fret-Sawing Attachment for 2½ in. Lathe.**—SEAFARER.—I have been sketching one out for you, but it looks very cumbersome of wood on such a small lathe. You can make it look better by having castings made from your own patterns, but then it is not worth while to make patterns for only one machine. Altogether, I think you would do very much better to have a separate machine. There would be a good deal of work in yours, with vertical stroke and presser foot, and it is not worth while to do it all on such a little lathe. Get a No. 8 machine from the Britannia Co., then you can use the lathe to turn the little pillars and pinnacles for your fretwork brackets.—F. A. M.

**A Canvas Canoe.**—G. G. (*Llandudno*).—The following treat of canoe and boat building:—"Practical Boat Building for Amateurs" (Gill); "Yacht Designing, Yacht and Boat Sailing," by Kemp. The weight of the canoe, I should think, is about 50 lbs. I should not recommend making it shorter: that would make the lines too bluff and more difficult to paddle.—J. B. F.

**Home-made Novelties.**—HOBBYIST.—We shall be very pleased to see sketches or photographs of such articles from you or any other reader of WORK, and if they are worth putting before our readers, you will be paid the usual scale rate. You should address the Editor of WORK.—ED.

**Bicycle Castings.**—AN OLD SUBSCRIBER.—With reference to the castings for safety I have but one set remaining—namely, steering barrel, seat bracket, and bottom bracket. The bottom bracket is somewhat different from that shown and described in the articles, the only difference being that the tube, B, joins on to the curved tube, D, a little above the bottom bracket, as in the accompanying sketch, the lug, A, being easily procurable of any of the dealers in parts. I could not get more castings done under four weeks, but if the one set is of any use to your correspondent I will be glad to send them to him. A safety with 28 in. wheels need not have the wheel centres any nearer than given in the articles. There is a rage just now for a long wheel base—*i.e.*, greater distance between the wheels. A 1¼ in. solid tire of very best rubber is superior to a cushion tire, unless the latter is also of very best rubber, and the hole not over ¼ in. The bearings in the bottom bracket are Bown's knuckle-joint, and there is no necessity whatever for covering the shaft between the bearings.—A. S. P.



Bicycle Part.

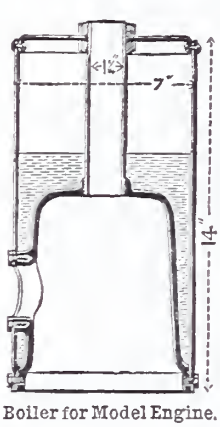
**Materials for Electric Alarum Clock.**—ANXIOUS ONE (*Rainton*).—If you will kindly turn to page 538, Vol. III., or, if you have the loose numbers, to No. 136 of WORK, you will find in the third column of "Shop," a reply to EXPECTANT, who asked where he could get materials for making coils. Any one of the firms mentioned in that reply will supply you with the bell, battery, switch, wire, and everything required to fit up the electric time alarum described by me in No. 32 of WORK. The whole will cost about 10s. 6d. at the lowest estimate, unless you make several of the parts yourself.—G. E. B.

**Tools.**—AMATEUR POOR MAN.—You complain of a tool-maker advertising in WORK, but you have placed neither name nor address on your letter. If the letters you have written to the tool-maker in question were equally faulty, we do not wonder at your getting no replies. Look into the matter from this point of view.

**Brazing.**—J. C. J. (*Gloucester*), A NEW ONE, and others.—For information on brazing, see Nos. 36, 42, 48, 50, 65, 76, and 92 of WORK.

**Vellum Drum-Heads.**—F. B. (*Clapham*).—For drum-heads in large quantities, you may apply to Messrs. Elzas & Sohnen, Barkeloo, Holland.—G.

**Boiler for Model Engine.**—A. H. (*No Address*).—How will this form suit you? It should be sufficient for your cylinder of 1¼ in. diameter and 2½ in. stroke. Shell of 7 in. diameter, Elmore copper tube ⅛ in. thick; top plate same thickness, flanged, riveted, and sweated to shell with soft solder; fire-box of cast brass, ⅛ in. thick. This avoids the difficulty of making the ring round the furnace door. It is an easy pattern to make; the casting will be turned in a lathe round the bottom, so as to drive tightly into the shell, and the mouth of the furnace also turned; joints made with red lead or soft solder, but if made with lead, boiler can be taken apart to examine. Chimney tube screwed into fire-box with red lead and joint at the top of boiler made with two nuts and red lead. If more steam is wanted, some "Field" tubes could be screwed into top of furnace, or some cross tubes might be put in. Working pressure 60 lbs.—F. A. M.



Boiler for Model Engine.

**Electro-Deposition of Iron.**—H. C. (*Surbiton*).—Unless you have had considerable experience in the electro-deposition of other metals, I should not advise you to attempt the electro-deposition of iron for an electrotype. Electrotypes are sometimes *faced* with a thin film of electro-deposited iron; perhaps this is what you mean. If so, you will not require a film ⅛ in. thick. I do not suppose you could get a deposit of workable iron so thick as this, even if you were experienced in its deposition. A solution employed in steel-facing electrotypes—that is, depositing a facing of iron on them—is made as follows:—Dissolve carbonate of ammonium in filtered rain water, at the rate of 1½ lbs. to each gallon of solution required. Suspend in this two plates of best charcoal iron, and pass a strong electric current from one to the other until a good deposit of iron is obtained on a test-plate of copper occasionally suspended in the solution to test it. When a good deposit of iron is obtained on the copper plate the copper electrotype may be substituted. This must be previously well cleaned with the usual potash solution, then rinsed in water, then dipped in a weak acid pickle for a few moments, well washed in water, and transferred at once to the iron solution. The anode surface of best charcoal iron must be seven times larger than the electrotype to be faced. A current of large volume at a pressure of 6 volts will be required. At the end of five minutes take out the electrotype, brush it with fine whiting and water, and re-immerse it. Repeat this every five minutes until a sufficient thickness of iron has been secured. Wash very carefully in boiling water, then rinse in cold water, brush dry, rub in benzine, then oil, and brush the surface with a soft brush. This is to prevent rust. This is only a brief outline of the process.—G. E. B.

**How to Soften Hard Boots.**—E. C. (*Folkestone*).—You say you "have tried all sorts of things, and they have failed." This does not give me much scope to give you any information, for if you have tried all, you must have tried the one I am going to tell you of; but still, as it is not always what is used, but the way it is used, I will tell you how. I have used it many times, and always without failure, and I think (any way, I hope) it will give you the same satisfaction. Let your boots be dry, and then give the hard parts a good drop of quite warm—but not hot—water. This, if done before the fire, will soak well in, and when you think it has gone right through, give them a good coat of neatsfoot oil, and keep them before the fire at a respectable distance, and as the water dries out the oil soaks in. As this action takes place, keep pressing the leather in different places to work it and make it mellow, and also, as this goes on, rub in one coat of oil as soon as the other has soaked in. Should this fail, let them lie by a day or two, and then repeat the above, first with the water and then the oil.—W. G.

**Boot and Shoe Repairing and Making.**—NOVICE.—In making riveted, pegged, or machine-sewn work, there is always between ¼ in. and ½ in. more stuff left on all round the bottom of the tops, or, in other words, the tops are cut longer and wider. This, because in this class of work the rivets, etc., are nearer to the centre of the sole than the sewing is in hand work, as the welt is sewn in nearer the edge, and any upper leather that is above the seam has to be cut off close to the welt. The leather is not (as you ask) subjected to any special treatment to soften it as a rule, though, if the leather is very stubborn, it can be made softer by damping it with water. All leather will form wrinkles and pipes in lasting, more especially at the toe, and here most at the extreme edge of the leather; therefore it is easier to last the first-mentioned work than it is to last hand-sewn (where there is only just enough to hold with the pincers). While lasting in the toe, only put a tingle in here and there, say, one in the centre, then the two draft tacks (one each side), and then (more particularly those you have the most trouble with—viz., "leather-lined") last up the lining first, only just knocking the tingles through the inner sole, so that they may be drawn out when you last the upper; and in doing this see that you last it smooth previous to proceeding with the upper. Then place a tingle between the centre and draft tacks. This will make or leave a pucker each side of it; these you try to tap or hammer out before putting in any more tacks. Every time you put in a tack, it should be through the top of one of these pipes or puckers, and when the toe has enough tacks in it, hammer it all round well, starting from the edge, and working to the centre of the sole, till you get to the edge of the leather. You will not get all the pipes out by this means, so you can cut a V piece out of each, and then top it down again, or the tops of them may be skived off; but, in either case, only cut to within about ¼ in. or ⅜ in. of the edge of the last, so that the rivets, pegs, or stitches have firm and solid leather to go through. By the above means light leathers can be lasted without the use of the knife at all. Perhaps the tops you used were small.—W. G.

**Kit of Tools.**—INTENDING CARPENTER.—For a kit of carpentry tools such as schoolboys could use, you cannot do better than buy of Melhuish, Fetter Lane, London, Hobday, Chatham, or one of the other tool makers who advertise in our columns.—W.

**WORK Exhibition.**—IVY.—There will be no WORK Exhibition this year, but due notice will be given in WORK of any similar exhibitions throughout the country. Secretaries should inform us.

**Mechanical Dentistry.**—AMOS.—In reply to your query as to how packing is done, there are two ways of doing this: the one is by taking your case off the model very carefully and sinking in the plaster—that is to say, you have your flask ready, and having mixed some plaster of Paris as before, pour into the bottom half level with the edge. Your case, we suppose, has been taken off the model and placed in cold water to prevent any alteration. You then take your case and sink in plaster, palate side downwards, deep enough for plaster to be half-way up the teeth; then allow to set, after which you must render non-adhesive the whole surface with liquid; then place the middle of flask on; mix some more plaster, about the consistency of cream, and fill up to the top, shaking well down while filling; then place its top portion on and put the whole under press and screw well down, and allow to stand, say, one hour, when you will be able to take your flask and place it in hot water sufficiently long enough to soften the wax on model; then you can take it apart. This you must be very

carcful about, as there is great danger in breaking away some portions of your counterpart: then pour boiling water over the whole to remove any portions of wax, as your flask must be quite clean. You then take your rubber, of which there are various colours, and cut it in slips, and place them on a hot-water plate, also to be had at a dental depôt, until they become soft. Having previously made your flask warm, which is of great assistance in packing, you then pack the rubber first well round the teeth, and then on the palate sufficient to take the place of the wax previously taken away. Then shake a little French chalk over the surface to prevent the two parts adhering; then put your flask together and place in press and screw well down; then unscrew press and open flask to see if you have sufficient: if not, add a little more, as your flask must be quite as close as with the wax. You then clamp it with an iron ring very tightly and transfer it to the vulcaniser, in which is placed about half a pint of water. The flask is then put inside and the cover screwed down quite tight, the gas lighted underneath, your thermometer placed in position and watched until it registers 315° Fahr., and kept at that for seventy-five minutes. Then turn your gas off, and allow to cool down sufficiently for you to be able to take it out, when, with a few sharp taps with a mallet, you will be able to divide your flask, and take out your case, and after washing all plaster off you finish your work with scrapers and files and finally polish, and your case is ready for the patient, for, as I before said, if the impression and model are correct so must your case be when finished. I will, later on, give a description of the process of making gold plates, and hope that the preceding letter may be of some service to parents who contemplate giving their sons an opportunity of being taught the profession, as for good workmen there is a great demand and good salaries paid; but the great secret is to place them in a good house, where they will have an opportunity of seeing the various cases made, which is necessary if the work is to be thoroughly understood.—DENTA.

**Model Engines and Motors.**—W. W. (*Cross Hills*).—If you had told us what you wished to work with the motor, I should have been better able to advise you. You will experience most trouble and expense with an electro-motor of 2 man-power, driven by current generated in a battery. You can get such a motor from Mr. Bottone, at a cost of about 50s., exclusive of battery. Electro-motors are only admissible in situations where some inconvenience would be experienced in the use of a model steam engine, a gas engine, or similar motor. Model steam engines are made by Mr. R. A. Lee, High Holborn, London, E.C. The castings for the ¼ horse-power horizontal engine described by F. A. M., in WORK, are sold by Mr. H. Milnes, Ingleby Works, Bradford. Probably Mr. Milnes will make the engine for you, as you cannot make it yourself. Have you noticed the advertisement of the Robinson hot-air engine in WORK? Perhaps this will suit your requirements. Small water-motors are made by W. H. Bailey & Co., Albion Works, Salford. Consult advertisements in WORK.—G. E. B.

**Camera.**—BUSY BEE.—The "Facile" camera, made by Fallowfield, Charing Cross Road, W.C., would suit you. All *very cheap* cameras are necessarily slightly made, and soon get out of repair, so, in the end, a more expensive one is really the cheapest, especially if it has to stand the continual vibration of a bicycle. We have had no experience with the instrument mentioned; it would be, probably, as good as might be expected for the money. Griffiths' guinea camera, or one made by Tylar, Birmingham, are both very good for the money; but you must not expect too much. You cannot do better than use Ilford plates for the negatives. Special plates are made for lantern slides. Thomas, or Mawson and Swan supply very good ones, as do many other makers. The formula for the developing solution is printed on each packet of plates. Hydrokinone developer is very suitable for this work. With any plates the following formulas will be found to answer: (A) Hydrokinone, 15 grains; meta-bisulphite of potash, 20 grains; water, 1 ounce. (B) Carbonate of potash, 180 grains; water, 20 ounces. For use, add 2 drachms of A to 5 ounces of B. Plates can be developed in this solution one after another until the developer is exhausted. A little of Judson's green dye diluted, and applied with a camel's-hair pencil, will answer very well; the other coloured dyes can be applied in the same manner. Consult the advertisements in WORK.—D.

**Small Galvanic Battery.**—J. M. (*Glasgow*).—A small galvanic battery may be constructed of copper and zinc sheet cut into strips 1½ in. by 1½ in., and immersed in weak vinegar contained in egg-cups for cells. Solder the copper and zinc strips together in pairs (except one of each kind, to form the poles of the battery at each end), and place one of each pair alternately in each egg-cup. The current from this battery will be weak, and will not be constant. If the zinc strips are amalgamated—that is, coated with mercury—and the copper strips are coated with platinum, and dilute sulphuric acid is substituted for vinegar, the strength and constancy of the battery will be increased. All batteries described in WORK are galvanic batteries, and a large number of these have been described in back numbers. Kindly refer to your indexes under the heading "Battery," and look in "Shop" for the information you require. If you had told me what you wanted the battery for, I could have given you a better reply.—G. E. B.

**Band Saw.**—ANXIOUS.—You ask if there is such a thing as a home-made band saw. You also want a description of it. I am of opinion that a band saw cannot be made at home, but I will give you a brief description of how one is made. In the first instance, the steel is rolled hot to an 18 in. gauge: it is next rolled cold to the gauge required for the saw. It is generally rolled out in lengths from 60 ft. to 100 ft. After the cold rolling has been done the steel is pared down by means of a paring machine, which is of an ingenious design, to the exact width required. After paring, the process of hardening and tempering the steel follows. This is done by passing the steel through an oven-like furnace, the speed at which this is done being regulated in accordance with the heat of the oven. The steel is afterwards passed through a fish-oil bath. After the hardening and tempering are completed, the teeth are cut in by means of a self-acting toothing machine. This machine does its work with great regularity and at a high rate of speed, cutting from 400 to 500 teeth per minute. The glazing of the saw is the next process. This is accomplished by passing the saw between two glazing wheels, emery-powder being fed on the wheels as the saw passes between them. When glazed, they are then brazed, set, sharpened, and finally tested. A good band saw should stand a strain of not less than 180 lbs. for every $\frac{1}{16}$ of its width. After reading the above, ANXIOUS will be able to judge for himself whether a band saw may be made at home or not.—A. R.

**Setting over Loose Headstock for Taper Turning.**—A. J. C. (*Carlisle*).—I have not one of the Britannia Co.'s 6 in. headstocks, and cannot, therefore, give you the dimensions of it without writing to them for it, and that you may as well do as I. Now, as to how the loose headstock is set

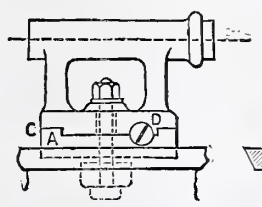



Fig. 1.

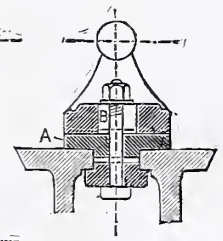



Fig. 2.

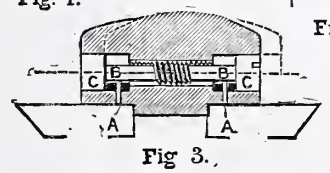



Fig 3.

Headstock for Lathe.

over for taper turning, the sketches will show how it can be done. Fig. 1 is a side view, and Fig. 2 a section through the headstock, which, you see, stands on a kind of shoe, A A, which fits between the shears in the usual way; to enable the headstock proper to slide across the bed on this shoe, the bolt-hole is elongated, as seen at B. The front, C (Fig. 1), is filed up bright, and there is an index line and scale engraved there to show central point, and also how far the headstock is thrown out to front or back. This movement is made, after slacking the holding-down bolt, by applying a screwdriver to the head of screw, D. Fig. 3 shows a way of fitting this screw. It has two heads, and is secured from moving endways on the shoe by a collar turned to fit at B B, and then cut in two, and each half secured by the pins, A, A; the hole for the screw is made first of the size B B, then enlarged with a pin-drill at each end to the size C C, then tapped for the screw-thread, which thread is then removed from the shoe, or lower half. Thus, by turning the screw the headstock may be moved upon the shoe, and then it may be clamped in any position by the holding-down bolt. A steady pin should be fitted through the sole of headstock and shoe, so as to enable the workman to return it to centre with more certainty than by means of the scale alone.—F. A. M.

**Marine Glass.**—BUTE has the tubes of an old telescope nearly complete that opens out about 20 in., the body tube being about 2 in. diameter, and wants to know what lenses are required, probable cost, and what to ask for. Lenses: object-glass, probably about 15 in. focus, and, say, 1½ in. diameter; without precise measurements of the tubes as to length, exact details cannot be given. The position of the erector must be found in the tube, then the focus of the object-glass must fall within the focus of the erector. Erector, two lenses: field, 1 in. diameter and 3 in. focus; second lens, $\frac{5}{10}$ in. diameter and 3½ in. focus; separated 4 in. apart. Eye-piece, two lenses: field lens, 1½ in. diameter, 3 in. focus; eye lens, 2 in. focus, $\frac{3}{4}$ in. diameter. These measurements are simply approximate. The cost of the object-glass will depend on quality; if an achromatic, about 5s. or 6s.; if non-achromatic, about 2s.; the other lenses about 1s. each. "What to ask for." Well, ask for what you want. If you write to a practical optician, such as Lancaster, of Birmingham, or anyone else who is pleased to accommodate amateurs, and simply say what you want, you will be supplied with the proper thing. What you need is a set of lenses for an erecting telescope, with the approximate measurement given. One thing be careful to ask—viz., how far the lenses in the erector must be separated, also the lenses of eye-piece, as the distance will depend on the exact focal length of the lenses. "How to chase a screw. I have a lathe." It is almost impossible to tell anyone how to do this. Is there no brass-fitter or mechanic in your neighbourhood? If so, ask him to show you; five minutes' seeing would teach you more than hours of reading. You will need a pair of chasers, inside and outside, which can be bought at any good tool shop. When the work is fixed in the lathe, turn rather slowly and steadily; place the chaser lightly to the work, and carry it forward at such a speed that with one revolution of the work the tool has progressed one thread. If moved forward too fast, the result will be that two or more threads will be chased on the work instead of one. It is exceedingly simple to watch one doing it, but to be able to do it is the result only of practice. As soon as the pitch is struck, then follow it up until the thread is cut sufficiently deep. If I were to write a page on the matter, I could not help you more. Practise on a piece of tubing, turning down the thread each time you fail.—O. B.

**Patent.**—J. W. M. (*Burslem*).—I believe it is generally understood that a patentee can allow his patent to lapse by ceasing to keep up his payments. The patent is granted for the fourteen years not absolutely, but conditionally, on the payment of the renewal fees.—C. C. C.

**Cycle Depôt.**—T. P. B. (*Bradford*).—It is somewhat difficult to give T. P. B. useful guidance in this matter. If he confines himself solely to repairs, it is little use keeping a stock of stampings unless he keeps a stock of all the different sorts and designs: and they are very numerous. When a repairer gets in a machine with a broken stamping, he may have a ton of stampings in stock, and not one of the pattern required. The rule is to send for a stamping or part by making a drawing of it, or finding a similar one in one of the catalogues. The only stampings that can be kept with safety are a few pair of rear-fork ends for cross-frames, a few cross-frame centre brackets, handle-bar T-pieces, clutch legs for steering-posts and seat-pillars, to fit 1 in. and 1¼ in. tubes, a few spoons for brakes, with forked ends for brake-rods, a few brake-pieces, and lugs for attaching to handle-bar; 6 in. and 7 in. crank-stampings may be kept, also finished axle and pedal pins. A small stock of weldless steel tubes should be kept, from 1¼ in. down to ⅞ in., falling by ⅛ in., some straight and curved forks, mud-guards and stays, L-pins for saddles, etc. A stock of spokes, both for safeties, ordinaries, and tricycles, is necessary, of a gauge from 10 to 15; also butted spokes, as many machines have the latter, the butt being No. 8, and the shank about 11 or 12. Cement for putting on tires is bought in hard lumps. Solution for splicing is quite a different thing, and is sold in bottles in a liquid state at most of the cycle shops. Enamel for touching up repairs is also got in bottles. Club black hard drying is very good, as it dries in ten minutes. An agent requires to keep a good show of finished parts and fittings, such as hubs, bottom-brackets, cranks, pedals, chains, saddles, bells, foot-rests, spanners, oil-cans, pouches, etc. etc. Taps and single-hole plates of the Abingdon make, which I have found to be very good, can be had: Nos. 11, 12, 13, from St. George's Cycle Co., and from several advertisers in WORK. T. P. B. should write to a few of the largest makers, sending his trade card, signifying his intention, when he will receive their catalogues and price-lists. The following firms will send illustrated lists of every possible part or fitting that goes to the make-up of the best cycles: Wm. Bown, Summer Lane, Birmingham; Hudson and Edwards, Sheepcote Street, Birmingham; Thos. Smith & Co., Saltley, Birmingham; St. George's Cycle Co., Upper Street, Islington, London; Brown Bros., Great Eastern Street, London; and the advertisers in WORK. I shall be glad to forward any further information to T. P. B., if he desires it.—A. S. P.

**WORK Volume.**—F. C. F. (*King's Cross*).—If you have applied to the publishers, as you say, and have failed to get the volume of WORK, then you should look out at the second-hand book-shops for a copy, or advertise your requirements in WORK. Some subscriber may care to sell his Volume I.; but your anxiety to possess a copy proves that the book has some increasing value.—ED.

**Altering Dimensions of Dynamo.**—O. G. (*Holloway*).—The alteration proposed by you could not secure the desired end. If, as you propose, you could take a Siemens dynamo having an armature 4 in. × 1¾ in., and field-magnets 4 in. × 3 in., and stretch them six times longer—namely, armature 24 in. × 1¾ in., and field-magnets 24 in. × 18 in.—you would not obtain any advantage whatever by the change. On the contrary, the internal resistance of the machine would be increased, and its output decreased in proportion. To increase the voltage of the current from a machine, you must wind more *turns* of wire on the armature, or run the armature at a higher speed. To get a larger output in ampères, a machine of larger proportions in every way must be built. In the series of articles referred to there are details of larger machines. Get the castings, and construct a machine according to the instructions given there; but do not presume to alter the dimensions until you know more about

the principles of dynamo construction than is shown in your letter. Your ideas respecting a dynamo to drive a motor and the motor to drive a dynamo, and an accumulator to drive a motor to drive a dynamo, are much like those of spending a penny to buy a penny to buy a pennyworth.—G. E. B.

### III.—Questions Submitted to Readers.

**** *The attention and co-operation of readers of* WORK *are invited for this section of "Shop."*

**Model Boiler.**—P. E. J. (*Gt. Bridge*) writes:—"Will any reader kindly inform me how to fix a model horizontal boiler in brick-work (boiler is 22 in. long and 12 in. in diameter, made of ⅜ in. plates)? If possible, kindly illustrate it by a longitudinal sectional drawing, showing the best way for fixing the flue, so that there will be a good draught for fire."

**Monogram.**—W. S. A. (*Kentish Town*) will thank any fellow-reader to favour him with a design for monogram for fret-saw work.

**Coffin Plates.**—H. E. L. (*Stockton*) writes:—"Could any correspondent kindly favour me with instructions how to letter coffin-plates (black ones only)? If so, I would estcem it a great favour."

**Telegraph Instrument.** — TELEGRAPHIST writes:—"Can any reader kindly inform me how I could construct a small single-needle telegraph instrument, and also the battery to work it?"

**Baize and Monogram.**—LOVER OF "WORK" writes:—"Will some reader kindly give me instructions for relaying my bagatelle board with green baize; also give me a monogram for fret-work with the initials J. W. B.?"

**Organ Bellows.**—C. W. T. (*Leytonstone*) writes:—"Will some kind reader of WORK inform me through 'Shop' the way in which the bellows suck the wind from the reeds of an American organ? I know the way the bellows are made."

**Steam Power.**—G. H. P. (*Norwich*) writes:—"Would any kind reader of WORK inform me through 'Shop' the price of a one horse-power (actual power) steam engine and boiler, and say if it is capable of driving a drilling machine and a small grindstone?"

**Electric Motor.**—C. H. (*Clerkenwell, E.C.*) writes:—"I should like to ask if any reader of 'Shop' would be kind enough to give me advice as to how to make a small electric motor? I am possessed of a fair amount of electrical knowledge, and wanted, if possible, to work it by battery power, and then the motor, in turn, to drive a small dynamo to light a small incandescent lamp."

**Carriage Building.**—R. S. (*Shelton*) writes:—"Will any kind reader oblige a beginner in carriage building with the dimensions for body-maker's tool chest, how to fit up interior, and what wood should be used for same? Also the probable cost of one ready made?"

**Mill Bills.**—W. H. J. (*Brentwood*) writes:—"Will any reader of WORK please state the process of tempering bills used by millers for dressing mill-stones?"

**Blackboard Composition.**—J. S. (*Amlwch*) writes, requesting the full address of Messrs. J. M. P. & Co. (*Nottingham*), makers of blackboard composition.

**Bagatelle Board.**—TASMON writes:—"I should be very much obliged for such information as would enable me to make a cheap bagatelle board about 7 ft. 6 in. long, giving kind of wood, cost of balls, and where they can be obtained."

**Gas Engines.**—YANKEE writes:—"Can any of your correspondents say if a gas engine has been applied as the propelling power in an ocean steamer? If not, would it not fill the bill, and he a great economy of boiler and bunker space? The gas to drive it could either be made from gasoline or from water."

**Engineering Drawings.**—BLUE EARTH writes:—"I should be very much obliged to any reader who can inform me where I can get coloured drawings, both engineering and architectural, illustrating the principles of cast shadows, etc."

**Bell.**—W. J. R. M. (*Sale*) writes:—"Will any kind reader give me a drawing of a dinner bell to hang on a bracket against a wall, so that it will swing to and fro by pulling a cord; and where to get a casting for an 8 in. bell, or a pattern for same, of the Old Church style?"

**"Great Eastern" Model.**—MODEL S. L. writes:—"I am about to build a model of the late *Great Eastern* steamship. If any reader can give me her dimensions, I shall be obliged—that is, her length from stem to stern, beam, depth from deck to keel, position of paddles, number and position of masts and funnels, and any other particulars that will be of use for making a good model, such as deck-fittings, etc."

**Monogram for Metal Working.**—WIN will thank any reader for a design for a H. E. B. monogram, to be cut out of metal.

### IV.—Questions Answered by Correspondents.

**Tatooing.**—THE JOHN WILLIAMSON CO., LD. (*London, W.C.*) write to APPRENTICE (see p. 654, No. 145), calling attention to their books on cutting, etc.

**Double Flageolet.**—C. B. S. (*Leeds*) writes to S. (*Bristol*) (see p. 702, No. 148):—"I have a first-class one, which I would sell for fifteen shillings. It has silver keys and ivory mountings."—[C. B. S. should advertise in our "Sale and Exchange" column.]

**Double Flageolet.** — B. A. B. (*Hampstead*) writes to S. (*Bristol*) (see p. 702, No. 148):—"This instrument, known as Bainbridge's Patent, was known in London some fifty years ago, and though quite obsolete as a musical instrument, may often be seen at second-hand or curiosity shops. Its tone is pleasant but feeble, and its musical value is trifling. The difficulty of playing it is greater than the effect produced."

**Oil Stone.**—M. (*Bishop Auckland*) writes to A. E. M. (*Cheshire*) (see p. 718, No. 149):—"You might try rubbing the face of the stone down on a level flag, with sharp sand and water, and finishing off with fine emery-powder. If this does not cure it, the only remedy will be to get a new stone. If you have to get a new stone, get a joiner to select one for you."

**Carpentry Kit.**—J. B. (*New Cross*) writes, in reply to C. H. J. (*West Bowling*) (see p. 718, No. 149):—"You want a list of tools for an amateur to begin doing 'household furniture' and 'cabinet making.' May I tell you that an amateur beginning has a lot to go through before he arrives at either of the two subjects he mentions. I do not think I can do better than band on the advice given me by an old chip when I was a lad. He told me to get a rule, a square (most important), a saw with teeth for general work, a medium-sized box plane, about 1 in. chisel, one or two gimlets and bradawls, a hammer, and a screwdriver. Then learn to use these well, but on something more simple than 'household furniture,' etc., to begin with. If you are quite a beginner, perhaps it may surprise you to know it is no easy matter to saw down a bit of 1 in. deal, say, 6 ft. long, making a good square cut, and right up to line from end to end, without practice. After you can use the above well, add to your list as you want them. The simple fact of wanting a new tool shows, in a small degree, that you know something of its use; and a tool, bought when required, is never money thrown away. Do not buy a lot of tools all at once—get them as you want them, and feel your way."

**Mangle Rollers.**—M. (*Bishop Auckland*) writes, in reply to LEARNER (see p. 654, No. 145):—"Holes are bored in the ends of the rollers, and the spindles—which have previously been turned—are driven in, and the roller is fixed in the lathe by the centres left in the spindles. You will require a long rest with two sockets and the ordinary wood-turning tools. You can turn them in a 5 in. centre lathe if you have sufficient power to drive it."

**Photography *versus* Painting.**—G. P. (*Elgin*) writes, in reply to A. B. (*Glasgow*) (see p. 686, No. 147):—"Oil paintings ought to be photographed on orthochromatic plates. A rapid rectilinear lens with a small stop should be used, and a suitable yellow screen fixed in front of it. The pictures should be fixed vertically, and the camera and dark back must be accurately levelled, so that the planes of the object and sensitive plate will be parallel. Care must be taken that the pictures are placed so that there are no injurious reflections from their glazed surfaces."

**Photography *versus* Painting.**—M. (*Bishop Auckland*) writes, in reply to A. B. (*Glasgow*) (see p. 686, No. 147):—"You will find instructions for copying oil paintings in 'Photographic Pastimes,' price 1s., published by Iliffe & Son."

**Indiarubber Hand.**—EDDIFRA writes, in answer to INDIARUBBER (see p. 702, No. 148):—"To receive correct information with regard to false hands, I called to see Mr. W. Marsden, the manager of Mr. Chas. Mackintosh & Co., Ltd., indiarubber manufacturers, High Street, Stockton-on-Tees. He told me they undertook to make all kinds of surgical appliances to order if they could not suit in stock; also, there is not much difficulty in making the fingers hollow—perhaps it would come in in fastening them to the hand. If you will write to them, and give them as much information as possible, or send them a model, they will be pleased to send cost. They have also branch establishments, and will give you the address of nearest branch, so you could personally visit them."

**Asbestos Cloth.**—EDDIFRA writes, in answer to JENWILL (see p. 702, No. 148):—"King & Co., Bristol, sell a cloth which they say is made of pure asbestos; also asbestos yarn spun from pure fibre. Send six stamps for catalogue."

### V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—OBLONG; W. W. (*Glasgow*); RICHMOND; R. J. H. (*Dublin*); T. H. F. (*Cornwall*); A. R. (*Scorrier*); R. T. (*Frome*); W. W. (*Balham*); NIGEL; A. B. (*Blackburn*); A. G. L. (*Stratford*); J. M. (*Dawley*); H. D. C. (*Bishopston*); A. F. (*Halifax*); J. G. (*London, W.C.*); WILLM; J. A. W. (*Waterford*); C. W. (*Openshaw*); SHOPMAN; T. W. (*Glasgow*); E. A. P. (*Cork*); F. E. B. (*Norbury*); P. S. (*London, E.C.*; G. R. (*Rushden*); J. B. (*Nelson*); J. M. B. (*Brixton*); E. J. P. (*Harrow Road*); W. T. K. (*Darwen*); T. H. (*Burnley*); HOLBORN; AMATEUR; F. T. (*Dover*); A. T. (*Sacriston*); G. M. (*London*); W. H. (*Padiham*); M. M. (*Edinburgh*); G. E. C. L. (*Ipswich*); E. T. (*Bolton*); G. W. (*Bournemouth*); J. L. S. (*Paisley*); P. R. B. (*Hitchin*); L. H. (*Everton*); BAPTISTA; W. H. C. (*Homerton*); J. L. (*Upper Holloway*; W. I. (*New Malden*); C. H. (*Ipswich*); CAWD HUD; J. B. (*Outlane*); B. H. R. (*Cardiff*); P. A. B. (*Manchester*); R. F. (*Kirkindillock*); F. P. S. (*Hemel Hempstead*); SENTINEL; G. F. J. (*Bristol.*); AMATEUR; TINKER; A. E. W. (*Purshore*); A. W. (*Lytham*); J. H. R. (*Sheffield*); G. H. *Rickmansworth*); C. K. (*Lockwood*); R. O. (*Rothe.hithe*).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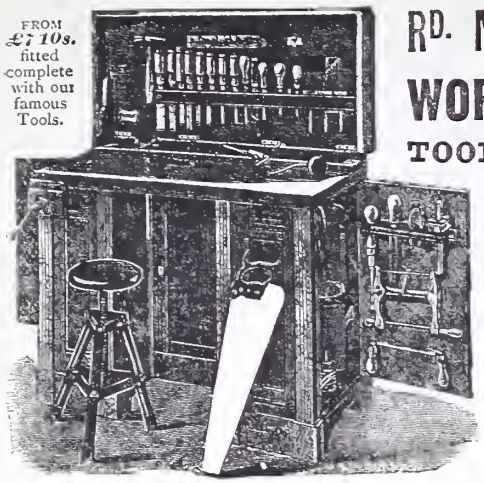

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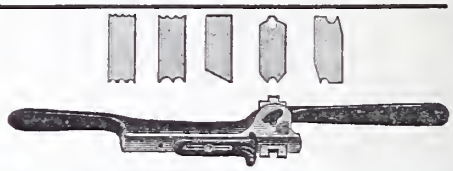

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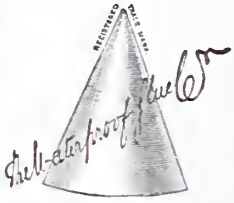


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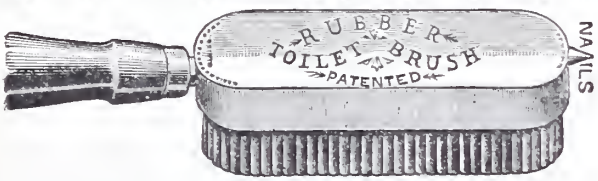


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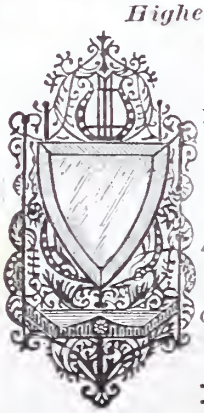

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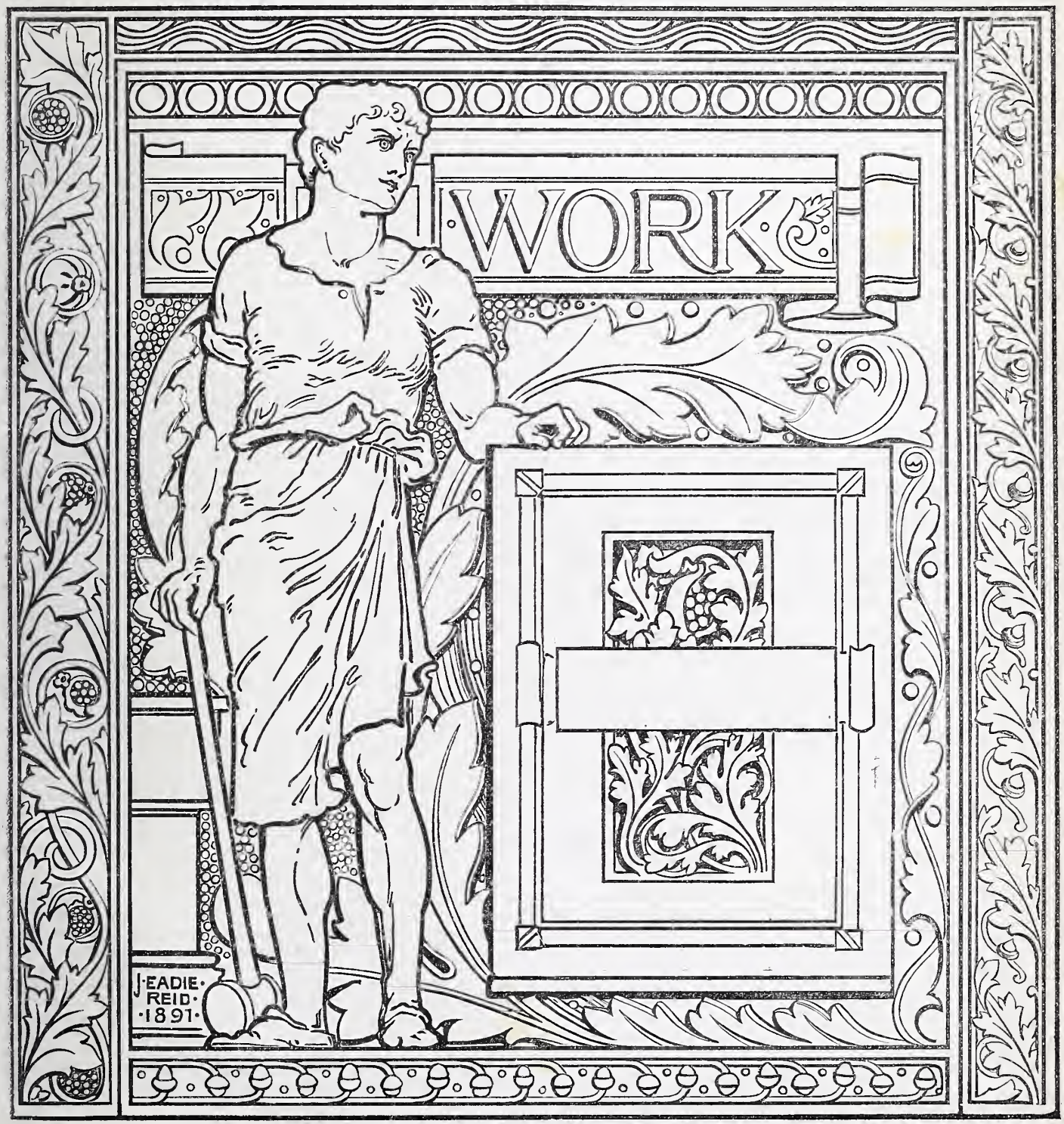
VOL. III.—No. 156.] SATURDAY, MARCH 12, 1892. [PRICE ONE PENNY.

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## DESIGN FOR ART WORK IN LEATHER.

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THE worker in leather, from the nature of his material, has before him an almost unlimited field for design. The wall-hangings, the tiny card-case, chair seats and backs, book-covers, etc., are all within his range. The quality of fineness in texture of the leather would of course be determined by the use for the article: pigskin, for instance, being preferable for dainty work, russet calf and such leathers answering for heavier articles.

The design which appears on the front page has been drawn specially as a cover for WORK. The block portion might be used as a card-case, while the borders will suggest many things to the worker.

The tools required are few and simple: a knife, a modelling tool, half a dozen ring tools, as shown at A in the accompanying illustration (these sizes will be found most useful), a few background tools, such as stars, shown at B, and a hammer. Having first sketched the design upon

Ring Tools (A), Star Tool (B), and Leather Ring (C), used in Leather Work.

the leather, cut the lines slightly into it with the knife, taking care not to go through. With a blunt tool then widen the cut, hammering the outer edge of the cut into the background, leaving the form standing in relief; to do this, the leather must be kept moist. The modelling and details can then be attended to and elaborated. In parts where "bossiness" is desired, it must be beaten up from the back. For this purpose it is necessary to have a few leather rings by you of varied size, as shown at C. Place the ring on the face of the form you wish raised, turn the leather carefully—seeing that the ring does not move—and beat into the ring (a blunt-headed tool will be useful for this). A paste made of bran put into the "bulge" will keep it raised; paper pasted over this again will keep the bran in place.

The design being now in a forward condition, it can be emphasised still more by giving texture to the ground. Star-shaped tools will now be found useful.

I have touched but lightly upon the salient points of the technique of this delightful craft. Experience alone will teach many of its subtleties—deftness will follow.

## THE MYSTERIOUS OR GRAVITY CLOCK.

BY CHAS. A. PARKER.

DESCRIPTION OF MYSTERIOUS CLOCK—SELECTION OF WATCH MOVEMENTS FOR MOTIVE POWER—PREPARATION OF METAL HANDS—MAKING RINGS TO CONTAIN MOVEMENTS—ATTACHING RINGS TO HANDS OF CLOCK—FITTING COVERS TO RINGS—MAKING AND FITTING HOUR HAND WITH MOTIVE WEIGHT—WEIGHTING AND BALANCING HAND—WINDING AND SETTING HAND IN MOTION—MAKING, FITTING, AND ATTACHING WEIGHT TO MINUTE HAND—BALANCING, SETTING, TIMING, AND REGULATING HANDS—PREPARATION OF GLASS DIAL—CUTTING GLASS DISC—FITTING SPINDLE TO DIAL—PLATE-GLASS DIAL—FAINTING DIAL.

THE mysterious or gravity clock which is illustrated in Fig. 1 represents a large glass plate painted with figures similar to the dial of an ordinary clock and suspended by means of a pair of silken cords, which pass through a couple of holes in the outer edge of the plate. A short spindle is cemented into another hole situated in the exact centre of the plate, upon which a couple of thin metal hands revolve, entirely free from any visible wheels or works of any kind, which thus renders the clock a source of considerable wonderment to those who are unacquainted with its manner of working, and causing the fingers of the mechanically inclined to itch with a desire to dissect its mechanism. To most people there is something singularly attractive in watching the almost imperceptible movements of a clock of this description, in which the steady and regular motion of the hands would appear to be produced by some hidden power. In the present paper the writer proposes to give sufficient manipulatory details to enable anyone who patiently and thoughtfully carries them out to construct a clock of this description which will not only go, but likewise keep accurate time.

Having thus introduced the subject to the reader, let us now turn to the details of manipulation. The first requisite will be a couple of small ladies' Geneva watch movements (without the cases), and of a uniform size of about an inch or an inch and a quarter in diameter: the movements employed by the writer measure exactly 1¼ in. Watch movements such as these can generally be obtained for about 1s. each from any local watchmaker, or, failing this, no difficulty will be experienced in buying them at a gold- and silver-refiner's in any large town, as these people frequently throw away the movements when the watch-cases are broken-up for melting. It will be necessary to pick out a couple of tolerably fresh-looking movements, which will keep going in any position when wound up. It will also be requisite to see that the motion work under the dial is complete. In order that the tyro may be certain of this, it will be found advisable to pick out a couple of movements with the dial and hands perfect, although in actual work we shall require neither. Nevertheless, by adopting this course he can rest assured that the motion work will be perfect. It is also advisable, if possible, to have the stop work in proper order, as this will prevent the possibility of the mechanism being overwound, and will likewise ensure the two hands travelling for a uniform number of hours, for without a stop work it might so happen that one hand would run down before the other, as it must be understood that they work independent of each other. The stop work of a watch will always be found attached to the underside of the barrel, but this can only be seen by first removing the dial. An experienced hand can, however, tell whether the stop work is perfect by the feel of the key upon the winding-up squares. Assuming a couple of movements of this description to have been procured, it will be necessary to just see that they are both going to time, and, with this end in view, they may with advantage be wound up and kept going until ready to be fitted to the hands.

The next proceeding will be the preparation of a couple of full-size paper plans of the hands, of which a suitable pair are shown (half size) in Figs. 2 and 3, or an alternative design of a more simple form in Figs. 4 and 5. It may be stated that the first-named are outlined from the hands belonging to the clock made by the writer, but in Figs. 6 to 8 will be found three other alternative designs, either of which may be employed according to taste. Having decided upon the design, a couple of full-size plans of half of the hands longitudinally should be made upon a piece of paper of suitable size, which is then doubled lengthwise, in order that the complete hand may be carefully cut-out by means of a pair of scissors. The paper plans, when ready, are pasted on to a sheet of thin brass of sufficient size, which should then be very accurately pierced to the form of the outline by the aid of a fret-saw with a very fine blade, after which the sawn edges are carefully smoothed to the exact curves and lines by the use of a second cut or smooth, half-round file.

For the convenience of those who are unable to do the piercing themselves, it may not be out of place to mention that Mr. H. M. Hewitt, of St. James's Square, Clerkenwell, metal-piercer to the trade, will accurately pierce a pair of hands to the design of Figs. 2 and 3 for a small sum. Having got the hands pierced, a hole should be drilled through the exact centre of the middle boss of each one, into which the hour motion wheel of an old verge watch may be soft soldered, in order to form the bearings upon which the hand may turn. Any short length of tubing of small bore would, however, answer the purpose as well, but in this case the reader might experience some difficulty in getting the hand to run perfectly true, whereas the flat portion of a motion wheel as above described will be found to afford a certain amount of hold for the solder.

The writer would strongly advise the reader not to make the hands of a smaller size than the plans given in Figs 2 and 3, as it would give the boxes containing the mechanism the appearance of being greatly out of proportion to the size of the hand, thus betraying their manner of working. Before proceeding further, the two watch movements should be made to fit tightly into a couple of half-inch lengths of thin brass tubing of sufficient diameter to contain them, both edges of each ring of tubing being accurately turned up in a lathe. An experienced hand in this case can dispense with the ready-made tubing by turning up a couple of half-inch strips of thin sheet brass and turning them into the form of a pair of rings of a suitable size to hold the watch movements, afterwards joining the two ends together with hard solder. On examining the outer edges of the movements the reader will doubtless find two or more small projecting brass pins, which have formerly served as an aid to fixing the watches in the case. By withdrawing these pins the movement may be made to fit closely into the metal ring, and when the latter has been attached to the hands, holes may be drilled through the sides of the rings, in order that the pins may be again pushed into the outer ring of the movement to again afford a means of securing it in position.

These two rings will now require to be soft soldered to the lower ends of each hand. This may be done by turning out to right angles, in either direction, the two outer leaves of the lower scrolls. Each leaf should now be moistened with soldering fluid, and then held over the flame from a Bunsen burner or spirit lamp, with a small globule of soft solder placed upon the outer side of each leaf. When the solder has covered the allotted space, the ring should be anointed with fluid in two places, and held over the flame in contact with the freshly tinned leaves of the hand until the union between the two is complete. When the ring has

been soldered to the lower end of each hand, it will be time to permanently fix the two movements in position, previously determining which shall constitute the front or outer side of each hand. Assuming the reader to have provided the central bosses with the motion wheels, as advised, it will be necessary for these to be at the back of the hands (next to the glass dial plate) out of sight. This being settled, the front of each movement should be inserted in the ring with the centre and wind-up squares just flush with the outer edge of the containing ring, and as the barrel will be the heaviest part of the watch, this side of the movement should be located at the bottom of the hand. When each one has been satisfactorily adjusted it will be well to secure them firmly in position by means of two or three small brass pins pushed through holes drilled in each ring and into the plate of the movement. In all probability the existing pins in the latter will simply require to be withdrawn and then replaced through holes drilled in a suitable position in the containing rings before mentioned. It is needless to say the dials will require to be removed previous to the movements being fitted into the hands, and great care should be taken not to lose any of the motion wheels but to keep them distinct for each movement.

A couple of small brass discs, barely $\frac{1}{8}$ in. larger in diameter than the containing ring of each movement, must now be cut to the form of a true circle, and afterwards provided with a slight projecting ring or ledge of metal, which should be carefully soft soldered on to the surface of each disc in such a manner as to transform each one into a kind of lid or cover, capable of being fitted on to either side of the containing ring of the movement, which will thus render the works accessible from either side and provide for the necessities of winding, regulating, or setting the hands.

Those of my readers who are the happy possessors of a lathe and metal-turning appliances will doubtless form these covers out of a disc of stout metal, of which the centre portion can be thinned considerably in order to lighten it, and thus provide the desired projecting ledge.

At this stage of the proceedings we shall be ready to make the two weights by which the hands are driven. For each of these mark out on a piece of sheet brass, or copper—about the thickness of a stencil-plate—a plan of the metal casing the exact shape of Fig. 9, which is drawn full size, the metal being carefully cut to the form of the outline by means of a pair of scissors, after which the sides are bent up to right angles in order to form the finished tray or casing shown in Fig. 10. Having got a couple of these trays exactly alike, proceed to fit one of them to the hour hand in the manner about to be described:—Take the hour motion wheel belonging to the movement fitted to the hour hand of the clock, and proceed to punch a hole in the end of the projecting rim of one of the trays of just sufficient diameter to pass over the tube or pipe of the motion wheel, fixing it in position by means of a touch of soft solder. This done, the interior of the tray should be moistened with soldering fluid and then filled with some solder, which may be melted over a Bunsen or spirit flame in an old spoon, and then poured into the tray, after which it is carefully trimmed up by the use of an old file. It is necessary that these weights should be neatly and carefully made, otherwise, in turning within the box, they might happen to come in contact with the sides of the latter and thus stop the mechanism. When the weight is quite ready it may be slipped on to the cannon pinion, with the minute wheel in its ordinary place. After having ascertained that the weight is quite clear of the box on all sides when the lid is on, and the set square is turned by an ordinary watch-key, it will be necessary to just rivet the boss of the minute hand on to the end of the set square (the rod upon which the cannon pinion is fitted) in order to retain the weight in its place. All that remains to be done now is to carefully float sufficient soft solder on to the under-side of the hand near to the point, in order to make it balance quite correct at the three and nine o'clock. It will, however, be necessary to see that it points true at twelve, and also that it hangs perfectly even at six. Should it happen to be a trifle out at either of these hours, it will require a little more solder on the under-side of one or other of the outer scrolls, near the point of the hand—at the same time remembering that the amount of solder must be regulated so as not to throw it out of balance at the three or nine o'clock. In actual practice the correct weighting of the hands may be said to be the part which will call for the greatest amount of care and attention. As an additional aid Figs. 11, 12, 13, and 14 show the correct position of the weight when the hand is pointing at twelve, six, three, and nine o'clock.

When the hour hand has been correctly weighted in the manner above described, so that it will balance quite equal at the four quarters of the dial, the mechanism may be wound up and set in motion, after which our attention will be called to fitting a weight to the minute hand in a precisely similar manner.

Having previously cut out and turned up another small tray similar to the one just finished, punch a small hole at the end of the projecting arm, of sufficient size to take the tube of the hour-motion wheel, which is then soldered to it in the same manner as before, after which the inside of the tray is moistened with soldering fluid and then filled with melted lead, being finally trimmed up with a file to match the previous weight. It may be stated, as a guide, that about one pennyweight of lead was used for each of these weights by the writer. The weight being ready for attaching to the movement, first remove the minute wheel, as this will not be required, and then pinch the tube of the wheel just soldered to the weight sufficient to allow of its being tightly pushed on to the cannon pinion, after which the boss of the minute hand is put on to the end of the set square, and then fixed in its place by means of a few taps with a light hammer. The weight should now be revolved in the case a few times, in order that it may be seen to be perfectly free at every part. As the weighting of the minute hand with solder requires to be carried out in a precisely similar manner in every respect to what has already been said with regard to the hour hand, it will be needless to repeat the process again. Suffice it to say that, as this hand is of a greater length than the other, it will not require so much weighting to make it balance true, and, when properly balanced every way, it can be wound up and set going in unison with the other.

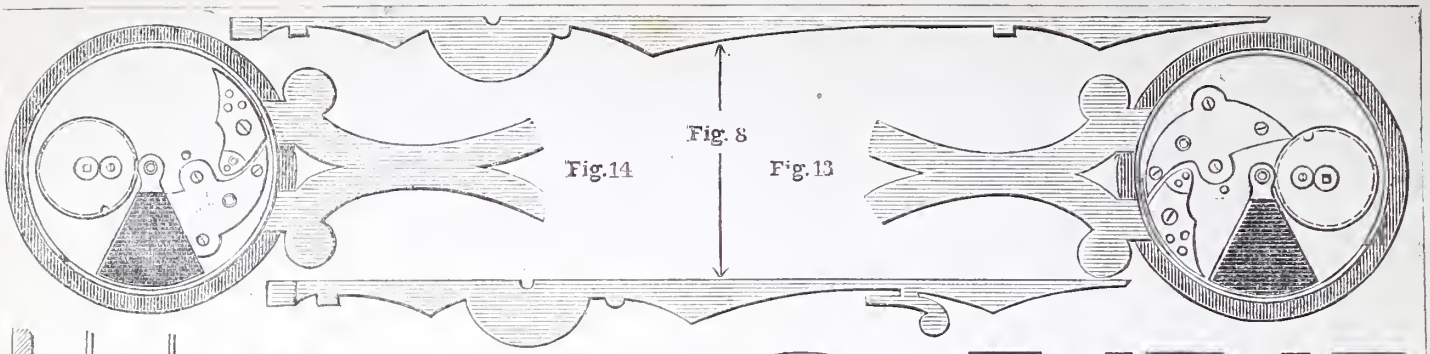
It will be found that, as soon as the hand has been started, the slightest movement of the small weight contained within the case will affect the hand, and cause it to move forward. If it should happen to move in short jerks, it is a certain sign that the weighting is at fault somewhere, and this should be remedied by cutting up thin strips of solder and bending them double, in order that they may be made to clip the hand at various parts, until it can be ascertained where they are required.

The watch is very easily set to time by removing the front cover and then turning the centre set square until it balances the hand at the desired hour; and as no works or wheels or wind-up holes are visible from the outside, it renders the clock truly "mysterious," and a source of great wonderment to most people. The only drawback to a clock of this description—if it can be called a drawback—is the necessity for winding it up every day. If the two movements have been carefully regulated in unison, the clock will be found to keep accurate time, as the two weights do not affect the going in the least, because every trifling decrease of the weight contained in the box caused by its moving onward will be found to add to the weight of the point of the hand, and thus to make it move forward.

For the purpose of trying the hands until the dial is ready, it will answer very well if they are pivoted upon a small French wire-nail, or a piece of thin, round umbrella wire driven into the wall.

Now that the clock is going, it will be advisable to turn our attention to the preparation of the glass dial-plate. For this we shall require a sheet of patent plate, of sufficient size from which to cut an 18 in. circle, which must be provided with an $\frac{1}{8}$ in. hole in the centre, and a couple more about 9 in. apart in the outer edge, to which to attach the silken cords for suspending the dial. Some of my readers may consider the cutting of a circular plate of glass of the size to be a matter beyond the capabilities of an amateur, but in actual practice this is not the case, provided that the following mode of procedure is adopted. In the first place, mark out a circle of the required diameter on a piece of stout millboard of sufficient size, and then cut this to the exact form with great care. The sheet of glass is now laid on a perfectly flat surface, with the millboard disc placed in a suitable position upon it, after which an ordinary sixpenny wheel glass-cutter is rapidly run round the outer edge of the card, care being taken not to press on the wheel sufficiently heavy to cause the glass to fly. When the circle has been cut—and not merely scratched—on the surface of the glass, the four corners of the plate are then cut across diagonally in the manner shown in Fig. 15, which will thus enable the operator to break away all the waste glass surrounding the cut circle. When the glass has been properly cracked by the action of the glass-cutter, it is possible to see the crack by turning the glass over on the reverse side. The diagonal portion can be readily broken off by holding the plate with the crack level with the edge of the work-board or table, and applying a uniform downward pressure upon the reverse side to the cut, any very obstinate portions being afterwards nibbled off by means of the slots in the glass-cutter. As soon as the plate has been cut, the edge will require to be ground smooth with very fine sand, after which the three holes are drilled in the positions before indicated by means of an ordinary glass-drill, heavily weighted, and a little emery powder and oil of turpentine as a lubricant.

At this stage of the proceedings, we shall be ready for the spindle upon which the hands are to turn. This can be formed



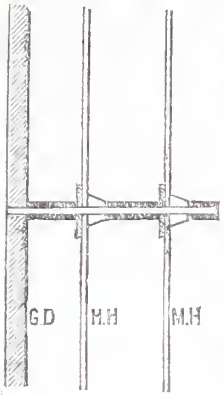



Fig. 16

Fig. 20

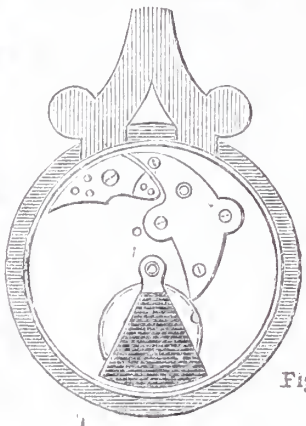


Fig. 11

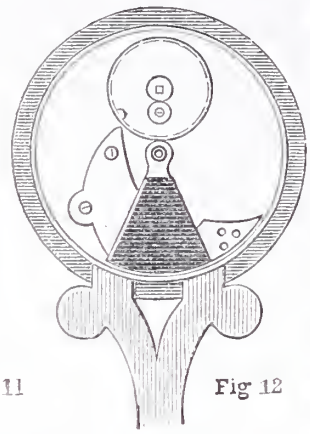


Fig. 12

Fig. 17. Fig. 18.

Fig. 19.

Fig. 2.

Fig. 5.

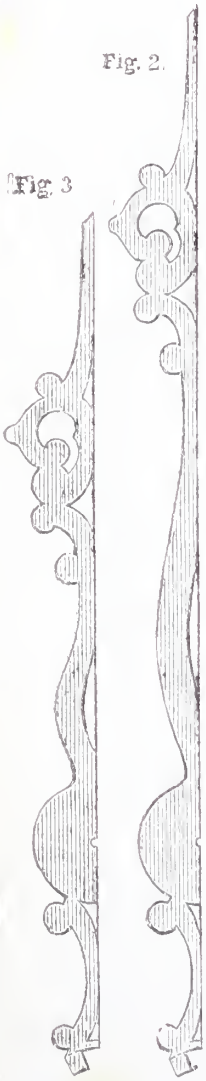


Fig. 3

Fig. 4.

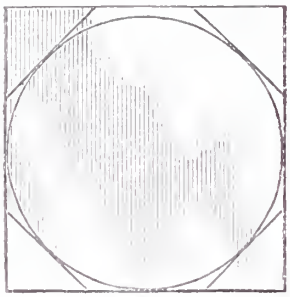


Fig. 15.

Fig. 9.

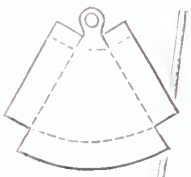


Fig. 10.

Fig. 1.

Fig. 6.

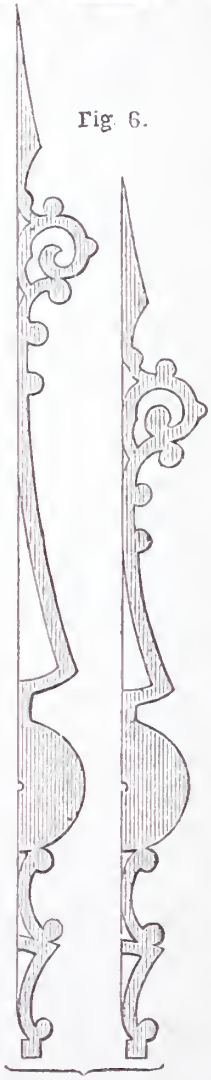


Fig 7

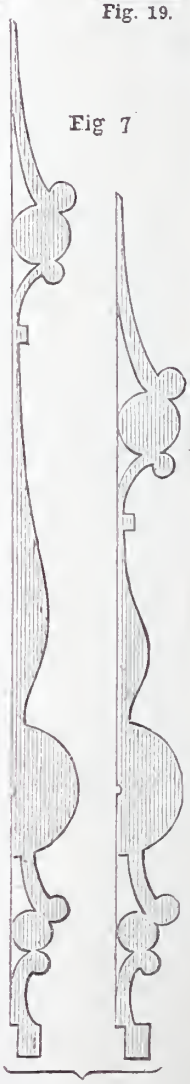


Fig. 1.—Mysterious Clock. Figs. 2, 3, 4, and 5.—Half-size Plans of Hands. Figs. 6, 7, and 8.—Alternative Designs for Hands. Fig. 9.—Plan of Casing for Weight. Fig. 10.—Weight complete. Figs. 11, 12, 13, and 14.—Position of the Weight at the four Quarters of the Dial. Fig. 15.—Plan of Glass Disc, showing Mode of cutting Circle. Fig. 16.—Section of Glass Dial, showing Spindle upon which Hands turn. Figs. 17, 18, and 19.—Full-size Roman Figures for Dial. Fig. 20.—Dots and Stars for denoting Minutes.

of an inch-length of straight steel or brass wire, upon which the hands will rotate easily. This should be fitted with three short lengths of brass tube of sufficient diameter to fit tightly on to the rod, and thus keep the hands apart, at the same time allowing them plenty of freedom. When the spindle is ready, it should be cemented into the central hole of the glass plate by means of a mixture composed of Le Page's fish-glue and plaster of Paris, made into a thick paste. Any other cement can, however, be used with equal success—as, for instance, Prout's elastic glue. Care should be taken to see that the hands run true before the cement has had time to set. Fig. 16, which is a section of the glass plate and spindle, will show clearly the disposition of the various parts.

For a large-size dial like the present, a dise of stout plate-glass would be far more preferable to one made of patent plate; but if the reader intends employing a disc of this description, he will find it impossible to cut it to the required shape and grind the edges without the aid of special appliances. He will, therefore, find it necessary to obtain it finished ready for use from some plate-glass warehouse. It may not be out of place to mention that Messrs. Hard and Austin, of Great Sutton Street, London, E.C., looking-glass manufacturers and silverers, will supply a disc of the dimensions required, with three holes drilled as described, for a few shillings.

The dial, when ready, can either be painted by a professional dial-painter—for instance, Mr. Pulman, of St. John's Square, Clerkenwell, who would paint a dial of the size with Roman figures for about 1s. 6d.—or the reader can cut the figures or numerals out of white, gilt, or black paper, and then paste them on to the glass by means of shoemakers' paste, Le Page's fish-glue, or similar suitable cement, small dots being used for the minutes and stars just above the numerals, as will be seen by reference to Fig. 1. The figures shown in the above-named cut can be enlarged, if desired, and cut out of paper as above directed. Three full-size examples of Roman figures suitable for this dial are shown in Figs. 17, 18, and 19. By cutting twenty duplicates of I, four of V, and four of X, the reader will thus have a full-size set of figures ready for pasting on to the glass dial-plate. He will also require forty-eight dots and twelve diamonds or stars the same size as Fig. 20. A touch of whiting mixed with a little soap, and applied to the under-side of the glass plate, will indicate the exact position to be occupied by the figures. Nothing less than two-inch figures should be used, as they would otherwise look insignificant by the side of the hands. The white-enamelled copper letters made by Messrs. Willing and Co. would, of course, look the best for the dial, but unfortunately the price is prohibitive to a great many, a complete set of two-inch Roman figures, with dots and stars, costing the not small sum of 13s. 6d. to make.

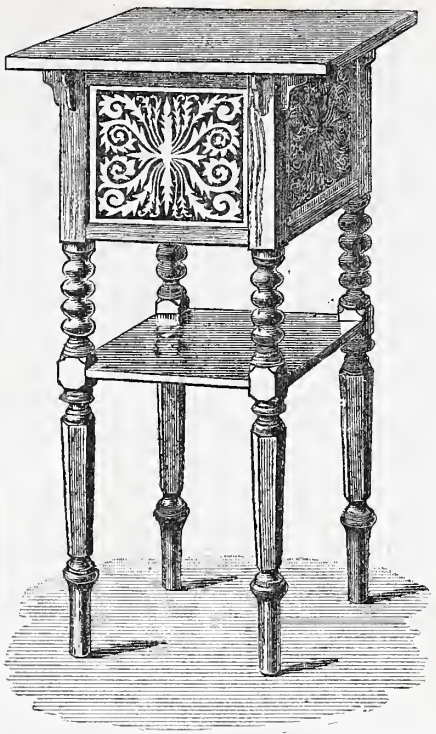


Fig. 1.—Work-Table complete.

## A TINY WORK-TABLE.

BY E. BONNEY STEYNE.

THE little table here illustrated is made from a set of turned legs, sold by Messrs. Duffy & Co., at a cost of 3½d. each in deal, 9½d. in pitch-pine for 1¼ in. size, and a trifle more for 1½ in., 1¾ in., and 2 in. respectively. The framework is of the simplest. A small cupboard is formed immediately under the top, enclosed by panels of fretwork. The quarter design given in full, if repeated to its intended size, will serve to fill either the front one only or all the sides, as the worker may wish. A shelf mid-way down the table assists in keeping the whole rigid, and increases the use of the little table. A deep drawer for work may replace the cupboard, or a drawer with a great bag pocket of fluted stuff, so frequent in old tables, may be added below the shelf.

The little table has no pretension to artistic beauty, but as an oddment, to be made in spare time at a small cost, may find favour in the eyes of our readers. The finish, whether ebony, enamel, or stained or polished, is a matter for individual taste to decide.

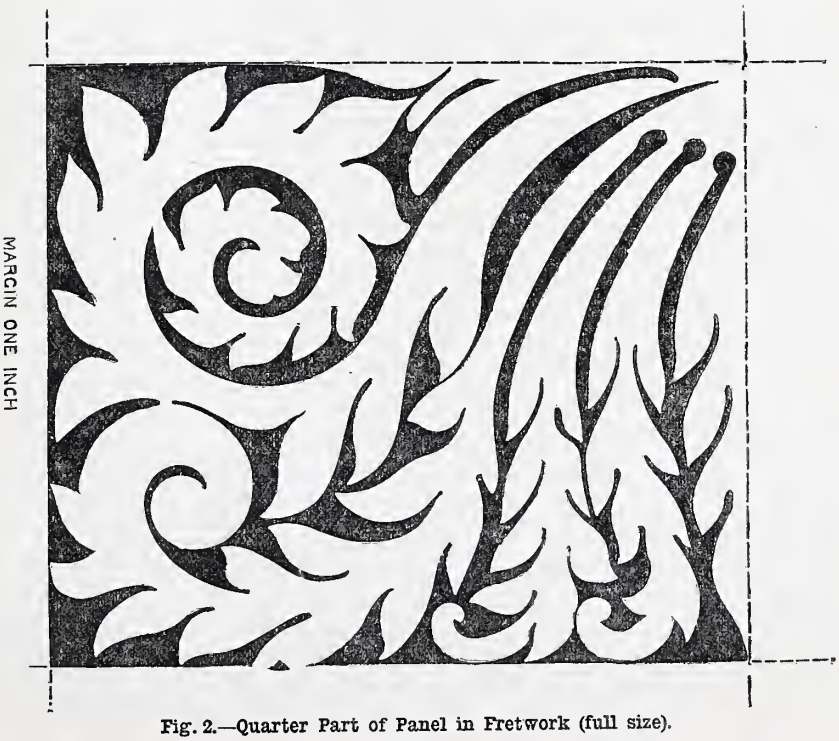



Fig. 2.—Quarter Part of Panel in Fretwork (full size).

## LENS SHUTTER ADAPTERS.

BY H. J. L. J. MASSÉ.

ADAPTERS—COST OF—SUBSTITUTE FOR—MATERIAL OF AND MODE OF FIXING—ADAPTING SHUTTER.

THE want of a ready means of adapting to my camera the three different lenses in my possession, without the delay in changing the front bodily each time, and without the expense of buying adapters (such as are sold for the purpose), led me during last summer to devise the following expedient.

In addition to the single landscape lens supplied by the makers of my camera, I occasionally use a wide angle and a rapid rectilinear lens. As the screw-threads on these where fitted on their flanges were all different, and as the flanges were all of different sizes, I found on inquiry that I should require an expensive universal lens-holder, or two separate adapters, one to adapt the wide angle and one to adapt the rapid rectilinear lens to the flange of the single lens on the camera. The estimated cost for the two adapters was about 6s., and, as I wished to economise, I took the flanges off the wide angle and the rapid rectilinear lenses, and screwed each of them on to a stout piece of leather, like that used for soling boots, which had been previously soaked a little, well hammered out, and allowed to dry. Then I chucked the flanges in the lathe, turning the leather in such a way that by removing a disc from the centre a washer of leather, bevelled on its inner edge, remained on each flange. These washers were then turned as to their outer edges, so as to fit exactly into the flange of the single lens.

Each piece of leather was cemented, as well as screwed, to its respective flange, for the sake of keeping all light out, and was well blackened with ink. Each flange is kept securely in its place on the camera front by two small brass buttons screwed on to the camera front.

I was led to adopt leather as being unbreakable, rigid, and not likely to warp. The weight of the two pieces of leather on the two flanges is practically *nil*, and the expedient has, so far, answered its purpose perfectly.

So far for the lenses. I next approached the subject of shutters. The one I use is a roller-blind shutter, a form to which I am peculiarly devoted, as it

gives the right exposure to the foreground. I had fitted it originally to the single landscape lens, and want of room prevented me from buying another for the rapid rectilinear lens; but, finding that the hoods of the two lenses in question differed so slightly in size, I slipped an indiarubber band on to the hood of the rapid rectilinear, and the cork back of the shutter fits on like a glove. By turning a washer of boxwood, or other hard wood, to fit the hood of the wide angle lens, the same shutter would do for that also; but with this lens I have, up to the present, required cap exposures only, as I have only used it for photographing interiors.

## CIRCULAR OR CURVED PANELLING.

BY "CHOPSTICK."

INTRODUCTION—CORRECT MEASUREMENT—SETTING OUT RAILS AND BLOCKS—GLUING UP AND CLEANING OFF INTERNAL CURVES—CONCLUSION.

I DO not intend this paper for the experienced joiner who is employed in a large establishment, where machinery for every purpose is at hand, and who would smile at the thought of doing a simple job by such primitive means, but rather for the small shop in the country where such jobs are few and far between, and where machinery is conspicuous by its absence. In such places it sometimes happens that a new counter front has to be made, and, instead of the common square corner to the panel work, it has to be rounded off, which, to say the least, looks decidedly better. When I was young and in the country ("about five miles from nowhere," we used to say), we had a bar in a public-house to fit up in this way, and I was ordered to make a piece of panelling for the front and a piece for the end, and fill in round the circle with narrow pieces of match-boarding. This did not suit my fancy at all, so I set my wits to work and made it in the way I am about to describe. The first thing to do is to take the

*Correct Measurement.*—To do this, you must draw on the shop floor a plan of the whole affair, with a circle at the corner of the sweep you intend having; then measure carefully round the outside of the marks. If this is not done correctly, when you come to fix the panelling you may have to cut away the outside stiles, and that would spoil the look of the whole job.

*Setting out Rails and Blocks.*—This will be done exactly as though it were a piece of straight panelling, but, if possible, arrange it so that a muntin will come at the extreme end of each straight part, as shown in Fig. 1: and if the circle is a large one, so as to require a muntin in it, it must come in the centre as shown, but it is much better for one panel only to bend round the curve. When the rails are set out and mortised, cut away between the two mortises which come close to the curve, so as to leave only a small piece of the thickness of an eighth of an inch. This piece is shown at D (Figs. 1 and 3). Then make a block as A (Figs. 1 and 4). The outside must be cut to the same curve which the finished panelling is to have, and at the points where the quarter circle ends cut a notch exactly the same depth as you cut out of the rails; these notches must be at right angles with one another, as shown by dotted lines in Fig. 4 (I omitted to say that the block should not be so deep as the rail by half an inch; thus, if the rail is 7 in., the block must be 6½ in.). A rabbet must now be cut round the circle at the top edge of block, three-eighths of an inch on, and the same depth, and a piece of wood an inch wide and three-eighths of an inch thick bent round and glued and nailed there. Now you place the block on the bench, and fix the front or longest part of the rail to one of the notches which are cut in the block, with a screw as shown in Fig. 1, then carefully bend the rail round, and fix the other side the same. If it comes correct—and it should do if you have followed my instructions closely—you can now unscrew and glue the block, then fix again in the same way with screws, and put on one side till dry.

The next part to proceed with is the gluing up, but before doing this cut off the inside of the groove for the panels on the

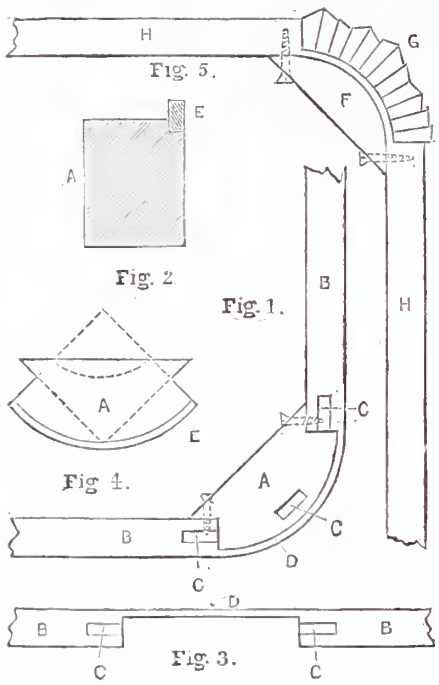



Fig. 1.—Plan of Circular Panelling. External—A, Block; B, Bottom Rail; C, Mortises; D, Part of Bottom Rail not cut away. Fig. 2.—Section of Block A—E, Thin Piece bent round to fill up to Panel. Fig. 3.—Bottom Rail cut but not bent. Fig. 4.—Plan of Block A. Fig. 5.—Plan of Circular Panelling, Internal—F, Temporary Block for Template; G, Blocks glued on to make up Rail after being bent; H, Bottom Rail.

two muntins into which the circular panel is to fit, so that this will go into a rabbet instead of a groove, then glue and wedge up in the usual way. This being done, you can proceed to put in the circular panel, and you will see the reason why the muntins are rebated instead of grooved, as, if they were done the latter way, it would be an impossibility to get the panel in. You will also see the meaning of the raised piece (E, Fig. 2) on the block, which is to make up the proper thickness outside of the panel. The panel can now be nailed into the rabbets from the back, as it will be found to bend round with a little persuasion, and it is as well to fix it still more firmly with thin curved pieces cut to fit it inside, and nailed to the blocks. The whole can now be cleaned off, remembering to take a little extra care round the curve; and, the moulding being put in, the job is finished, and if properly done cannot fail to be satisfactory. If you thought proper, the block could be cut away as shown in dotted line in Fig. 4, but it would take away part of its strength, therefore I do not recommend it.

The above, you will of course understand, refers to panelling with the circle outside. I will now show you how to proceed when the circle is inside, as shown in Fig. 5. This is done in the same way as the other as far as setting out, etc., is concerned, and the rails must be cut out in the same way, only the part left on to form veneer will have to bend the opposite way. We must also make a block, as before, but it will require no notches, only it will want carrying on for an inch or two in a straight line beyond the quarter-circle, so that the screws for fixing it can be screwed into the solid rail beyond the veneer. The block in this case will only be required temporarily until the glue has set, as it will be on the face side of the panelling. Having got all ready, screw the block in position as shown at F (Fig. 5), then fit blocks all round as shown at G, and glue them so as to fill up tightly and firmly to the proper thickness. This, after the glue is set, will effectually hold the rails to the proper curves; and as all the rest of the work will be the same as I have explained above, with the exception that the panel and mould have to be bent the opposite way, I need not go over it all again, as you will be able to manage one as well as the other.

In conclusion, I may say that the latter way of filling up the part cut away is nothing new, as it is the way adopted in making good staircases, with well-holes, to fill up the string-board after bending, and is much better for this purpose, as well as for the panelling, than cutting the curve out of the solid, as it shows the grain of the wood all round, which the latter would not, as well as being stronger.

If there are any details which I have not explained clear enough, I will do so, if called upon, in the "Shop" columns.

## SHORT LESSONS IN WOOD-WORKING FOR AMATEURS.

BY B. A. BAXTER.

### FIXING SHELVES.

THESE papers would be very imperfect if some attention were not bestowed on fixing of a simple character. To fix a shelf is regarded by the ladies as a proof of mechanical ability and of helpfulness.

We will suppose a recess and a board of ample length destined to become a shelf. The following plan will lead to success:—First take the angle of one end of the recess. This can be done with a two-foot rule, opening it to fit the angle, and marking the same on the board. Secondly, measure the length of the recess, and mark the same on the back edge of the board. Thirdly, take the angle of the other corner of the recess as the first was done, and mark in like manner on the board, as before. If the board is now cut to the lines, it will fit. To avoid any disappointment which might arise from imperfect plastering, rendering the angle uncertain, it would be better to decide the height, and fix a ledge or bearer of wood to the wall. These bearers of 1 in. wood, about 3 in. wide, and length according to the width of the shelf, are usually nailed to the wall—if it is a wall, and not a lath-and-plaster partition. There is some risk of failure, which cannot be avoided. The nail may come in contact with a very hard brick, and refuse to be driven. In that case, either drill or chisel with a small

cold chisel a hole in the wall, cutting it deep enough to hold—say, at least 2 in. Then cut a piece of deal about the right size, but taking care to chisel it somewhat in winding. The hole may be slightly undercut, and the plug driven in with a hammer. When driven sufficiently, no more blows must be administered, for when the plug will go no further, additional blows only tend to loosen it. Any surplus block must be cut off with a saw, taking great care to avoid spoiling the wall surface beyond that which the bearer covers. In most instances, however, it will be found that a good nail, straight and stout, will go into most brickwork that has been plastered over; but avoid slender nails, and bore holes in the bearers for the nails, for it is essential that the nail should hold more tightly in the brickwork than in the wood. But it may be that our wall (in appearance) is but a lath-and-plaster partition. Then the position of the upright timbers must be ascertained, and the bearer screwed or nailed to them. By all means use screws if possible. To find out where the timbers are, tap with the knuckles or very gently with a hammer. The difference of feeling and of the noise will soon indicate the position. Do not strike hard, or a rattling noise will remind you that you are knocking off the "key" or overhanging plaster from the inner surface of the laths. If you do much in that way, the plaster will soon be loose in front, so be gentle, and use screws instead of nails. When one nail or screw is inserted in one of the bearers, test with a spirit-level. When satisfactory, put in the rest of the nails or screws; then put the shelf in, if properly cut. It will almost support itself. If loose, get a helper to hold it at the free end, or prop it up; test with spirit-level, and mark for the other bearer, if necessary. Remove the shelf, but if it fits rather tightly, avoid doing so, as it will most likely damage the wall. If the ledges have been cut wide enough, they can be fixed without the removal of the shelf.

Only one other difficulty may occur—the partition may be covered with patent plastering, in which case it will be difficult to tell where the timbers are. But there is this compensation: that screws will hold fairly well in the plaster itself, independent of the timbers.

### Building up and Putting Work Together.

Amateur work depends very much upon the care with which the various parts are united. Structures which professionals make in few parts, of considerable size, the amateur must construct in smaller parts, and unite these together afterwards. We will look at a few of the methods adopted for this purpose.

There is the plinth and cornice mode of uniting parts, capable of being used even more frequently. In this a pair of frames are made, usually dovetailed together, though the back rail is often grooved to the end pieces and blocked. These frames, forming the vertical surfaces in the finished work, have affixed to the edge of each a piece of wood, moulded, or suitably finished. The inner angles of these frames, not being visible, are secured more firmly by means of "blocks." These are merely pieces of wood, prepared in any length to the proper angle. In this case, two adjacent surfaces must be at right angles. In order to distinguish these prepared sides of the wood, the opposite angle is planed off, and the strip is cut into suitable lengths. These "blocks" may be used in any interior angle not exposed to sight, and are most useful and effective.

Dowels, used in this union of parts, serve to prevent sliding motion, and to secure the proper position of each portion of the work. Ordinary wood screws are frequently used in conjunction with dowels. Table tops are frequently fixed with screws inserted obliquely through the inner sides of the frames; such fixture ought not to be permitted where any probability of shrinkage exists. A better plan is to make a mortise in the frame and screw a block, which has a projecting tenon, to the under-side of the table top. It is quite useless and unwise to ignore the fact that wood will shrink, even after considerable time has elapsed since its being made into furniture, unless the material has been kept for a long time in a dry place. No expansion, through damp, need be feared in furniture; but outside work, such as doors and sashes, if made of well-seasoned wood, will often need "easing" in damp weather. This shows that panels for exposed situations should not be too wide, and that ledged or clamped work is unsuitable.

The use of mouldings to conceal the junction of parts has much to recommend it to the amateur. These mouldings should be fixed to one of the parts, and preferably to the part most exposed to sight, the part fitting loosely into the moulding not being so good in appearance.

Bolts, screws, thumb-screws, dining-table fasteners, studs and plates, hinges with loose pins, and pivots in lieu of hinges, are all means, provided by the ironmonger, by which parts of a structure may be connected to each other, but they ought not to be depended upon without means of adjustment made by the worker; they are, in most cases, fixtures capable of spoiling the work by careless adjustment.

I know that this will be regarded as a reason for planning out the whole work carefully before attempting construction. Be it so. No better lesson can ever be given than one which most convincingly sets forth the value of careful planning as a precursor of successful construction.

## HOW TO MAKE A RESONANCE BOX.

BY AN OLD TEACHER

Although the zither is universally admitted to be one of the sweetest of all stringed instruments, it is also one of the least noisy—indeed, its tones are so "sweetly subdued" that it becomes imperative to augment them artificially. For this purpose we make use of a simple but very effective contrivance, known as the resonance box. This appliance consists of a shallow closed box, either supported upon legs—when, to all intents and purposes, it becomes a table—or upon short claws or knobs, as shown in the diagram, when it is placed on another table when in use. As its only use is to augment the tone and volume of the instrument, neither form has any advantage over the other; it is simply a matter of taste. For those who have ample room the table form has the preference, as, except on the top, it admits of any amount of ornamentation or enrichment, and thus forms an elegant addition to a drawing-room; while those who are cramped for space naturally prefer the more portable form, which may be placed aside when not in actual use. There is not much to describe about this article, and the veriest tyro will have no difficulty in making a thoroughly serviceable one. The sizes given in the illustration need not be taken as hard and fast, as, so long as the box or table is longer and wider than the zither, and at least twice its depth, the exact size is immaterial. The table shown in elevation in Fig. 2 represents one made for a pupil some years ago by the writer, and may be taken as a fair type.

The materials used were as follows:—For the sides and ends, ¾ in. pine; for the top and bottom, ½ in.; the legs were already on hand.

For the top a nice piece of wood must be used, free from knots or shakes, while that

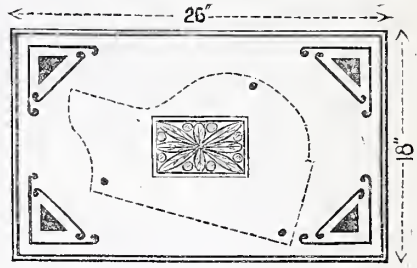



Fig. 1.

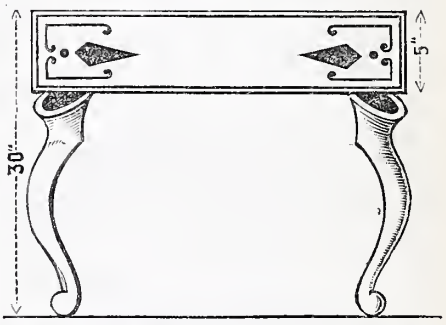



Fig. 2.

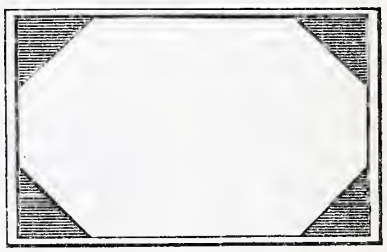


Fig. 3.

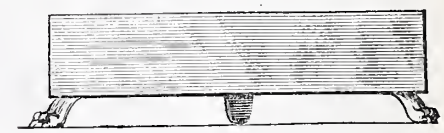
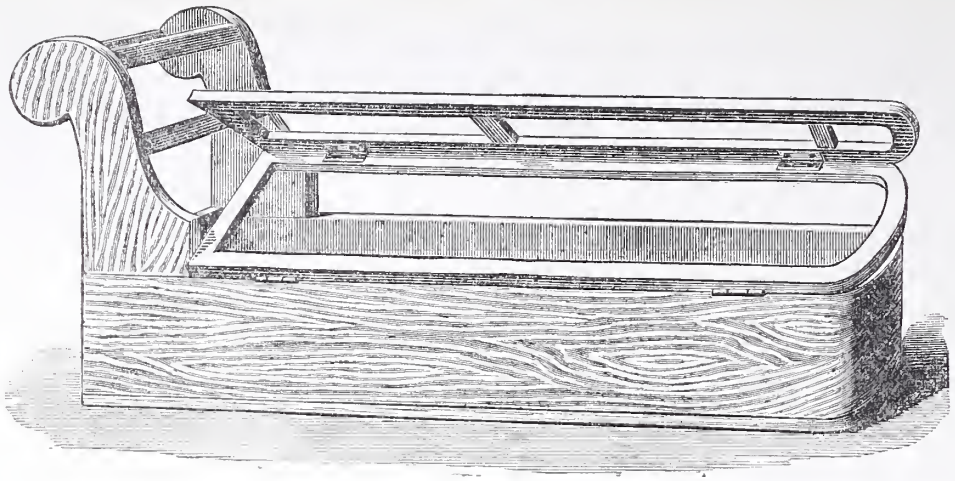


Fig. 4.

Fig. 1.—Plan. Fig. 2.—Elevation. Fig. 3.—Inside of Box, showing Method of fixing Legs. Fig. 4.—Alternative Form for use on Table.

used for the bottom should approximate to it as nearly as possible. If there is any best, let it come at the top. In the centre of the latter a sound-hole must be cut of any approximate shape or size, but this may be filled in with a fretwork panel. Instead of one large sound-hole, two, three, or four smaller ones may be made, but in this case care must be taken to keep them clear of the places where the "legs" of the zither will come. The dotted outline on Fig. 1 shows the position of the instrument on the table when in use, and the "legs" are shown as black dots. Pine is the only wood suitable for the top and bottom, but any kind of *hard* wood may be used for the sides or ends. Fig. 4 shows the alternative form of the

resonance box, but the construction is precisely the same, as the short legs should be continued up to the top, as in the case of the others (see Fig. 3). Probably the most logical mode of finishing would be to polish, but the one which formed the prototype for this article was simply ebonised and picked out with gold, the fretwork panel being gilded, as were the lines shown in the cut. The precise amount of ornamentation may safely be left to individual taste, but do not overload it, as, after all, such a table should serve as a foil for the instrument placed upon it, and may, therefore, be kept as severely and classically plain as you please. It ought to be noted that when made for use upon another table, three legs are preferable to four, as stability is thereby ensured, which is a matter of considerable importance. It might also be worth while to combine a music desk or stand, which no one would be at a loss to know how to do. As a rough guide as to height (when made as a table), you may remember that, when seated, the zither should be on a level with your *elbow*.



Reversible Lid for Box-Ottoman Couches.

## A REVERSIBLE LID FOR BOX-OTTOMAN COUCHES.

BY JAMES SCOTT.

AMONG my many trade acquaintances, I number one who is possessed of much inventive talent of a simple nature. One of his "ideas" is embodied in the article illustrated herewith. Upon noticing the paper "How to make an Ottoman Couch" (page 728, No. 97, Vol. II.), it occurred to me that many readers who might have adopted H. Hinge's practical and plain instructions, or had intentions of making such a couch in the future, would prefer to fit it with a lid of the peculiarly useful kind which is shown in the annexed sketch.

Its object and utility must be apparent to all workmen who will examine the drawing. There are two framings: the top one being covered in a similar manner to that lucidly described by H. Hinge in the above-mentioned paper; and the under one being always uncovered, precisely as it is here shown. The lower one is hinged to the couch on one side, it matters not on which, while the upper one is similarly attached to the upper surface of the lower one, on the opposite side. A handle is fitted on the front of the top frame, and another to the back of the lower frame. Whether the article be placed in an apartment with the scroll on the left-hand side, or on the right-hand side, the lid can be opened: in one case by raising only the upper framing, and in the other instance by raising both together.

Only an extra framing, therefore, is needed, in addition to the various parts spoken of by H. Hinge, in order to convert the couch into a reversible article. I do not know of a more *useful* couch than this "box-ottoman," as it is dubbed.

It may be well for me to add that my sketch is taken from a sheet of drawings of this particular couch, which I drew and printed for its maker, who is also the inventor of its lid, a year or so ago; and is not traced, as might at first appear, from H. Hinge's drawing. A note to the inventor and manufacturer, Mr. J. Trevallion, 14, Henson Street, Old Street, E.C., will elicit any further particulars relative to this article; and a request for a sheet of illustrations with prices indicated thereon, for anyone who may wish for such, will meet with courtesy.

I need only add that if any amateur who tries his hand at making this reversible lid finds that he cannot manage a rounded end to it, he can make it square, but he must bear in mind that the box must be square also.

## AN OAK TEA-TRAY: HOW TO MAKE IT.

BY ALEXANDER MARTIN.

THE days when highly decorated iron tea-trays were a necessary in every parlour are past and gone, but the fashion seems to be setting in again, though, instead of iron, wood is the material employed in their manufacture. Oak tea-trays are so easily made, and are so pretty and useful when they are made, that the following lines may be interesting to most of the large army of woodworkers.

The general view in Fig. 1 gives an idea of the nature of the tray, and a section of the edge, or rim, is given full size in Fig. 2. From these it will be seen that the sole of the tray is the foundation, and the rim is mitred on it. In selecting the wood for the sole, it should have as little heart in it as possible, so as to reduce in the greatest degree the tendency to "cap." The moulded rim planted across its ends will act to a certain extent in keeping the sole flat; but every precaution ought to be taken to ensure the sole keeping as level as possible.

The handles consist of three turned pillars each, two screwed to the rim and sole and a cross-piece between them. Fig. 3 shows nearly full-sized drawings of these turned pieces, the dotted lines indicating the portions which are hidden, but necessary for constructing the handle.

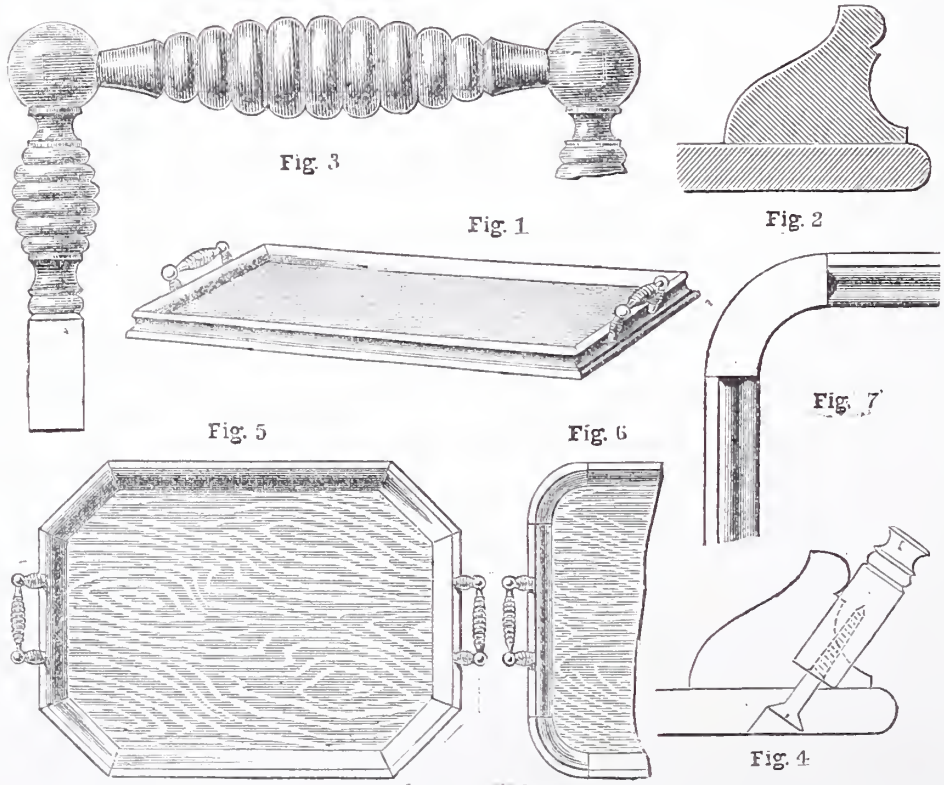



Fig. 1.—General View of Tray. Fig. 2.—Section of Rim. Fig. 3.—Handle (full size is 3¾ in.). Fig. 4.—Mode of securing Handle. Fig. 5.—Tray with Canted Corners. Fig. 6.—Tray with Rounded Corners. Fig. 7.—Block to form Corner.

The plain portions of the two uprights are set into the moulded rim a little bit, and then a screw is put into each from underneath and the handle is firmly secured. This must be carefully and strongly done, for it might be a serious matter if the handles gave way when some choice china was being carried in the tray. Then there would be lamentation! The illustration in Fig. 4 represents the method of securing the handle already mentioned, and if this be carefully executed there need be no fear. This completes the tray.

Another form is given in Fig. 5, with canted corners, otherwise it is exactly the same as that shown in Fig. 1. Yet another way of treating the corners is shown in Fig. 6, where they are rounded. These round corners may be turned in a circle, cut in four, and then placed in position; or a block may be cut to the shape and planted in the corner as shown in Fig. 7, the various members of the moulding being carved out after it is glued firm. Either way, the result is the same.

The size of the tray must be regulated to a great extent by individual taste; but a good useful dimension is 18 in. long by 14 in. wide for the size of the sole. Another size larger might be 21 in. long by 16½ in. wide; while a smaller size would be 15½ in. long by 11½ in. wide. Of course, any intermediate dimensions may be decided upon; but the reason for giving these particular sizes is that, while they are convenient by themselves, they also form a capital set of three.

In finishing such trays as these, the oak may be treated in different ways. It may be polished its natural colour or it may be stained a nice rich brown. Then, again, the sole may be light and the rim dark, the sole dark and the rim black, or the sole light and the rim black; this latter way has a very smart appearance indeed, and is the writer's favourite arrangement. The handles are always best to be dark, unless metal handles be substituted for wooden ones, in which case they should be electro plated.

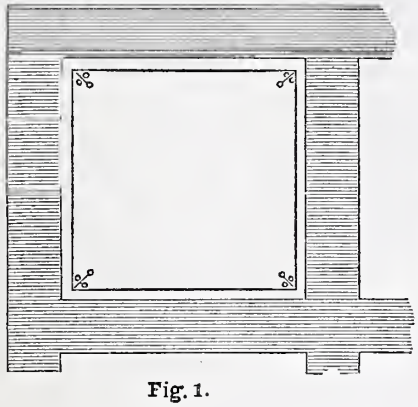


Fig. 1.

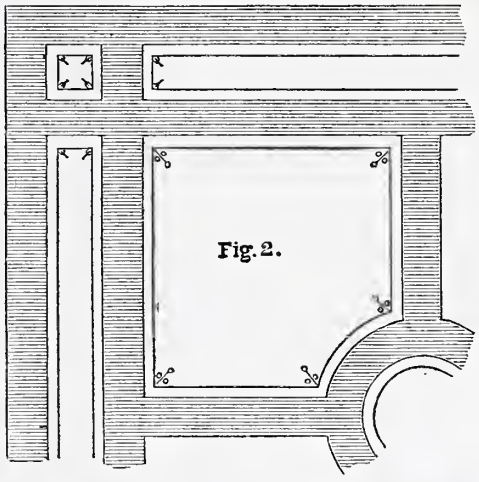


Fig. 2.

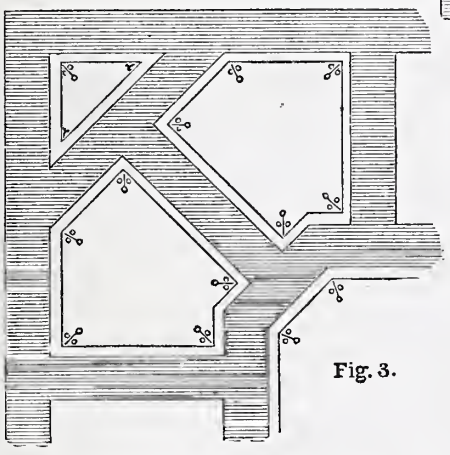


Fig. 3.

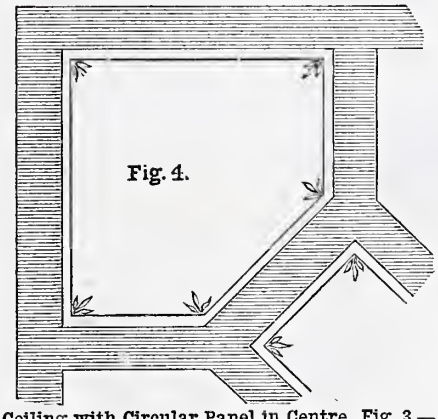


Fig. 4.

Fig. 1.—Ceiling divided into Four Panels. Fig. 2.—Ceiling with Circular Panel in Centre. Fig. 3.—Ceiling with Octagonal Panel in Centre. Fig. 4.—Ceiling with Square Panel in Centre.

## HOW TO IMPROVE THE APPEARANCE OF PLAIN CEILINGS.

BY T. R. BLACKETT.

In the majority of houses the ceiling presents a plain, flat expanse of white, without anything to relieve its monotony; sometimes a cornice is run round the room, which improves it a little, but in very few cases is anything done to improve the remaining portion of the ceiling. In the present article it is proposed to show how, by a very little extra expenditure, the appearance of the ceiling may be greatly improved.

In commencing to colour or whitewash a ceiling, it should first be washed with a brush and clean water, to remove all dirt, stains, etc., and, when dry, any rough places should be scraped or rubbed smooth, and all cracks filled up with plasterers' putty, or Paris white, mixed with a little plaster of Paris, to make it set. The cracks should be wetted with a brush, and the putty squeezed in with a small trowel, and rubbed down smooth. If the stains cannot be got off by washing, the ceiling should be painted white, in flat colour, or paint mixed with turpentine. Then commence to whitewash from one corner of the room, going over it as quickly as possible, and finishing with straight, even strokes, so as not to show any brush-marks. The strokes of the brush should be made towards the portion already whitewashed, so as not to show a join.

To mix the whitewash, break up the Paris white and put it into a bucket, putting as much water on as will cover it, and let it stand for a few hours; then pour off any clear water which may remain on the top, and mix it up with thin glue, or patent size which has been melted, in hot water. A little blue added to it will improve the appearance. After mixing it should stand for a few hours, when it will be ready for use.

After the ceiling is whitewashed, and dry, make a mark with a chalk line 6 in. from the cornice or walls, and get some narrow wall-paper bordering of suitable colour, and paste it on to the chalk lines, putting corner pieces at the angles; the bordering should be 1 in. or 1½ in. wide, and should be put on quite straight. If desired, the space between the bordering and the cornice may be tinted.

Or instead of using the bordering, colour a margin 6 in. wide all round the ceiling, and at a distance of 1 in. or 1½ in. from this, paint a line of chocolate ⅜ in. or ½ in. wide all round, and stencil an ornamental pattern at each angle. The edge of the coloured margin should be kept perfectly straight, and the chocolate lines should be painted to a rule, or straight-edge, held against the ceiling.

If there be a cornice, it should be washed, the cracks filled up, and whitewashed in the same manner as the ceiling, the cove, or large hollow, being tinted the same colour as the margin on the ceiling, but the other members of the cornice will look better white, as when tinted it gives the cornice a heavy appearance.

If the ceiling is large it may be divided into four panels, as shown in Fig. 1, the shaded part representing the colour. The width of the margins may also be increased in a large ceiling.

Fig. 2 shows another method of dividing a ceiling into panels, a circular margin being formed in the centre, round the chandelier.

Before laying the colour on it should be tried on some surface and allowed to dry, as if made too dark the ceiling will have a heavy appearance. Pink or salmon colour will be found very suitable colours for the margins, although others may be used: the stringing lines and stencilling will look best in chocolate, or similar dark colour.

Figs. 3 and 4 show two other forms of dividing the ceiling, which have a very good appearance. The centre portion of the panels may also be tinted, if desired, to a very light shade of the colour used in the margins; but when the room is low it is advisable to have the colours light, while for a lofty room, well lighted, a darker shade is sometimes an improvement. Each drawing represents one-fourth of the ceiling.

## A USEFUL DRILLING TOOL.

BY J. THOMPSON.

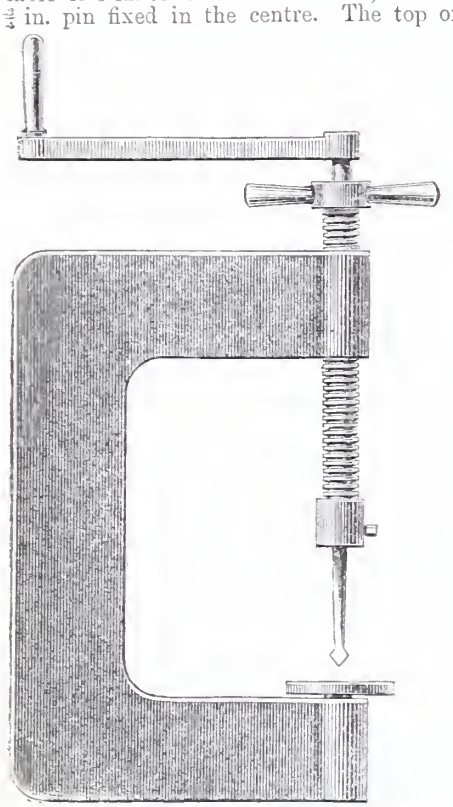
This drill, sometimes called a cramp drill, is a very useful tool, as it can be used in almost any position, and, by the addition of two lugs on the lower part of the frame, could be bolted to a bench. As it has not been described in this Magazine, a description of it may be interesting to some of the readers.

The tool is shown in the accompanying

illustration. It consists of a frame, with a screw fixed in the upper part; the drill spindle passes down the centre of this screw, having a projection on the lower end upon which the screw bears. The screw can be raised or lowered by means of a handle fixed on the top. A handle is fixed to the drill spindle for working the drill, pressure being given to it by the screw. A small table is fixed at the lower part of the frame, upon which the work rests while being drilled. The frame is made of wrought iron, 3 in. by ½ in., the ends being bossed for the screw and table. The hole for the screw is 1⅛ in. in diameter, tapped for the screw, and for the table ⅝ in. in diameter; they must be drilled in line with each other. The screw is a hollow tube of wrought iron or steel, with a handle fixed on the top.

The drill spindle is ⅝ in. in diameter, of steel, the lower end being made 1¼ in. in diameter, with a ½ in. hole drilled in it for the drills; it must fit the inside of the screw without any shake. The screw may be cut on the tube by a pair of stocks and dies, or in a screw-cutting lathe. In the latter case, it will be mounted on the spindle while cutting the screw, to keep it central. The top end of the spindle projects above the top of the tube, and has four flat faces filed upon it for the handle to fit on.

The handle is 10 in. or 12 in. long, fitted on the top end of the spindle, as shown. The table is 3 in. or 4 in. in diameter, with a ¾ in. pin fixed in the centre. The top of



A Useful Cramp Drill.

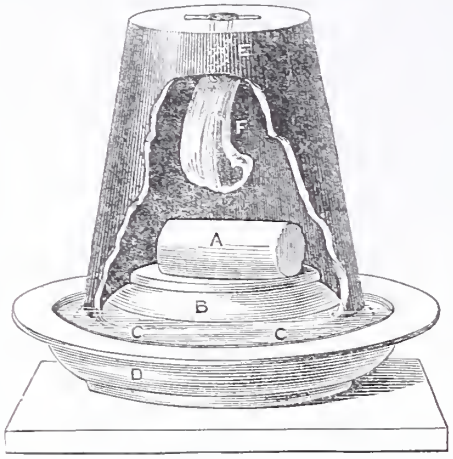
the table and the pin should be turned, so that any work fixed on the table will be drilled true and square. The shanks of the drills are turned, so that they run true, and a flat is filed on one side, by which they are fixed in the drill spindle with a set-screw.

No amateur wood-worker should be without some sort of drill to enable him to do such drilling in metal-work as he may be called on to execute in connection with wood-work. A metal-worker will be furnished with bigger and more powerful drills.

## A CHEAP BUTTER COOLER.

BY D. WILLIAMS.

Most housewives know how difficult it is to keep their butter firm during the hot weather, and how unpleasant it is to find the butter to be almost like oil. Well, here is a cooler which has these four advantages: (1) it costs practically nothing—a great consideration in these struggling days; (2) it is




A Cheap Butter Cooler—A, Roll of Butter; B, Saucer; C, Water; D, Dish; E, Hook for Meat; F, Piece of Meat.

perfectly equal to any refrigerator; (3) it is quite simple, and capable of being cleansed easily; (4) it is based upon sound scientific and hygienic principles. To make it, get an ordinary flower-pot (unglazed, of course), a saucer, and a glazed plate or dish. These are all that are necessary. Thoroughly clean the flower-pot inside and out, and dry it in a current of air, or the sun; then soak it well in clear cold water. Place the butter upon the inverted saucer; stand the saucer in the dish, which you must fill with cold water, taking care that the water is not high enough to reach over the top of the saucer; and then place the flower-pot over the saucer, and your cooler is made. It will keep your butter hard in the hottest weather: the hole at the top will allow free access of air, and the porous sides of the pot will hold the water, and yet permit the air to percolate through. This kind of cooler has been tried during a severe run of hot weather, and has been found to act beautifully. It can also be adapted for small joints of meat by bending a piece of wire as shown in the illustration, inserting the loop-part through the hole, and hooking the meat on inside. In this case the pot should stand upon two sticks, to allow the air to pass underneath. Flies will not readily go under the pot, and if the water be kept above the lower rim it will exclude them entirely; or a wire-gauze dish-cover could be placed over the whole. Still, as a meat-safe it is not so efficient as for a butter cooler; and, if it is once tested, there are few housewives who will again submit to the butter going oily or turning rancid. The accompanying sketch will show how the article is made. One thing to be remembered is: do not let either the inside or outside of the flower-pot get greasy or dirty. The oftener it is scrubbed, the better will it act. Grease or dirt prevents the water soaking into it, and the cooling properties become impaired.

The utility of a cooler of this kind will be far more apparent when one has been made and brought into use.

## OUR GUIDE TO GOOD THINGS.

**** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

### 119.—"The Optics of Photography and Photographic Lenses."

The book that bears this title is published by Messrs. Whittaker & Co., London, and is written by Mr. J. Traill Taylor, editor of the "British Journal of Photography." It forms one of the series known as Whittaker's Library of Arts, Sciences, Manufactures, and Industries, and, as the author takes care to explain in the preface to his work, "is not theoretical but practical, and it is not intended for the makers, but the users, of photographic lenses." He further explains that, although there are many lenses in the market which are not even mentioned by name in the volume, inasmuch as the chief difference in them is to be found in the variations of diameters, foci, and curves of the lenses, and their distinction by special trade terms, he has wisely preferred in all cases to deal with the lenses in classes associated with the name of the first inventor of each particular kind. The book is well conceived, and written in the clearest terms, and cannot fail to be useful to every photographer who desires to thoroughly understand his business and to comprehend the nature of the instruments and appliances he uses.

### 120.—"The Practical Telephone Handbook."

This is another volume of the series mentioned above, and is issued by the same enterprising publishing firm. It is written by Mr. Joseph Poole, Chief Electrician to the late Lancashire and Cheshire Telephonic Exchange Company, Manchester, and a Whitworth Scholar of 1875. Although, considering the importance of the subject, the manual itself is of moderate size and cost, yet it is thoroughly practical, and gives in detail, as far as the space will admit, the most recent methods of telephonic working. It is not only a volume suited to meet all the requirements of telephone *employés*, but one which affords all the information necessary to users of the telephone and to all who desire to acquire some knowledge of the nature of the instrument and its construction and use. The text is elucidated by nearly two hundred and thirty diagrams and illustrations.

### 121.—Quarterly Supplement to the "Wood Carver."

This is not the *Wood Carver* noticed in page 474 of this volume, but a work from the pen and pencil of Mr. J. S. Gibson, of Edinburgh, and published by Messrs. Scott & Ferguson and Menzies & Co., of that city, and Messrs. Simpkin Marshall & Co., of London. It contains thirty-four full-sized designs of useful articles, with practical instructions in carving, modelling, etc. The Supplement to this desirable work—which should be in the hands of all wood carvers—is issued quarterly. The one before me contains bold and well-executed designs for panels for a lamp-stand, the back and seat of a spinner's chair, a photo frame, and a brief paper on "The Study of Historic Ornament," with two appropriate illustrations.

### 122.—Melhuish's Illustrated Price List of Cabinets.

Amateurs who are desirous of obtaining a handsome tool cabinet with work bench and other accessories in combination should not fail to send for Messrs. R. Melhuish & Sons' new catalogue before purchasing. Space unfortunately prevents me from making more than this very brief mention of Mr. Melhuish's specialities in this line. The Editor.

*Notice as to New and Important Features to appear in*

"WORK."

SUCCESSFUL as "WORK" has been during the three years which have elapsed since the First Number was issued, the

NEW AND VERY IMPORTANT PAPERS

which will appear in the next and forthcoming Numbers will, it is believed, still further extend the circle of its readers and the sphere of its usefulness.

Amongst the Special Series of Contributions for which the Editor has already arranged, and which will be in addition to the usual variety of papers, may be mentioned :—

**Original Designs in Art and Ornament for all Art Workers.**
**Induction Coils and Electric Work in General.**
**Bent Iron Work—Affording an Occupation for Women.**
**Staircasing and Handrailing—for Professional Workers.**
**Chemistry Appliances, and How to Make Them.**
**Designs and Studies in Home Decoration.**
**How to Learn "Drawing Office Work."**
**Furniture—Original Designs in.**
**Photographic Appliances, and How to Make Them.**
**Coach and Carriage Painting.**
**Microscopic Appliances, and How to Make Them.**
**Stories of Great Engineering Triumphs.**
**Pages of Easy Carpentry.**
**The Spectroscope: How to Make and Work It.**
**Tools: How to Buy, Select, and Handle Them.**
**Practical Papers on** :—How to Whitewash a Ceiling.—How to Purify the Cistern.—How to Control the Gas Meter.—How to Put on a Lock.—How to Mend a Window, etc.
**How to Grind Optic Lenses.**
**How to Learn to Design.** By a Member of the Arts and Crafts Guild.
**Sewing Machines: How to Select and Work Them.**
**Poker Work, and How to Do It.** By a Danish Art Teacher.
**Telescope Making and Working.** By a Practical Hand.
**Country Carpentry**: Being a Series of Papers on Profitable Outhouse Building.
**Workshop Joinery in all its Stages.**
**Slaters' Work.** By a Master Slater.
**Plasterers' Work.** By a Working Plasterer.
**Jewellers' and Silversmiths' Case Making**
**Stained Glass Window Making—Domestic and Ecclesiastical.** By a Foreman Worker.
**Work and Power Papers.** By a Civil Engineer.
**Design and Decoration of all Ages** :—1. Barbaric Art.—2. Greek.—3. Celtic.—4. Early English.—5. Chinese.—6. Japanese.—7. Indian.—8. Naturalistic.—9. Conventional.—10 Grotesque.—11. Ecclesiastic.—12. Application of Styles.
**Embroidery: Its Principles, Purposes, and Practical Application.**
**Simple Arts for the Cottage.**
**How to Make an American Organ.** By a London Factory Foreman.

A notable feature of the New Volume will be the weekly publication of

TRADE AND LABOUR NOTES, AND NEWS

from the principal trade and industrial centres. The Editor has secured the co-operation of leading men holding responsible official positions, whose notes will thus possess a peculiar value, and be of special importance to all workers.

Arrangements have also been made by which the Editor hopes to secure from time to time direct intelligence from Colonial districts offering fields and opportunities for emigrants and workers who suffer from the overstocked condition of the home labour market.

There will also be a separate column devoted to a

WEEKLY SURVEY OF SCIENCE,

in which the latest developments of practical science will be chronicled in a concise and readable manner.

Thus it will be seen that "WORK" will even more fully than heretofore carry out its aim of furnishing clear practical exposition, as well as Designs and Illustrations, of

EVERY ART, CRAFT, AND SCIENCE

that bears directly or indirectly on handiwork of a constructive or decorative character, and at the same time serve as an index to the worker upon questions and matters connected with labour and the labour market—the fluctuations in which so immediately affect him, and in which he must necessarily feel an active interest.

CASSELL & COMPANY, LIMITED, *Ludgate Hill, London; and all Booksellers'.*

## SHOP:

### A CORNER FOR THOSE WHO WANT TO TALK IT.

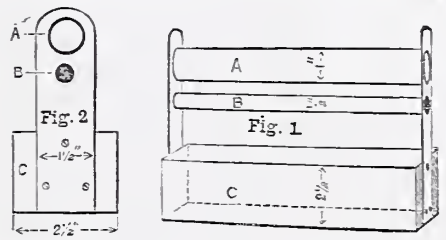
*** In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

*In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of* WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given.*

### I.—LETTERS FROM CORRESPONDENTS.

**Plain Sketches.**—THEO D'OLITE writes to T. P. (*Frodsham Bridge*) (see p. 717, No. 149) :—"C. E. is, I think, incorrect in supposing that Maxton's very complete work on Engineering Drawing is to be found in Spon's catalogue. My copy is one of the Weale Rudimentary Series published by Crosby Lockwood & Co. I should advise T. P. to get it by all means; he will never regret the expenditure of 4s. 6d. less."

**Violin Making and Varnish.**—H. H. (*Latchford*) writes :—"Having found a difficulty in bending the ribs of a viola so that they would retain their shape on the mould, I set about making a 'bender;' and as it is a great success, I send you a rough sketch of it for 'Shop.' It is heated by placing a piece of round iron bar red-hot into the tube. For convenience' sake I have put a wooden handle on the heater. The ribs are passed between the bar and the tube, and bent over the latter. A thin wedge of hard wood is useful for clipping the ribs to the tube where necessary, but the bar is intended to act as a grip. I have just bent some 'cello ribs out from maple, and they retained their shape splendidly. As anything that saves time and patience is worth knowing, I send you the sketch without further remarks. The articles which recently appeared in WORK on Violin Making, though in themselves the best of the kind ever written, left the matter of varnishing in a very vague state. I suppose this is through violin-makers guarding their trade secrets very closely. There has been a great deal of nonsense written about the old makers' so-called amber varnish. My

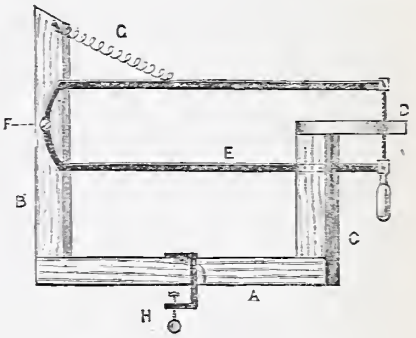



Violin Bender. Fig. 1.—A, 1 in. Iron Tube, either turned or smooth; B, ½ in. Round Iron Bar; C, 2½ in. Wood Block. Fig. 2.—Section—A, 1 in. Tube; B, Bar.

own opinion is that the old varnish was a very simple affair—how could it be otherwise, seeing the outlandish places these people lived in? With this view I have recently been experimenting in varnishes, and have succeeded in getting one which I think will satisfy anyone. I cannot give you the exact quantities, but I will tell you how I made it. I procured 2 oz. juniper gum, ½ oz. elemi, ½ oz. myrrh, ½ oz. benzoin. These I dissolved separately in methylated spirit previously coloured (just sufficient spirit to dissolve the gum). For colouring I used: yellow, gamboge; red, alkanet root, or dragon's-blood; brown, aloes. When thoroughly dissolved, I mixed the gums with about 3 oz. linseed oil (boiled), added 1 oz. turps, and boiled altogether in a water bath until a great proportion of the spirit had evaporated. This I poured into a bottle when cold, and the result was a sort of jelly. I added about a tablespoonful more spirit, and shook the lot up, and in a day or two the jelly broke up, and a beautiful clear varnish rose to the surface, whilst the undissolved gums and oil remained at the bottom. I poured off the clear varnish, and put a little spirit in what was left, gave it another shaking, and did as before. This process I repeated till there was nothing left but the excess of oil and the foreign substances and dirt which are in all gums. This varnish takes about twenty-four hours to set, and it should be strained through fine muslin before use. It requires about six coats to varnish a violin. The violin should be oiled in before commencing, and each coat should be rubbed down with oiled felt. It is better for keeping a month or two; and although anyone who tries it may fail in the first attempt, yet it is well worth any trouble you may have. A mixture of brown and red makes a very nice colour. The yellow is rather light for some tastes, although I consider the viola I varnished that colour looks very well."

**Needed Inventions.**—B. A. B. (*Hampstead*) writes :—"There is a need for a sash pulley that can be easily oiled, or else composed of such metals as require no oiling. It should be similar in appearance and dimensions to those now in use, so that the old ones may be easily replaced by a better pattern. A pulley suitable for the balancing of side lights of bay windows, where there is no room for sash weights, would sell. The only disadvantage of such a mode of hanging sashes is that when the lower sash is raised the upper one descends; but that is better than both being fixed, as they are generally made at present."—[Thanks for these notes for needed inventions and requirements. We wish you and every reader of WORK would begin and continue to favour us with any necessity of this kind as it comes before you, whether in practical work or idea only, in order that prominence might be given to such useful suggestions in WORK. —ED.]

**Fret-saw Contrivance.**—W. S. (*Cambridge*) writes :—"I send a rough sketch of a hand fret-saw contrivance. Two great advantages of it are: it cuts the work true, like a treadle machine; also, it leaves the hands more at liberty to thread the saw through the work, and costs but a few pence—that is, if you have the saw-frame by you. Of course, you can buy these made in first-class style, but they then come to 6s. or 7s.; mine cost me only 2d. for spring and screws, as I had frame and cramp by me, and wood from an old soap-box. Let me say it




Hand Fret-saw Contrivance.

is all made of wood, screwed together, and those handy with their tools can dovetail the uprights into the base-board. A is the base-board, 4 in. wide (or about) and 1 in. thick; B the upright to which the saw-frame is screwed with a small round-headed screw, with just enough play to work the saw up and down easily; C, upright to which the table, D, is attached. Run the saw down C for the lower half of the steel frame to work in, which also acts as a guide for the frame; screw table on top of C, and bore a small hole through table, D, just where the saw must go through. G is a spring from the frame to the uprights; H, cramp by which to clamp the base-board to the table or bench. All the wood would be best 1 in. thick except the table, which may be ½ in. hard wood, either round or square, but must be smooth on top to move the work easily when sawing. It will be seen that two small holes will have to be bored in the saw-frame, E, one for screw in centre of back, and the other for the spring in the top part of frame. The length of base-board and uprights depends on the length and width of saw-frame."

**Etching on Tools.**—LOST MOTION writes :—"I have noticed several recipes for etching names on steel tools in your 'Shop' columns, and can from personal experience confidently recommend blue vitriol, or sulphate of copper, and common salt. After coating the blade with wax, and scratching in the name with a needle or some other fine-pointed article, sprinkle over the scratched place some finely-powdered sulphate of copper, and cover this with common table salt; leave for twelve hours, at the end of which time the name will be found *deeply* bitten in."

### II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

**Camera Lens.**—SUNMAN.—The explanation of the two brass tubes is this: The brass tube to which is attached a flange is intended to be screwed into the camera to hold the other brass tubes in which the lenses are fixed. Each pair of lenses, forming combinations of different focal length, can thus be easily adjusted for working. If only one combination is wanted, it can be fixed in the single tube with the flange, two tubes being unnecessary. Any camera will suit these lenses, providing they will draw out sufficiently far to focus.—D.

Camera Lens —A, Outside Tube; B, Flange; C, Inner Tube; D, Stop; E, Lens.

**Honeycombed Holes.**—C. T. (*Bradford*).—Put a bit of soap, about the size of a five-shilling piece, into the metal just before pouring; stir it round for a few seconds, and pour slowly, without splashing, from one end of the ingot mould. Nothing more is needed to ensure sound ingots.—J.

**Model Loco' Boiler.**—E. W. L. (*Newcastle-on-Tyne*).—You can do nothing with it except throw it on the scrap heap. It is too small for charcoal, and is not rightly made for a spirit-lamp. Have nothing to do with these trashy bought engines. If

you want a *working* model, you must either pay a good price or spend a lot of your own labour in constructing one. Cheap engines of this type are simply useless.—J.

**Cork Picture-Frames.**—W. R. W. (*Colne*).—I imagine this to be too trivial an art to have any book specially devoted to it—at least, I know of none. Within the narrow limits of the "Shop" columns, any designs which I could give would be too small to be of practical use; but our Editor promises the space, and I will give what you require as soon as possible in a short illustrated article.—A. Y

**Magnetism.**—H. A. B. (*Middlesbro'*).—(1) When a piece of iron is placed in contact with one leg only of a horse-shoe magnet, some of the lines of force are lost in air, since they spread around the edges of the steel bar and are not concentrated in the iron armature. When, however, the soft iron armature is placed in contact with both legs, some of the lines between the poles are also taken up, and, as a consequence, the hold is more than double that of one pole only. The relative difference may be ascertained by boring a hole in the armature and suspending from it a small scale pan, then adding small weights until the attractive force of the magnet is overcome by the added weights. (2) I have no data at hand to guide me in answering your second question. As the coercive force of magnetised steel is high, it will not be much affected by the earth's magnetism. At the same time, reasoning from theory, one would suppose that the magnet with its south pole pointing downwards would be weakened, and the other slightly strengthened. What is your experience?—G. E. B.

**Battery for Electro-Motor.**—R. McG. (*Govan*).—As the working resistance of the electro-motor is low, you must employ a battery giving a large volume of current with a low internal resistance of the cells. Batteries suitable to this work, having a low internal resistance, are the Bunsen, the Grove, and modifications of these for use with chromic acid. Get a set of four Bunsen cells, taking a quart of liquid to charge each cell, and charge the porous cells with a mixture of chromic acid, 3 oz., chlorate of potash, ½ oz. in each pint of water, made acid with 3 oz. of sulphuric acid. Charge the outer cells containing the zinc cylinders with a mixture of one half-pint of sulphuric acid to each ten half-pints of water. In Nos. 1 and 2 of WORK you will find a full description of the Bunsen battery. These numbers will cost you 3d. by post. If you have the back numbers containing the articles on "Model Electric Lights," you will find some suitable batteries for your motor described in the third article in WORK, No. 89.—G. E. B.

**Zither.**—S. S. (*London, W.*).—An article on the Zither appeared in No. 129, and "Hints on the Stringing of the Zither" in No. 139.

**Magnetic Needle for Telegraph Instrument.**—TELEGRAPH.—A telegraph instrument of the single needle type has two needles: one on the outside of the dial to act as a hand or pointer, and one inside the instrument, behind the dial. Both are fastened to the same spindle, and therefore both move together. The outside needle need not be magnetised, but the inside needle must be of hard magnetised steel. This is, I presume, the "small plate in the back" mentioned in your letter. It works inside a coil of very long fine wire, much the same as in a galvanometer. A paper showing how to construct a galvanometer is in the Editor's hands; and as the coils and needles of both instruments are the same, you will do well to follow the instructions given in that article. The lozenge-shaped piece of steel to go inside the coil may be magnetised by drawing its ends several times over the ends of a permanent magnet, such as a horse-shoe magnet, or winding it with a coil of silk-covered wire, and sending an interrupted current from a strong battery through the coil.—G. E. B.

**Cutlery Case Making.**—J. S. (*Amsterdam*).—There are two ways in which the "puffing," as it is called, is carried out. The formal way you refer to is done by machine, and the best work we know of carried out in that manner is by Messrs. Dewsnap, cutlers' case maker, Sheffield. The other form of puffing, which is irregular in appearance, and, to our mind, the most effective, is done by hand in the following way: Cut to the size required a sheet of paper—the sort usually employed in the trade is called "ledger" paper, and is, in fact, procured from old account books of good quality; place on this a layer of wadding, and then cut the satin about one-third larger than the "cushion," as the combined paper and wadding is technically named. The satin is then glued all round on back edge of cushion in small pleats equally distanced. When the glue has dried, the satin is arranged in puffs, as small or as large as taste or the size of the cushion may dictate, and these puffs are fixed or kept in position by lightly sewing right through the wadding and paper with needle and silk thread matching the satin. The machine for corrugating or ribbing pasteboard is made by the employment of two steel rollers with fluted surface all round, held in a framework precisely as the ordinary wringing machine used in laundry work. The rollers are adjusted so that they cog into each other when the handle of machine is turned, the space between the rollers being regulated by a screw. But the corrugated pasteboard itself is quite an ordinary article in the market, and can be obtained so cheaply that, unless the pleasure lies in the constructing of the machine, it seems hardly worth while going to the expense of making the machine to produce it. This corrugated board is largely used by wine merchants for bottle packing, by silversmiths' case makers, and others, and can be obtained from Messrs. Munt & Son, Cross Street, Hatton Garden.—P.

**Lens.**—W. R. R. (*Carlisle*).—There is no better all-round lens than a good rapid rectilinear of 8 in. focus. By removing one of the combinations from the mount, the remaining one makes an excellent landscape lens, providing the camera will rack out sufficiently. The exposure will, of course, be longer in proportion to the extra length of focus. If half second is required with the complete lens, two seconds will be necessary for the half of it. *Any* of the numerous photographic dealers will supply your requirements. We can scarcely recommend one before another. All dealers charge about the same for the same quality of goods, unless a speciality is made of any particular class. The weekly periodicals and WORK teem with advertisements.—D.

**Gold Colouring and Suitable Alloys.**—R. C. (*Battersea, S.W.*).—In the first place, the best book for practical information is G. E. Gee's "Goldsmiths' Handbook," published at 3s. by Crosby Lockwood & Co. This deals at much greater length than I can with the alloys, colouring mixtures, etc. Get it by all means; there are many useful tips in it. Now for the special difficulties that you write about, the chief one being the different surface you get over the soldering seams to what you have over all the rest of the article. Your colouring mixture is all right, except that there might be a little more acid in it; the fault lays undoubtedly in the solder. In both the hard and the easy solder there is too much silver. ·010 should be plenty of silver to add to ·250 of 15 carat for the harder quality, and ·090 for the easy. If you calculate it out, you will find, I think, that your easy solder is less than 12 carat, and 12 carat is the lowest quality which should be coloured with the mixture you give. In our workshop there is added to the easy solder some metal like zinc. Now the use of zinc in an alloy causes it to melt at a lower temperature than the quality would if alloyed with silver and copper only, therefore a slightly higher quality of gold can be used for soldering than would otherwise be the case. You might get the book, and try Gee's recipes; but meanwhile, instead of your last alloy, try what a mixture made up of these proportions will do: 15 carat, ·250; silver, ·075; pure zinc, ·01. This is very much like what we use for a differently composed 15 carat to yours. The zinc must be added when the other metals are perfectly melted and ready to pour; and do not spare the borax. As to getting a paler colour on your work, surely this can be got by adding more water to the colour than you have done in the last stages. Write again if this does not clear matters up.—H. S. G.

**Bronze and Gold Lines on Picture Mounts.**—R. H. (*Lancaster*).—There are different ways of producing these lines. Were the work of a cheap character, I should mix bronze powder with varnish (the clearer the varnish the better), and thin with turps till the mixture would flow freely from a how-pen or lining pencil. Work thus done will *not* be bordered by a greasy line. Pale gold-size may be used instead of varnish; the bronze will then be darker, but will not necessarily look amiss. A higher class of work may be made by first drawing the lines in isinglass or other water-size upon this, when dry, drawing the lines again in gold-size, and when the gold-size is just tacky, rubbing bronze powder over it. If real gold-leaf is used, it must be applied by this last process; but if the mount is porous, as mounts often are, more than one coat of water-size may be necessary, since gold-leaf does not adhere so readily as bronze powder. A water-size may also be made strong enough to fix the bronze or gold alone. When similar lines have to be repeated many times, as in photographic albums, the printer will do the work more cheaply than it can be done by hand.—S. W.

**Type-Writing by Lithography.**—L. J. K. (*Dublin*).—(1) "Can any sort of ink and paper be used with a type-writer, so that the type-written matter can be transferred to a stone to have a large number of copies produced by lithography; and if so, of what kind?" We are not aware that type-writing has been so applied, but we know of no reason why the plan should not be feasible. The ink, we presume, would have to be the ordinary lithographic transfer writing ink, for no other will adhere to stone, and the paper the ordinary litho transfer writing-paper, both of which our correspondent may get from Hughes & Kimber, Fetter Lane, E.C., or any other dealer in litho materials. We assume that his plan will be to rub down his stick of ink (which will cost him 1s.) to the thickness required, and in it to soak a ribbon or band similar to ordinary type-writing bands. It would be desirable that the face of the paper should *not* be handled, as any marked or soiled portions will readily roll up when transferred to the stone. It would also be desirable that the matter should be put upon the stone as soon after it is written as possible. These are the best suggestions we can give him, but he must bear in mind that they are suggestions merely, and that we cannot promise that they will lead to success. (2) "Is there any other surface—parchment, zinc, tin-plate, etc.—to which the copy could be transferred?" We presume not, unless the surface can be charged with some kind of composition for the transfer to adhere to. He does not say for what purpose he wishes to transfer to these surfaces. Are we to suppose that it is for the purpose of multiplication by lithography? If so, his chances of transferring successfully to a litho zinc plate will be much the same as to stone, and our suggestions given in reply to his first query will be equally applicable here. He can get a zinc plate, of any size, from the Litho Zinc Plate Co., Ltd., Hull. (3) "Is it feasible for an amateur to reproduce the copies, or must it be done by a lithographic printer?" We fear that it would not be feasible, unless the amateur were skilled in lithography.—S. W.

**Stereoscope.**—G. P. D. (*Aberdeen*).—Stereoscopes were mentioned on p. 521, Vol. II., of WORK, and on p. 541, Vol. I. I rather fancy that I have seen something concerning them in Vol. III.; therefore, when the index appears, I should advise you to search it.—J. S.

**Kallitype.**—J. A. (*No Address*).—No; the kallitype process is a rapid process, and the image produced by development, which would render it difficult to work for the purpose mentioned. It would produce white lines on a black ground. The thickness of the paper would interfere with this print being used as a negative, although it might be so used to produce black lines on a white ground. The paper may be had from Fallowfield, Charing Cross Road, London, W.C. We are now able to see how, without measuring, any definite quantity of saturated solution could be ascertained. The difficulty with all saturated solutions is to ensure that the *same* quantity of substance is contained in a given measurement, as the saturation *varies* with the temperature. In all exact measurements, so-called saturated solutions are never used unless the saturation at a *certain temperature* is stated.—D.

**China Drilling.**—TRYER.—The article upon "China and Glass Riveting" appeared in Vol. II., No. 53, p. 4. As regards the second part of your query, although you can get drills in London, I would advise you, in your case, to write to Mr. E. Claxton, Tower Street, King's Lynn, and he will make you just what you require. He is a practical man, and knows exactly what is wanted for the work. Explain that you have the spindle, and only need a diamond drill, and also mention if it is needed for light or heavy work.—W. E. D., JR.

**Letters for Signs, etc.**—H. H. (*Brighton*).—I think you will find Willing's Patent Enamelled Copper Letters as good as anything you can use, as they can be affixed to glass with ease, and look exceedingly well. They are also suitable for facias, signs, or anything of that kind. I have no doubt you could get appointed agent, and you could affix them yourself, as the firm supplies cement for the purpose, accompanied by printed instructions for use. Apply to Mr. J. Willing, Clerkenwell Green, London, E.C., enclosing business card and asking terms. As regards rubber stamps, not much is to be made out of them now, as so many are agents; but if you think you could do a little business in them, write to some firm for their terms. There are plenty of manufacturers to choose from. I could not undertake to say which is the best firm; but if you do not know of any, here are two or three addresses: Crystal Palace Marking Ink Co., 75, Southgate Road, London, N. (see advertisement in WORK); Ireton & Co., Gracechurch Street, London, E.C.; J. Berkley, Livery Street, Birmingham.—W. E. D., JR.

**Cement.**—CONSTANT READER (*Ottawa*).—One of the easiest cements to make is to dissolve isinglass in acetic acid by the aid of heat (a water bath—glue-pot—for instance), and it will join all the articles you name, but it won't stand water or damp. Pound the isinglass before adding the acid, and if it needs it, strain through a piece of muslin. Keep in a well-corked bottle. Or perhaps the following might suit you better. It is a little more trouble to make, but I believe it is a thoroughly reliable cement: Dissolve five or six pieces of gum mastic, the size of a large pea, in as much spirits of wine as will suffice to render it liquid. In a separate vessel dissolve as much isinglass (previously softened in water, though none of the water must be used) in rum or other spirit as will make a 2 oz. phial of very strong glue, adding two small pieces of gum ammoniacum, which must be rubbed or ground until they are dissolved. Then mix the whole together with a sufficient heat. Keep it in a closely-stopped bottle, and, when it is to be used, set the bottle in boiling water. You do not say if you need the cement in large quantities; if you do, you can easily increase each item. Strictly weighed articles are not needed, but simply a general adherence to the formula.—W. E. D., JR.

**Hive Appliances.**—G. S. T. (*Birmingham*).—(1) It would scarcely be right for me to name any particular dealer as being the *best*, but most of the large manufacturers are sure to have agents in Birmingham. If you write to Messrs. Abbott, Southall, London; Messrs. Blow, Welwyn, Herts; Messrs. Baldwin, Bromley, Kent; Messrs. Neighbour, of High Holborn, London, and ask for a catalogue and the name of their agent in your town, the information will more than repay you for your trouble. It is a pity hive-makers do not advertise more in such a paper as WORK. Many amateurs would, I am sure, become their customers for such things as they do not care to make for themselves. (2) The zinc you name would cost about 1s. 6d. (3) Cowan's "Guide-Book," at 1s. 6d., to be got from any of the dealers or booksellers, is as good as any.—APIS.

**Distillation.**—STILL.—Plenty has been written upon this subject, but I am unable specially to recommend any treatise for your purpose. The process is so simple that probably an encyclopædia

article would give all the information you want. You ask whether you can use your still for making perfumes. Certainly, but you must remember that only the coarser perfumes, such as those from orange and lemon peel, geranium leaves, etc., are made by distillation. The more delicate ones, such as those from violets, jasmine, etc., are extracted by grease, either by packing the flowers in lard (the process known as *enfleurage*), or in the *bain Marie;* the perfume being afterwards drawn from the grease by alcohol. Be careful how you use your still, or you will have the Excise authorities down upon you.—M. M.

**Electric Bells.**—W. H. C. (*London, S.E.*).—Articles on "Electric Bells" appeared in Nos. 12, 18, and 20 of WORK.

**Caning Chairs.**—A. H. P. (*Lewisham*).—I will take your questions *seriatim*. (1) Cane can be bought, ready for use, in Bethnal Green Road, at one or two shops close to the junction of the old and new parts of the road. A short sharp knife, a punch (often made of a stout broken bradawl), and a light hammer are the only tools required. Punch out old pegs from below. Cane can be split and made uniform by passing it under a sharp razor blade fixed at the proper distance from the block which forms the base of the tool. (2) I have seen caning done, and the two strips across and two strips along were done before the diagonals were put in. (3 and 4) The caning was done throughout before the pegs were put in, but the cane was drawn fairly tight, one strip of cane being laced through and brought back as many times as length will allow. (5) The wooden 3-ply seats are cheaper than cane seats, if you have to put out the caning. You can certainly fix the 3-ply seats yourself. The only other plan is to have a stuffed seat. (6) There are three different modes of caning, or rather, three prices: one with canes described as above, six rows in all, with a row as bead held down with cane staples—3d. and upwards is charged for this; secondly, the same without the bead; thirdly, a cheap plan adopted by the people who cane chairs in the street, who only use four rows, and often use the inner strips of cane for two of the rows: these having no smooth surface, get dirty and rough very soon.—B. A. B.

**Cement.**—KILN.—For filling up cracks in earthenware, I know of nothing better than plaster of Paris mixed with water. If mixed with alum water, it gets very hard indeed. This, perhaps, may answer your purpose better than with simple water, although the latter way is that which professional china-menders use.—W. E. D., JR.

**Incubator.**—INCUBATOR.—You can obtain glass tube and all other fittings from Mr. T. Stevens (see advertisement in "Sale and Exchange" column of WORK).—LEGHORN.

**French Polishing.**—W. B. (*Rushden*).—It is impossible to instruct you in the whole art of polishing in the limits of a "Shop" reply, but as you are a new subscriber, I will give you the outline of the *modus operandi*, as practised by myself. I cannot advise you to attempt a chest of drawers for a beginning, as probably you would only make a mess of it. Try your hand on some waste pieces or a smaller article; then, when practice begets confidence, tackle the larger job. If you can get to see a polisher at work, it will give you some insight into the method of using the rubbers. Your work being all smoothed and ready, it will first be necessary to fill up the pores of the wood. For this filling take a sufficient quantity of tallow, and work it well up with powdered whiting to form a stiff paste. Colour to match the wood (for mahogany I use portions of dry ochre, umber, and Venetian red); moisten, if necessary, with a little raw linseed oil, and with a piece of rag apply it all over the surface of the work across the grain, so as to fill all the pores. Now remove the surplus, and we are ready for polishing. If you wish to darken the wood, apply a weak solution of bichromate of potash before "filling." I, however, much prefer mahogany unstained. Now get some French polish (buy it at your nearest oil and colour shop), raw linseed oil, methylated spirit, wadding, a piece or two of flannel, and a supply of clean white rag. Take some wadding sufficient to make a ball about 2 in. in diameter (this is a convenient size, but it must be determined by the work in hand), cover this with a piece of flannel, and saturate the pad with polish. Now take a piece of rag, and enclose the pad in it, gathering the corners all together tightly, so as to present a circular surface to the work. When ready, pass the rubber over the work in light circular strokes, beginning at one end, and gradually traversing the whole of the surface to be polished, letting each stroke overlap the last. Moisten the rubber with fresh polish as the former lot gets used up, and continue the rubbing until your work presents a fairly even polish, increasing the pressure on the rubber as the work proceeds, and moistening the surface of the rubber with a trace of linseed oil if it shows any signs of sticking. Now put the work aside for an hour or two, to allow the polish to harden, and upon resuming, give it a rub with fine glass-paper to remove all inequalities, and proceed with a second coat of polish. When there appears a nice even coating, lay aside again to allow it to harden, and, if possible, leave it till next day, when you may proceed to "spirit off" the work—that is, to work out the oil so as to leave a clear bright surface. Make a rubber as before, and moisten with methylated spirit only, and go over the work in the direction of the grain with light quick strokes, until all cloudiness disappears. Spiriting off is the most difficult part of the job, as, if unskilfully done, the polish is apt to tear up in patches. Remember that practice makes perfect, and if at first you don't succeed, try again. I omitted to mention that all polishing operations must be performed in a warm room.—H. E.

**Painting Slides.**—BUSY BEE.—(1) "Is it within the power of an amateur to paint optical slides?" It depends on the ability of the amateur. Anyone with a fair knowledge of drawing, an eye for colour, and patience, could, I am sure, with practice produce really good results, and in time might even secure professional work. (2) "What kind of paint is used, and where procurable? What kind of brushes are best, etc.?" The paints used are those known as transparent, and can be bought of any dealer in artists' material. As BUSY BEE lives in London, many names will be familiar to him—such as Newton, Reeves, etc. The colours may be procured either as water or oil; BUSY BEE must decide for himself which he will elect to work with. I can only say here that the treatment of the work in each kind is different. The colours used are as follows: *Yellows:* gamboge, yellow lake, Italian pink, yellow madder. *Blues:* Chinese, Prussian, indigo. *Green:* verdigris. *Reds:* crimson lake, pure orange, burnt sienna. *Browns:* Vandyke, madder brown. These can be procured at about 4d. per tube; madder lake, French ultramarine, and pure scarlet at 1s. per tube. Besides paints, varnishes will be required—viz., copal and mastic—also gold-size and turps. Mastic 3 parts, and turps 1, are mixed with gentle heat with lampblack for outlines; mastic, ¾ oz., turps one teaspoonful, and 20 drops of gold-size to mix the colours. Brushes.—These must be sable, varying from 0 to 6, and one or two riggers made, I think, of ox-hair for outlining. In addition to these materials, an easel will be required of a skeleton kind, so that the slide shall simply be gripped and allow a piece of white paper to be seen through the slide. This will enable one to see how the colours are spreading. (3) The glass does not require any preparation beyond rendering it perfectly clean. The glass painting referred to in Vol. I. is for window decoration, and not for optical lanterns. When BUSY BEE comes to work, he will find difficulties which as yet he does not anticipate, but which, by patience, may be overcome. Look out for coming articles in WORK.—O. B.

**Repairing Cycle Tires.**—J. B. (*Eastbourne*).—I have to say that, in my reply to RETRENCHMENT (see p. 652, Vol. III.) anent pneumatic tires, if I remember rightly, the reference was to the "Dunlop" species of pneumatic tire. In that reply I adhered to a rule I have ever endeavoured to observe—namely, never to attempt giving information to others from theory, but only from my own personal experience. I had not, neither have I yet, any personal experience of the construction or repair of the "Dunlop" tire. I have "Points for Cyclists." I could easily have copied out what it has to say regarding tire repairing and sent it as *my* reply. I did not do so; first, because I had no practical knowledge of the process, and secondly, I do not consider the instructions there given sufficiently minute to guide anyone without other aid in the mystery of repairing these tires. There was an air of mystery surrounding the repair of these tires that does not now exist. The difficulty of repairing them still exists, however, and the necessity also; for the tire is admittedly even yet not perfect, and I think the art of repairing them is not worth the candle. I do not believe the tire has come to stay, and I do not care to spend time learning the mystery of repairing them, which at best is not a simple, but a ticklish job. I have also a book issued by the Pneumatic Tire and Booth's Cycle Agency. The instructions therein given are much more precise than in "Points for Cyclists," yet at the outset the latter book says: "If the rider has previously got a lesson in repairing, he will easily follow these instructions. If not, he must make sure that he understands the *construction* of the tire before trying to effect the repair." After describing the process of replacing a broken spoke, repairing a puncture, etc., about as well as it can be described in a book, it ends up with the following: "Customers of the Company will be instructed at the Company's offices, and in all the principal cycling centres agents have been, or will be, instructed, who, no donbt, will be prepared to show their respective customers how repairs *can* be effected." So, after all, a practical lesson is what is needed; and my advice to RETRENCHMENT, and all others who have the misfortune to possess a pneumatic machine, is to give it to a practical repairer. It will be cheaper in the end.—A. S. P.

**Pocket Medical Coil.**—A. E. J. (*Staleybridge*).—You evidently wish to have a small induction coil, small enough to go into a pocket and be worked by a silver chloride battery. The following dimensions will probably suit your requirements:—Core of No. 20 iron wire 3 in. in length, annealed soft and made into a bundle ⅜ in. in diameter. Cover the core with three layers of tough, thin paper, soaked in hot paraffin wax, and wind on two layers of silk-covered No. 24 copper wire; this is named the primary wire. Over this wrap two or three layers of the prepared paper above mentioned, then fill up the remainder of the 1¼ in. bobbin (to hold the coil) with No. 34 silk-covered wire, well soaked in hot paraffin wax. A magnetic contact-breaker must be fitted to one end of the coil, to be actuated by the magnetised core. The two wires from the battery must be connected to the two ends of the primary wire, one end of which will go to a binding screw and the other to the foot of the spring carrying the armature of the contact-breaker. A wire from the pillar of the contact stud to a binding screw connected to the battery will complete the circuit. A stinging shock will be given by the two ends of the secondary wire when two silver chloride cells are connected to the coil.—G. E. B.

**Kinetic Theory of Matter.**—ELECTRA.—I do not know certainly that there is such a theory in existence, consequently I cannot recommend "a good book on the modern kinetic theory of matter." What you are pleased to name a theory is merely a mode of expression applied to a fact. Kinetic energy is merely a term used by some persons to denominate energy of motion. That is to say, when matter is in motion, the velocity of its movement is distinguished by the term "kinetic energy." The word "kinetic" has a Greek origin, and is applied to "that part of mechanical science which treats of motion without reference to the forces producing it." I quote the following from Ganot's "Physics":—"The energy possessed by a body in consequence of its velocity is commonly distinguished as *energy of motion* or *kinetic energy;* it is measured by half the product of the moving mass into the square of its velocity."—G. E. B.

**Self-acting Fountain.**—T. N. D. (*No Address*).—You can purchase a fountain as described in No. 69 of WORK in London for about 37s., but name and address cannot appear in the columns of "Shop." If you send your address under cover to the Editor, I will give you the necessary particulars.—C. M. W.

**Compo Tubing.**—W. J. (*Rossendale*).—It is surprising that you should find any difficulty in obtaining this article at an ironmonger's. The fact must be that they do not wish to sell it. Compo tubing is a well-known article, and in daily use by all gasfitters in small sizes as a substitute for lead pipe. Have you tried getting it at a gasfitter's?—C. M. W.

**Iron Frame Piano.**—W. H. C. (*Tipton*) and WOULD-BE PIANO MAKER (*Cape Town, S. Africa*).—The instructions given in WORK on "How to Make a Piano" were written so as to make the proceeding as simple as possible, but the instructions there given require very little modification to accommodate them to the construction of an iron frame piano. Your best plan would be to purchase an iron frame. This you can obtain, already drilled and pinned, from W. Hughes, of Drury Lane, London, W.C. A 3 ft. frame would suit you—that is, that it is 3 ft. from the bottom to the top edge, which fits under the bottom edge of wrest plank. The back would only require six bracings, as the frame resists a large amount of the strain. The bent side need not be made of beech; spruce will do, as the frame merely rests on it and is bolted to it. It would be trichord to the covered strings. Your bridges on the sound-board will require to be 1½ in. in thickness, and as there are breaks in the frame, or bars to strengthen it, your bridge would be in three parts, one part supporting the covered strings and the remaining two supporting the steel. Your back would be 4 ft. 3 in. wide, and add a 9-in. wrest plank, and let the back extend two inches below the frame. When complete, with top and castors, your piano would stand 4 ft. 1 in. high. If you make the top bridge on the wrest plank, a couple of octaves, with a double row of bridge pins, it will make your treble brighter. You might write to W. Hughes, of Drury Lane, London, W.C.; he would probably supply you with all the materials you require, and give you the cost, as they could be packed in one case. Any further particulars you may require, write again.—T. E.

**Steps.**—E. H. (*Rawdon*).—Our subscriber wishes to know if the method he adopted to set out a string-board is correct: it has led to a successful result, so it must be free from serious error. His sketch is scarcely good enough to print, but as he asks for a correct way to arrive at the desired end, we will remind him of first principles. The treads of stairs ought to be level, and the risers vertical; that being so, the riser and tread are at right angles to each other on the exterior surface. If, therefore—neglecting for the moment the overhang of the tread, and regarding the thickness of the tread as added to the riser—E. H. takes a piece of board, having the ends accurately squared, and sets off the net width of tread, and on the adjacent edge the gross rise (that is, riser plus thickness of tread), by joining the points thus obtained he will have drawn a right-angled triangle, the third side of which is parallel to the edge of the string-board. A board such as this is usually prepared as a preliminary to staircase making, and is called a pitch-board. E. H.'s steps are too steep to be convenient: it is rare for the rising to exceed the forward movement, though it is sometimes needful when space is very restricted. Authorities give various data for determining the proportion between riser and tread. Some say tread plus twice the rise should equal 24 in.: thus, 10 in. forward would give 7 in. upward movement; others say these figures, multiplied together, should give an arbitrary number: about 70. This 70 would agree with the foregoing. By the first rule, 11 in. tread would require 6½ in. riser, which, if multiplied as the second rule, would give 71½. Other examples will show that these rules are, after all, mere generalisations, and that a comfortable staircase is only to be had by consulting the average length of step of the human species. Examples—tread 15, riser 4½, by first rule; tread 15, riser 4½, by second; tread 9, riser 7½, by first rule; tread 9, riser 7½, by second rule. These, of course, are extreme instances; in moderate cases the rules agree fairly. The rise should always

be equal in every stair between each floor.—B. A. B.

**Organ Accordion.**—G. T., J. B., and others.—This question must be treated in an article; the full description of how to make one of these is too long for "Shop." As some parts will be beyond the powers of an amateur to construct, we will find out if those parts are to be had at the musical fittings warehouse. Stands, reeds, and ivory for keys can be purchased, but some other parts offer difficulties not easily overcome.—B. A. B.

**Damp in Cylinder of Electric Machine.**—G. W. S. (*Biggleswade*).—You can only remove the dampness in the cylinder by warming it before a fire, turning the cylinder around as it gets warm. If the cylinder has wooden ends, drill a few fine holes in the wood to facilitate the escape of damp, and stop these with sealing-wax after the cylinder has been well warmed and you think all the moisture has evaporated.—G. E. B.

### III.—Questions Submitted to Readers.

**** *The attention and co-operation of readers of* Work *are invited for this section of "Shop."*

**Marionette Show.**—Marionette writes:—"Can any correspondent give me instructions as to how to construct a marionette show, size of the stage, how to fit up, etc., and whether I could make the figures? I want to show it next season. As I am an invalid, and have no means of earning my living, I might work one of the above. I saw a model theatre representing the Spanish Armada. Which would be the easier to make—the marionettes or the theatre?"

**Glass-Blowers.**—Drofsaba writes:—"Will anyone inform me of the address of an experimental glass-blower who deals in glass rods and tubing; also manufacturer of chemical and scientific glass ware, incandescent lamps, etc.? The address given of Mr. D. Williams, p. 668, Vol. III., in reply to Draughtsman, is of no use, as he has removed from that address."

**Embossing on Glass.**—Bonâ Fide will thank anyone who knows to kindly explain the method of embossing on glass with lead foil.

**Stain for Celluloid.**—Ebony writes:—"Will any kind reader give me a recipe for staining celluloid (imitation ivory) a black colour? I have some I want to stain, and have tried several dyes, but without any good results."

**A. S. L. Monogram.**—R. R. (*Greenock*) writes:—"I would be very much obliged to any clever reader who would be kind enough to give me a design for the initials A. S. L., to be inlaid as a centre-piece on lady's workbox. The top of box is 13 in. by 9 in., and has a Chippendale border round the edge."

**A. E. T. Monogram.**—Shamrock—an Emerald lad—will thank any reader for a suitable monogram with the letters A. E. T. to fit the shield drawn on p. 700 of Work, Vol. III.—[As Shamrock takes particular pains to emphasise the fact of his being "an Emerald lad," and we want to help the Irish cause, perhaps M. (*Bishop Auckland*) or some other tried correspondent will come to the rescue.—Ed.]

**Copies of Photographs.**—Rectilinear writes: "Will some reader of Work tell me how to get the best results in copying yellow and faded photographs, using ammonia, bromide of potassium, and pyro?"

**Monogram.**—T. W. T. (*London, N.*) writes:—"I should be obliged for a monogram for initials T. W. T. for painting on a Gladstone (brown) bag, ornamental preferred; also what kind of paint should I use? Would Aspinall's enamel or any other made-up paint do?"

**Leather Work.**—J. B. M. (*Blairgowrie*) writes:—"Will anyone tell me the best work on fancy and ornamental leather work? I have seen it made into picture-frames, brackets, etc. Also where is the best place to purchase the necessary tools, and their probable cost?"

### IV.—Questions Answered by Correspondents.

**Hand v. Treadle Fret-Saws.**—W. E. C. (*Wakefield*) writes, in reply to W. M. (*Brixton Hill*) (see Work, p. 654, No. 146):—"As an amateur with a long experience with treadle machines, both of my own make and invention, as well as others now in the market, I have no hesitation in strongly recommending him to go in for a good treadle machine with a vertical stroke and an even tension spring, which prevents the unpleasant upper resistance of the spring. All those machines on the principle of the Rogers, Windsors, Lester, and others with the oscillating arms and circular stroke, are really useless where good work is required. If W. M. is not in a great hurry to get a machine, I should strongly recommend him to wait until the Britannia Co. send out their new and improved machine, which has been already noted in one or two papers. He will then have a chance of purchasing a machine that has no equal."

**Market for Fretwork, Wall Designs, etc.**—F. Standage (*49, Fifth Avenue, Queen's Park, Harrow Road, London*) writes, in reply to Fretworker (see p. 733, No 150) and T. W. (*Accrington*) (see p. 732, No. 150), to say that he is open to consider novelties in these lines.

**Model Ship Building—Rig, etc.**—M. (*Bishop Auckland*) writes, in reply to Cutter (see p. 733, No. 150):—"I suppose you want a cutter rig. Make mainmast 22 in. above deck, ¾ in. diameter: topmast 11½ in., $\frac{7}{16}$ in. diameter; bowsprit, 12 in. long, projecting 5½ in. over stem; jibboom, 17 in. long, projecting 10 in. over bowsprit, and tapering from ½ in. to $\frac{5}{16}$ in. diameter; spanker boom, 18½ in. long, ½ in. diameter, tapering to $\frac{3}{16}$ in.; gaff, 13 in. long, ⅜ in. to $\frac{5}{16}$ in. diameter; topsail-yard, 5½ in. long, $\frac{5}{16}$ in. diameter. If you lay these down to scale, you will get the size of the sails, the mainsail, foresail, and jibsails being attached to the mast just under the crosstrees. You will require eight single-sheaved blocks and one double-sheaved block, eight dead-eyes for main shrouds, and six smaller dead-eyes for the stays. You will also require some cleats, fixed either at the foot of the mast or on the bulwarks, to fasten the halliards for working the sails."

**Naval Architecture.**—M. (*Bishop Auckland*) writes, in reply to Art T. (see p. 733, No. 150):—"Perhaps one of the following would suit you: 'Iron Ship Building,' by J. Grantham, 4s.; 'The Forms of Ships and Boats,' by W. Bland, 1s. 6d., published by Crosby Lockwood & Son, London."

**Engraving on Brass and Metal.**—M. (*Bishop Auckland*) writes, in reply to Nelson (see p. 732, No. 150):—"You will find instructions for this, and description of tools, on p. 595, Vol. I., of Work."

**Bamboo Flower Stands.**—M. (*Bishop Auckland*) writes, in reply to Melton Constable (see p. 733, No. 150):—"You can procure bamboo from Mr. F. Westbury, Great Dover Street, Boro'. For making joints, plug the end, glue, and fix with screw or wire nail."

**Fret Machine.**—M. T. C. (*Watford*) writes:—"If W. M. (*Brixton Hill*) (see p. 651, No. 145) will try the Dexter C. Fret machine, he will find it all that he can desire. I have had one in use for the last three years, and it is a first-rate machine."

**Cutter Yacht.**—Eddifra writes, in answer to Cutter (see p. 733, No. 150):—"I have a 24 in. model cutter yacht. The spars and sails were calculated as follows: Divide length of boat into twelve equal parts, and step the mast at the fifth mark from bow, at right angles from water-line. Let the mast rise above the deck just double as far as it stands from the bow. Let the bowsprit project beyond the bow the same distance the mast is stepped behind it. Let the mainboom be the same length as the mast rises above the deck, and let it slant upwards a little to clear water when the vessel heels. The length from the stern to the tip of the bowsprit will give you the height the topmast-head should be above deck. For the sails, halfway between stem and stern draw a line parallel to the mast half as long again as the length over all, or, in other words, three times as long as the distance between the line and stem and stern. From the end of this draw one line to the end of mainboom, and another to the bow. In the line to the boom take a point at the same distance from the top as the topmast projects beyond the mast; halfway between, where the line to the bow cuts the topmast and the deck, take a point in the lower mast: joining these you will get your mainsail, with gaff at its proper angle. The jib you get by joining the head of the lower mast with the end of the bowsprit; the foresail by drawing a line from the crosstrees to the bow. The line drawn to the bow from the perpendicular parallel to the mast gives you the position and angle of the topsail-yard, which, on the bow side, should be as long as the distance down the yard from the perpendicular to the mast, and on the stern side just as long as the part of the bowsprit which projects beyond the boat's bow. A line from where the yard crosses the topmast will give you the stay for the jib topsail. Perhaps this will be a puzzle to you, but if you will draw it full size, you will, I think, be able to work it out."

**Breeding Cage.**—F. H. (*Battersea*) writes, in answer to Gamma (see p. 702, No. 148):—"I would advise Gamma not to make a fancy breeding cage if he intends to keep birds in it. A fancy cage will give him endless trouble. A breeding cage should be made as plain as possible, avoiding all fretwork—in fact, as little wood as possible should be employed. If Gamma wishes to make a model of a Gothic building, let him do so by all means; but make a breeding cage for the comfort of the birds, and not for show. For making breeding cages, see Nos. 54 and 80 of Work."

### V.—Letters Received.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—A. R. (*Scorrier*); J. B. (*Keighley*); W. K. (*Watford*); A. C. (*Falfield*); J. Y. (*Woolwich*); G. A. M. (*Partick*); F. J. (*Oldham*); W. Y. B. (*Deptford, S.E.*); F. H. R. (*York*); Reader (*Aberdeen*); A. T. (*Sheffield*); J. H. (*Walsall*); J. C. (*Altrincham*); F. A. G. (*Sheffield*); G. E. W. (*Upper Tulse Hill*); Limited Means; F. S. (*Deptford*); W. B. (*York*); G. T. (*Newport, Mon.*); A. W. M. (*Holywood*); W. J. (*Glasgow*); G. L. (*Birmingham*); W. H. E. (*Redruth*); R. G. H. (*Richmond, Yar.*); A. J. S. (*Canterbury*); A. B. (*Blackburn*); C. T. (*Edinburgh*); H. J. (*Blackburn*); J. J. (*Blackpool*); S. L. (*Sydney, N.S.W.*); W. T. (*Birmingham*); T. S. (*York*); J. J. (*Walthamstow*); E. C. (*Birkenhead*); J. R. (*Fourstones*); T. W. (*Silloth*); John; S. S. (*Salford*); B. H. (*Batley*); G. T. (*Birmingham*); B. H. (*Colne*); J. G. (*Edinburgh*); F. C. (*Bath*); Electric; E. H. (*Rockferry*); Eddifra; A. G. (*Sheffield*); Iron; H. Mcl. (*Cork*); Pen; F. H. (*West Ham*); J. T. (*Sunderland*); C. H. W. (*Erith*); Tip; D. M. L. (*Waterloo Road*); W. H. H. (*Colne*); F. J. B. (*Newton*); J. E. R. (*Limavady*); J. R. S. (*Liverpool*); Utiledulci; D. T. (*Liverpool*); J. H. W. (*New Brompton*); P. T. (*Birmingham*); A. D. (*Sheffield*); M. (*Prince's Park*); E. P. (*Birmingham*); V. L. (*Bayswater*); C. P. (*Primrose Hill Road*); Cymbo: Woodbine; N. N. (*South Stockton-on-Tees*; F. J. (*Exeter*); T. T. (*Sefton Park*); W. R. (*Mill End*).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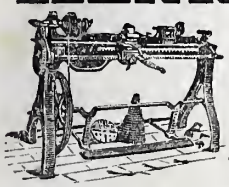

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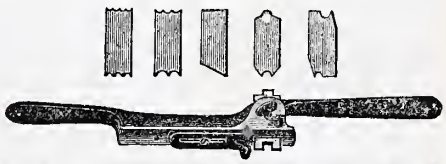

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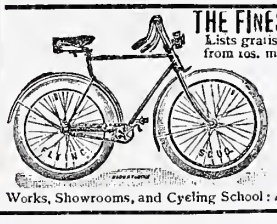

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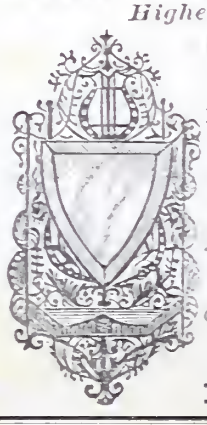

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